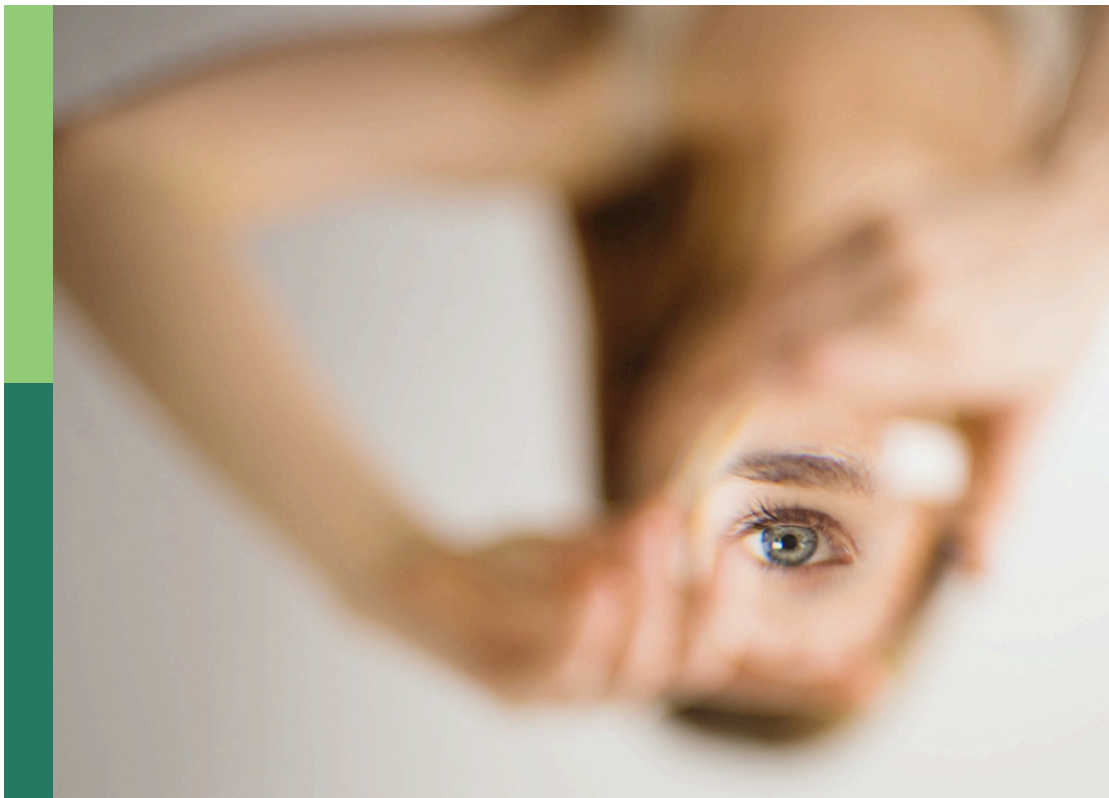
frontiers | Research Topics

Decision making and problem solving in organizations: Assessing and expanding the Carnegie perspective

Edited by
Pino G. Audia, Daniella Laureiro Martinez and Daniel A. Newark

Published in
Frontiers in Psychology



ISSN 1664-8714
ISBN 978-2-8325-5402-9
DOI 10.3389/978-2-8325-5402-9

About Frontiers

Frontiers is more than just an open access publisher of scholarly articles: it is a pioneering approach to the world of academia, radically improving the way scholarly research is managed. The grand vision of Frontiers is a world where all people have an equal opportunity to seek, share and generate knowledge. Frontiers provides immediate and permanent online open access to all its publications, but this alone is not enough to realize our grand goals.

Frontiers journal series

The Frontiers journal series is a multi-tier and interdisciplinary set of open-access, online journals, promising a paradigm shift from the current review, selection and dissemination processes in academic publishing. All Frontiers journals are driven by researchers for researchers; therefore, they constitute a service to the scholarly community. At the same time, the *Frontiers journal series* operates on a revolutionary invention, the tiered publishing system, initially addressing specific communities of scholars, and gradually climbing up to broader public understanding, thus serving the interests of the lay society, too.

Dedication to quality

Each Frontiers article is a landmark of the highest quality, thanks to genuinely collaborative interactions between authors and review editors, who include some of the world's best academicians. Research must be certified by peers before entering a stream of knowledge that may eventually reach the public - and shape society; therefore, Frontiers only applies the most rigorous and unbiased reviews. Frontiers revolutionizes research publishing by freely delivering the most outstanding research, evaluated with no bias from both the academic and social point of view. By applying the most advanced information technologies, Frontiers is catapulting scholarly publishing into a new generation.

What are Frontiers Research Topics?

Frontiers Research Topics are very popular trademarks of the *Frontiers journals series*: they are collections of at least ten articles, all centered on a particular subject. With their unique mix of varied contributions from Original Research to Review Articles, Frontiers Research Topics unify the most influential researchers, the latest key findings and historical advances in a hot research area.

Find out more on how to host your own Frontiers Research Topic or contribute to one as an author by contacting the Frontiers editorial office: frontiersin.org/about/contact

Decision making and problem solving in organizations: Assessing and expanding the Carnegie perspective

Topic editors

Pino G. Audia — Dartmouth College, United States

Daniella Laureiro Martinez — ETH Zürich, Switzerland

Daniel A. Newark — HEC Paris, France

Citation

Audia, P. G., Laureiro Martinez, D., Newark, D. A., eds. (2024). *Decision making and problem solving in organizations: Assessing and expanding the Carnegie perspective*. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-8325-5402-9

Table of contents

frontiers | Frontiers in Psychology

TYPE Editorial
PUBLISHED 23 August 2024
DOI 10.3389/fpsyg.2024.1455794

OPEN ACCESS

EDITED BY
Axel Cleeremans,
Université Libre de Bruxelles, Belgium

REVIEWED BY
Sebastian Hafenbrädl,
University of Navarra, Spain
Daniel Levinthal,
University of Pennsylvania, United States

*CORRESPONDENCE
Pino G. Audia
✉ pino.audia@dartmouth.edu

RECEIVED 27 June 2024
ACCEPTED 12 August 2024
PUBLISHED 23 August 2024

CITATION
Audia PG, Laureiro Martinez D and Newark DA (2024) Editorial: Decision making and problem solving in organizations: assessing and expanding the Carnegie perspective. *Front. Psychol.* 15:1455794. doi: 10.3389/fpsyg.2024.1455794

Editorial: Decision making and problem solving in organizations: assessing and expanding the Carnegie perspective

Pino G. Audia[1]*, Daniella Laureiro Martinez[2] and Daniel A. Newark[3]

[1]Organizational Behavior, Tuck School of Business at Dartmouth College, Hanover, NH, United States, [2]Management, Technology, and Economics, ETH Zurich, Zürich, Switzerland, [3]Management & HR, HEC Paris, Jouy-en-Josas, France

KEYWORDS

decision making, learning, goals, aspirations, decision premises, Carnegie perspective, organizations

Editorial on the Research Topic
Decision making and problem solving in organizations: assessing and expanding the Carnegie perspective

Introduction

Decisions steer the course of individuals, organizations, markets, and governments. It is therefore unsurprising that significant research efforts in economics, psychology, political science, and sociology are dedicated to understanding how they are made and how they can be improved. However, within this intellectual landscape, the large and growing body of work linked to what we refer to as the Carnegie perspective on decision making has increasingly been siloed (March, 1989, 1994; Argote and Greve, 2007; Posen et al., 2018). Despite the centrality of the Carnegie perspective to decision making and of decision making within the Carnegie perspective, the last edited collection on decision making to include Carnegie among its various perspectives dates back over 25 years (Shapira, 1997). Undoubtedly, the immense popularity of the heuristics and biases research program (Kahneman, 2011) has played a role in the diminished visibility of the Carnegie perspective. At the same time, the increased tendency to classify research within the Carnegie perspective as being about learning rather than decision making (Levinthal and March, 1993; Audia and Greve, 2021), when in reality both labels are likely apt, has also separated Carnegie from predominant scholarly conversations on decisions.

After these developments of recent decades, we think the time may be ripe for the Carnegie perspective to resume a more central place in decision making research in the social sciences for several theoretical reasons. First, the Carnegie perspective complements other theoretical perspectives by offering a more agentic take on decision making. For example, while sharing with the heuristics and biases program the premise that individuals are boundedly rational, it does not reduce decision making to an analysis of deviations from a narrow form of economic rationality stemming primarily from cognitive processes. Instead, it views individuals as problem solvers capable of adapting through the decisions they make to changes in their environments, though it identifies conditions that reduce this capacity. Second, by integrating learning from experience in the decision process, the

Carnegie perspective may be well suited to assess the implications for decision making of the increased use of Artificial Intelligence, a technology that relies heavily on past actions and outcomes. Third, the Carnegie perspective tackles the central issue of attention allocation by proposing mechanisms that remain distinctive in comparison, for example, to the economic logic of the allocation of scarce resources. This confluence of issues presents a unique moment of reflection and openness to reconsidering and reshaping the academic dialogue on decision making. To that end, a key objective of this Research Topic is to facilitate an exchange between scholars within the Carnegie perspective on decision making and scholars studying decisions using other approaches.

What is the Carnegie perspective on decision making? What is distinctive about it?

To define what we mean by the Carnegie perspective on decision making, we follow Scott and Davis (2015), who suggest that a theoretical perspective should be understood in two senses: (a) the intellectual foundations that created the context in which it developed and (b) the analytically enduring features that make it distinctive.

Intellectual foundation

The intellectual foundation originated in the 1940s and 50s at Carnegie Tech (now Carnegie Mellon University) thanks to the seminal contributions of Herbert Simon, James March, and Richart Cyert. Three inter-related intellectual building blocks stand out in their seminal work: bounded rationality, behavioral realism, and multi-method orientation. First, Simon postulated (Simon, 1955, 1956, 1964, p. 2) "important constraints (in the decision process) arising from the limitations of the actor himself as an information processor" and referred to decision theories that incorporate such constraints as theories of bounded rationality. Like Cyert and March (1963) after him, he used stylized models of rational decision making that were dominant in economics as an alternative conception against which he articulated the notion of boundedly rational decision making. Second, from these initial steps came a commitment to behavioral realism, that is, to studying actual decisions and to developing models that reflect how people and organizations make actual decisions (Gavetti et al., 2007). As Cyert and March (1963, p. 2) put it: "the emphasis on studying actual decision processes implies a description of the firm's decision in terms of a specific series of steps used to reach that decision." This commitment to behavioral realism brings to the fore steps in the decision process that are less prominent in other lines of decision research, such as the allocation of attention, the search for alternatives, and the resolution of conflict (e.g., conflict among goals and preferences). The result is a broader conception that integrates activities of problem solving (e.g., choosing issues that require attention) and decision making (e.g., choosing among alternative actions). Research in the Carnegie perspective generally asks, given limitations to individuals' cognitive abilities: (a) To which issues do they allocate their attention? (b) Once an issue becomes the focus of their attention and potentially a subject of a decision process, how do they identify and evaluate, through a process of search, alternatives among which to choose?, and (c) How are choices among endogenously generated alternatives made?

Third, tied to behavioral realism was also the orientation to combine a variety of methods to study decisions. This reflected the interdisciplinarity of Simon, March, and Cyert. Because their scholarly work and interests crossed the boundaries of psychology, sociology, organization theory, artificial intelligence, political science, and economics, they saw value in combining methods from different areas of the social sciences and balancing the concern for internal validity with the concern for realism. As a result, studies in this perspective are not as reliant on experiments involving students or participants in online research platforms as are other lines of work on decision making. Scholars within the Carnegie perspective complement experimental data (e.g., Laureiro-Martinez et al., 2015; Billinger et al., 2021) with analyses of archival data (e.g., Bromiley, 1991; Clough and Piezunka, 2020), qualitative research (e.g., Rerup, 2009), simulations (e.g., Gavetti and Levinthal, 2000; Baumann et al., 2019) and theoretical work (e.g., Newark, 2018). This multi-method orientation is unique within the decision research landscape. Overall, as numerous strands of decision research went on to build on the concept of bounded rationality, research in the Carnegie perspective pursued a distinctive path oriented by the combined influence of these intellectual building blocks.

Enduring features

Considering core ideas laid out in the foundational work and the areas of study where greater progress has been made over the past two decades, we identify three analytically enduring features that make this perspective distinctive within the broader landscape of research on decision making. The first is the centrality of goals and aspirations (Cyert and March, 1963). Within this perspective, goals and aspirations influence several steps of the decision process: attention, conflict, search, and evaluations of alternatives. The starting point is that individuals generally seek to achieve multiple goals, and they resolve the potential conflict of doing so by focusing on goals sequentially, rather than simultaneously. Moreover, instead of choosing alternatives that maximize performance on a goal, individuals *satisfice* by choosing alternatives that exceed a desirable performance threshold known as the aspiration level. When performance on a goal is met, their attention moves to another goal for which performance is still below the aspiration level. Assessments of failure on such a goal triggers the search for a solution, which stops when a solution sufficient to meet the aspiration level is found.

Two recent developments have extended these ideas in important ways. The first is the recognition that low performance often is evaluated not in relation to an aspiration level but to a survival point, and shifts of attention between these two reference points have ramifications for choice (March and Shapira, 1992; Audia and Greve, 2006; Boyle and Shapira, 2012). The second is the integration of social psychological research on self-enhancement in

the process by which performance is evaluated (Jordan and Audia, 2012), which has led to a more complete understanding of how multiple goals and alternative aspiration points influence decisions (Audia and Brion, 2007; Joseph and Gaba, 2015; Keil et al., 2023).

The second enduring feature is individual learning from experience, both own experience and others' experience (Levitt and March, 1988; Argote and Miron-Spektor, 2011). Decisions are not seen in isolation but within a flow of events that influences the definition of a problem, the formation of aspirations, the considered alternatives, and the desirability of each. As March (1988, p. 11) notes, "aspirations adapt to experience, generally rising with success and falling with failure—though not necessarily at the same rate. Aspirations also adapt to the experience of others within a reference group." Carnegie scholars examine the implications of different updating rules of aspirations (Lant, 1992; Mezias et al., 2002) as well as conditions that guide the formation of different kinds of reference groups (Audia et al., 2022; Luger, 2023).

Experience also impacts the search for and the assessment of alternatives. The actions of comparable others add to the pool of alternatives considered when a decision is made (Greve, 1998; Baum and Dahlin, 2007). But a success trap can alter that process as individuals repeat decisions that have led to success in the past while failing to discover or recognize alternatives that would produce better outcomes (Levinthal and March, 1993; Audia et al., 2000). Conversely, "a hot stove" effect occurs when individuals immediately abandon alternatives that initially appear worse than they actually are (Denrell and March, 2001).

The third enduring feature is the idea of decision premises. As Simon (1947, p. 79) notes, "individual choice takes place in an environment of 'givens'—premises that are accepted by the subject as the basis for choice". Routines are perhaps the most researched decision premises within the Carnegie perspective (Cyert and March, 1963; March and Olsen, 1989). They are patterns of behavior that arise in repetitive situations and enable individuals to simplify the decision process (Cohen and Bacdayan, 1994). Importantly, their use is not confined to the individuals who learned these patterns (March and Olsen, 1989). Organizations store routines often in the form of standard operating procedures which they transfer to individuals for whom routines become decision premises. Routines generally improve decisions, but they also hinder decisions when they guide choice in the wrong circumstances. To illustrate the negative effects of routines, Cohen and Bacdayan (1994), refer to situations in which room operators, airline pilots, and Soviet troops followed routines in the wrong situations. A recent wave of research moves beyond the influence of routines on decisions to examine the circumstances under which routines change (Feldman et al., 2016).

Directly building on the work of Simon and March, another important line of work on decision premises focuses on the influence of institutional logics—"a set of assumptions and values, usually implicit, about how to interpret reality, what constitutes appropriate behavior and how to succeed" (Ocasio, 1997, p. 196; Thornton and Ocasio, 1999; Thornton et al., 2012). Logics are conceived as a cultural mechanism that regulates the allocation of attention and the identification of desirable solutions. For example, studies show that logics influence risk behavior (Almandoz, 2014), the type of acquisitions firms make (Greve and Zhang, 2017), and the type of executives firms appoint (Thornton and Ocasio, 1999). In environments in which multiple logics coexist, socialization and work experience are often sufficient to capture variation in logics that have a measurable influence on the decision process.

An example of what is distinctive about the Carnegie perspective

To provide an example of the ways in which the Carnegie perspective differs from other lines of work on decision making, consider the following decision scenario from Lovallo and Kahneman (2003): "In 1992, Oxford Health Plans started to build a complex new computer system for processing claims and payments. From the start, the project was hampered by unforeseen problems and delays. As the company fell further behind schedule and budget, it struggled, vainly, to stem an ever-rising flood of paperwork. When, on October 27, 1997, Oxford disclosed that its system and its accounts were in disarray, the company's stock price dropped 63%, destroying more than $3 billion in shareholder value in a single day."

Lovallo and Kahneman use this and other examples to call attention to the influence on decisions of heuristics and biases such as the planning fallacy, anchoring, and competitor neglect (Kahneman, 2011; Thaler and Sunstein, 2021). While the cognitive processes they highlight undoubtedly play a part in guiding the decision process, the Carnegie perspective—through its focus on goals and aspirations, learning, and decision premises—offers a wider analytical lens. First, it asks whether this decision failure is a failure of attention. Decision makers might have overlooked problems and delays related to the implementation of the computer system because their attention might have been directed to other activities tied to other goals deemed more important. Alternatively, problems and delays in the implementation of the computer system might not have received attention because they might not have been evaluated to be below the goals and aspiration levels set for it. For example, some goals might have been met whereas others might have not. Likewise, some aspiration levels might have been achieved whereas others might have not.

Second, the Carnegie perspective asks whether this decision failure is a failure of learning. Here the focus is how own experience and others' experience influence the search for and the assessment of alternatives. Indeed, the Carnegie perspective holds that the process of generating alternatives does not occur in a vacuum. Past success in completing successful implementations potentially even when facing delays, for example, might have made this process myopic, stifling the generation of new alternatives and making some alternatives more desirable than others. Similarly, implementation challenges of the same computer system experienced by peer firms might have impacted the evaluation of lack of progress.

Third, the Carnegie perspective asks whether this decision failure is a decision premise failure. For example, if a standard operating procedure was in place to guide the implementation of a

new computer system, the question is whether it included steps that would have prevented the decision failure. If such steps existed, this might have been an instance of routine decay. Carnegie research on routine change would then help identify conditions that might have led to this form of failure. Additionally, while it may not apply to this example, if multiple logics potentially coexisted in the decision environment under consideration, the Carnegie perspective also asks which institutional logic is likely influencing decision makers' allocation of attention and consideration of desirable solutions. Overall, as this example reveals, taking on a Carnegie perspective on decision making implies adopting an analytical lens that highlights the importance of the context and the endogenous nature of some of the key steps of decisions. Such a different understanding of the reasons behind this decision failure would lead to corrective actions that differ from those advanced by Lovallo and Kahneman.

The papers in the Research Topic

The call for papers for the Research Topic was published in August 2022. We received a total of 39 submission, of which 11 were selected for publication. We accepted for publication the first paper in March 2023 and the last one in February 2024. This accelerated schedule, typical of Frontiers academic journals, was made possible by the contribution of many colleagues who agreed to complete reviews in an expedited fashion as well as the support of the staff of Frontiers in Psychology, particularly its Chief Editor, Prof. Treadway. Special thanks go to Giovanni Gavetti and Thorbjorn Knudsen for guest editing two papers submitted by members of the editorial team. The authors of the 11 papers are affiliated with institutions in Asia, Europe, Latin America, and North America, reflecting the international impact of the Carnegie perspective on decision making. Three papers are conceptual and eight are empirical. The latter illustrate the multi-method orientation of work done within the Carnegie perspective. They include experiments, quantitative field studies, meta-analysis of archival studies, lab-in-the-field methods, and simulations. The manuscripts draw on and extend central ideas within the Carnegie perspective on decision making.

The three conceptual pieces situate the Carnegie perspective on decision making in relation to other lines of work on decisions, identifying similarity and difference as well as opportunities for integration. In a conceptual piece, Levinthal and Newark locate the Carnegie perspective on decision making in relation to other lines of work in economics and psychology. They contrast different intellectual traditions along a key dimension, namely, how they characterize the context of decisions. In classical conceptions of rational choice in economics the context is external, taking the form, for example, of changes in relative prices. Context takes the form of framing in Kahneman and Tversky's heuristics and biases line of work and choice architecture in Thaler's work on nudges. Context is a decision makers' familiarity with their environment or choice in Gigerenzer's work on ecological rationality.

Using these distinct intellectual lenses as counterpoints, Levinthal and Newark suggest that Carnegie offers a characterization of context that is more social and more organizational. For example, learning from own and others' experience captures the social dimension of context, organizational structures and standard operating procedures are uniquely organizational, and recent work on institutional logics considers cultural influences. Yet, while emphasizing the influence of the context on decisions, the Carnegie perspective retains an important role for individual agency by recognizing that decision makers routinely face situations that require interpretation. Levinthal and Newark underscore the richness that accompanies Carnegie's fidelity to behavioral realism, as the Carnegie perspective attempts to incorporate the historical, social, structural, and interpretive dynamics of choice.

In another conceptual piece, Greve focuses on the influence of goals on decisions, one of the most productive lines of work and a key mechanism in the Carnegie perspective. He identifies three ways in which goals impinge on the decision process: regulating the allocation of attention through satisficing, enabling numeric control that triggers decisions, and guiding the search for alternatives. While noting that considerable evidence has accumulated on the influence of the profitability goal on a wide range of change decisions, he also points to evidence that, when goals are more specific, the change decisions tend to match the goals such as when low market share prompts change in market positions and accidents spur changes in safety. Besides confirming the influence of goals on the choice of alternative, the work on more specific goals documents the importance of multiple goals. While highlighting some progress, Greve sees greater gaps between theory and empirical evidence on the relationship between goals and search and how aspirations are formed.

To address these gaps and, more broadly, to advance Carnegie research on goals and decision making, he calls for more work on how decision makers integrate information from multiple goals and use it to direct search and make decisions. This echoes Levinthal and Newark who also view interpretation as a key process underlying individual agency in the Carnegie perspective. However, Greve uses the psychological term "construal" to emphasize the proximity between such development and contemporary research on social psychology. As an example of this construal research, he refers to work on self-enhancement that documents that multiple goals or aspirations open for multiple forms of construal can lead to inaction when performance is low enough to indicate a need for problemistic search.

Goals figure prominently also in Gaba and Joseph's conceptual piece on conflict. Like differences in perceptions of the internal and external environment, differences in goals are a key source of conflict that has the potential to interfere in the decision process, for example, by complicating the selection of action alternatives. Gaba and Joseph highlight progress on the identification of situations that create conflict stemming from these two sources. They point to active lines of work on multiple goals and cognitive representations as offering new insights on the implications of conflict for decision making. Importantly, unlike research in psychology that directly measures perceptions of conflict, in Carnegie, work conflict remains unobserved. This latent conception of conflict reflects the theoretical positions articulated by Cyert and March that conflict is an inherent characteristic of organizations that is never fully resolved. While Carnegie research, with its focus on context, offers an understanding of the

situations that accentuate conflict and of the mechanisms by which conflict is reduced—sequential attention to goals, decentralization, slack, and coalition formation—Gaba and Joseph call for work that provides a more fine-grained and dynamic understanding of conflict, differentiating, for example, between latent conflict and expressed conflict. They suggest that integrating psychological research on the expression of conflict could offer an avenue for bringing in emotions in Carnegie research on conflict.

The eight empirical papers ground the broad conceptual picture and tackle specific propositions. In the spirit of the call for papers, each paper draws connections to relevant work outside Carnegie, particularly psychological research. Each paper also seeks to explore new angles on topics that have been and are still central within Carnegie. As our discussion of these papers show, there are fruitful connections between the papers that point to potential new themes.

Blettner et al. use meta-analysis methodologies to examine the relationship between performance and strategic decisions involving change, search, risk taking, and RandD investments. While this relationship has been studied using a variety of methods (e.g., experiments, case studies, and simulations), data availability and an interest in actual decisions made within organizations have steered a considerable volume of studies toward analysis of publicly listed firms. The assumption in this work is that the strategic decisions of publicly listed firms are largely the result of their Chief Executive Officers' deliberations. So, it should not surprise the reader that their meta-analysis includes 205 studies yielding 516 effect sizes and >3 million firm-year observations. Impressively, their baseline findings confirm the view that has recently been advanced in the literature that the influence of performance on decisions is more consistently seen when performance falls below the aspiration level. Indeed, in their data, changes in performance that is above the aspiration level are not significantly related to those strategic actions.

Among their key findings, Blettner et al. report that the relationship between low performance and strategic decisions is altered by two types of CEO knowledge—knowledge acquired through job experience and knowledge acquired through domain expertise. Job experience weakens the relationship between low performance and strategic actions, whereas domain expertise strengthens it. This difference arises, they argue, because, unlike domain expertise which gives access to a wide range of beliefs and actions, knowledge acquired through experience is more likely to be biased and to lead to overconfidence. They also consider two types of incentives—performance-based and compensation. Surprisingly, neither alter the relationship between strategic actions and low performance.

Carnegie research recognizes the influence on decisions of own experience and others' experience but understanding of how these two forms of experience combine is still relatively rare. Kim et al. tackle this topic by developing a simulation model that aims to account for irregular decision patterns in which entrepreneurs vacillate between self-employment and wage-employment. Their simulation shows that switches of attention from learning from own experience to learning from others' experience prompted by performance falling below the historical aspiration level may account for such patterns which they term "intermittent risk taking." Instead of simply opting for the other available option when performance is poor, decision makers extend their assessment of alternatives by considering the outcomes of other decision makers. This may result in sticking to options that have not produced desirable results or in moving away from options that are meeting the aspiration level. Greve, in his conceptual piece, highlighted as an important research gap the question of how decision makers draw on own experience and others' experience to form aspiration levels and make decisions. Kim et al. study of irregular decision patterns in an entrepreneurial context is an example of the kind of advances that can be achieved by moving in that direction.

Liu and Tsay take a different look at learning from others' experience. Their focus is the extent to which decision makers can correctly infer useful knowledge from others' performance. The extreme case is a top performer whose positive outcomes are entirely due to luck. In that case, incorrectly inferring that the actions of the lucky top performer are advantageous would be detrimental. They pose the question: in a performance distribution, where is the greatest probability that performance does not match merit?

Previous studies suggest that the top performers are likely to be the luckiest, thus evidencing the greatest disconnect between performance and merit. Liu and Tsay undertake an analysis of performance and merit among academics to test their novel prediction that that gap between merit and performance is greatest in the middle of the performance distribution. Using publicly available citations to identify performance and a survey of academics to determine merit (i.e., impact), they find that the decoupling of performance and merit is greater for publications with moderately high success. They attribute this finding to early reinforcement processes. Early recognition due to authors' prestige or tight networks allow some papers to experience a reinforcement process that leads to many citations. However, the growth in citations is constrained by their lesser quality. Highest recognition requires both high quality and early recognition which suggests that some high-quality papers get stuck in the low end of the distribution. Within the broader Carnegie theme of the influence of vicarious learning on decision making, Liu and Tsay highlight the decoupling of performance from merit as a condition that may derail the decision process.

Koçak et al. seek to move Carnegie research toward a more direct consideration of conflict, in line with Gaba and Joseph's recommendations. Instead of assuming latent conflict and focusing on conditions that elevate it and the consequences of conflict, as much of previous Carnegie work has done, they conceptualize different types of cognitive conflict and examine their implications for coordination. Using the term "code" to denote fuzzy mappings between concepts adjusted through experience, they differentiate between causal codes—beliefs in what actions cause which outcomes—and moral codes—beliefs in what is evaluated as desirable. In their main experiment, they use two vignette scenarios, one concerning a proposal for opening a daycare facility and a second one concerning the evaluation of a carbon emission reducing technology and have online participants read the private and independent thoughts and opinions of two managers involved in the decision. Participants are then asked to complete a survey regarding relationship conflict, likelihood of reaching an

agreement, likelihood of negative affect between the parties, and likelihood of negative engagement. Compared to no misalignment, both forms of misalignment negatively impact all conflict variables, but, in line with their prediction, moral code misalignment has a greater negative impact on all conflict variables than causal code misalignment. By linking cognitive representations, a growing literature within Carnegie, to conflict, this proof-of-concept study points to a new approach for expanding understanding of this central topic.

Stumpf-Wollersheim et al. examine the influence of emotions on the emergence of routines. Following Cohen and Bacdayan (1994), they focus on four dimensions of routines. The first three connote how a routine helps alleviate the constraints posed by bounded rationality: the degree of repetitiveness of action sequences; the speed with which those actions are taken; and the degree of reliability, defined as the extent to which the action sequences generate good outcomes. The fourth dimension captures the potential downside of routines, namely, the failure to change the action sequence when the need arises, which they term attentiveness in action. Stumpf-Wollersheim et al. focus on sadness and fear because these two emotions are often experienced during periods of change—fear of an unknown future and sadness for leaving a past state. Yet, they are different because sadness is associated with uncertainty acceptance whereas fear is associated with uncertainty avoidance.

They rely on an experimental design in which pairs play a computerized version of the Target the Two card game developed by Cohen and Bacdayan. They prime the emotions through recall of an experience and use music and pictures while participants play the game. They find that sadness increases repetitiveness, speed, and reliability but it reduces attentiveness in action. The effect of sadness on reliability was against their prediction. Also contrary to their predictions, fear does not influence repetitiveness, speed, and reliability, but, in line with their prediction, it increases attentiveness in action. They conclude that sadness fosters heuristic decision making, whereas fear fosters comparatively more-attentive team-level decision making.

Richner et al. study adaptive decision making in a lab-in-the-field-study involving officer cadets in the Swiss Armed Forces. Their interest lies in exploring the role of individual antecedents—personality traits and cognitive flexibility—and context-evoked antecedents—recent stress, present emotional states, and task motivation—on individuals' capacity to balance exploitation (i.e., learning and continuing to use solutions that have yielded good outcomes) and exploration (i.e., trying new solutions that may give superior results).

Carnegie research has shown that decision makers often fail to switch from exploitation to exploration particularly following success and when following standard operating procedures. Officer cadets are asked to complete a four-armed bandit task over 150 trials, which, analogous to war simulations, presents the challenge of balancing exploitation (i.e., learning and continuing to use slots with positive payout) and exploration (i.e., trying different slots that may yield better payouts). Exploration-exploitation performance equals total payout. Combining three of the indicators of cognitive flexibility in one factor—vigilance, working memory, and switching—Richner et al. find that cognitive flexibility is positively related to exploitation-exploration performance. Moreover, cognitive flexibility mediates the positive effects of emotional stability and context-evoked task motivation on exploration-exploitation performance. Emotional stability mediates the negative effect of context-evoked stress on cognitive flexibility.

Aggarwal et al. examine a construct similar to cognitive flexibility, cognitive versatility (i.e., the ability to shift in cognitive styles). Their focus is on fluid participation in teams—changes in team composition and skill sets. When people come and go, coordination failures that compromise decision making are more likely. A structural remedy to alleviate this bounded rationality gap is intersecting role sets in which some tasks are completed by more than one role. But, because organizations often lack people to fill intersecting roles, many teams are set up with disconnected role sets that complicate coordination and adaptation. Aggarwal et al. propose that the cognitive versatility of core members who have decision authority may compensate for the use of disconnected role sets. More cognitively versatile members attenuate the gap in performance between teams with disconnected role sets and teams with intersecting roles sets because they may rely on their cognitive versatility to make decisions that make the team more adaptive. Their analyses of a sample of 342 teams from a hospital Emergency Department support their proposition: teams with disconnected roles are less effective than teams with intersecting roles, as evidenced by longer hospital stays and more hand-offs for patients. But the presence of a cognitively versatile core member reduced the gap.

Guo et al. also focus on roles. Dating back to work by Guetzkow and Simon (1955) and March and Simon (1958), a central insight in the Carnegie perspective is that different types of structures alter communication in ways that influence coordination and decision making. But this view overlooks the possibility that the people occupying critical roles may not be a good match with the requirements of the position. In that scenario, structural arrangement alone may not be sufficient to deal with the constraints posed by bounded rationality. Guo et al. suggest that allowing group members to choose who occupies the central position in a centralized network creates a better match between the capacity of the chosen individual and the role. The reason is that, through working together, members learn who possesses which skills and can rely on this learning to identify the best match. They study 41 triads working on a complex programming task. All triads are allowed to express their choice but, in the position chosen condition, the triads were given their choice, whereas, in the position assigned condition, the triads were given a randomly selected person they did not choose. Communication activity both predicted selection to the central position and mediated the relationship between choice and team performance which was measured as the number of errors. This selection process, they conclude, complements the centralized network as a solution to the challenges posed by bounded rationality.

New directions for the Carnegie perspective on decision making

We conclude by identifying new research directions that emerge from the papers in the Research Topic. The first research direction concerns the study of individual characteristics. As Greve

(p. 6) provocatively said, research within Carnegie has been quite person-less. Indeed, most theorizing tends to be process oriented and focused on the influence of the context. However, as several papers in this Research Topic suggest, we are increasingly seeing a shift toward a more careful consideration of the person. The context remains prominent even within this new research direction. In fact, rather than examining the direct influence of individuals characteristics on decisions, an approach revealed by some of the studies in this Research Topic is to look at their influence within specific contexts, where individual differences may serve as a complement to structural arrangements that help cope with bounded rationality or as filters to contextual influences such as performance feedback. Studies on self-enhancement (Audia and Brion, 2007, 2023; Lauenstein et al., 2024), cognitive flexibility (Laureiro-Martinez and Brusoni, 2018), and job experience (Gaba et al., 2023) exemplify the emergence of this new research direction.

The second research direction is to integrate within the Carnegie perspective the study of emotions. Levinthal and Newark (p. 7) encourage Carnegie scholars to move away from the "Tin Man" sensibility of an actor without a heart by providing a better accounting of the role of emotions. Two papers in this Research Topic tackle this task. Richner et al. examine emotions as context-evoked (e.g., stress) and as individual traits (e.g., emotional stability) and find some evidence indicative of the importance of the latter in the decision process. Stumpf-Wollersheim et al. show how emotions such as sadness and fear may enter Carnegie theorizing through their influence on the emergence of routines and their negative effects. Together with earlier work on the influence of emotion of routine adoption (Dojback Hakonsson et al., 2016), these early efforts show the promise of pursuing this research direction.

A third research direction is the examination of interpretation in the face of ambiguity. Levinthal and Newark (p. 2) note how a focus on the influence of context implies recognizing the importance of interpretation when the signals coming from the context are not clear cut. Greve is even bolder, as he identifies construal as a central area for future work. In this Research Topic, an example of interpretation under ambiguity is the study by Kim et al., where learning from own experience and others' experience requires interpretation. In previous research, a notable example is the line of work examining the influence of multiple goals and multiple aspirations on decision making (Audia and Greve, 2021; Levinthal and Rerup, 2021). Levinthal and Newark also expand the view of interpretation as an antecedent of decision making to suggest that interpretation in the form, for example, of stories, allows individual to assign existential meaning to what they do (Newark, 2014). Although the empirical papers do not directly deal with these conceptions of interpretation under ambiguity, we view this as an important research direction.

Pursuing these three research directions will require integrating within the Carnegie perspective insights and findings generated by research in psychology and neuroscience. Whether examining cognitive versatility, sadness and fear, or conflict, the authors of the papers in this Research Topic undertook that task. The results are novel insights and findings that strengthen the explanatory power of the Carnegie perspective and simultaneously create opportunities for dialogue and increased visibility with other lines of work.

Author contributions

PA: Writing – original draft, Writing – review & editing. DL: Writing – review & editing. DN: Writing – review & editing.

Funding

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

Almandoz, J. (2014). Founding teams as carriers of competing logics: when institutional forces predict bank's risk exposure. *Adm. Sci. Q.* 59, 442–473. doi: 10.1177/0001839214537810

Argote, L., and Greve, H. R. (2007). A behavioral theory of the firm – 40 years and counting: Introduction and impact. *Organizat. Sci.* 18, 337–349. doi: 10.1287/orsc.1070.0280

Argote, L., and Miron-Spektor, E. (2011). Organizational learning: from experience to knowledge. *Organizat. Sci.* 22, 1123–1137. doi: 10.1287/orsc.1100.0621

Audia, P. G., and Brion, S. (2007). Reluctant to change: self-enhancing responses to diverging performance measures. *Organ. Behav. Hum. Decis. Process.* 102, 255–269. doi: 10.1016/j.obhdp.2006.01.007

Audia, P. G., and Brion, S. (2023). A Carnegie plus self-enhancement (CSE) model of organizational decision making under ambiguity. *Res. Organizat. Behav.* 43, 1–13. doi: 10.1016/j.riob.2023.100194

Audia, P. G., and Greve, H. R. (2006). Less likely to fail: Low performance, firm size, and factory expansion in the shipbuilding industry. *Manage. Sci.* 52, 83–94. doi: 10.1287/mnsc.1050.0446

Audia, P. G., and Greve, H. R. (2021). *Organizational Learning from Performance Feedback: A Behavioral Perspective on Multiple Goals*. Cambridge: Cambridge University Press.

Audia, P. G., Locke, E. A., and Smith, K. G. (2000). The paradox of success: an archival and laboratory study of strategic persistence following radical environmental change. *Acad. Manage. J.* 43, 837–854. doi: 10.2307/1556413

Audia, P. G., Rousseau, H. E., and Brion, S. (2022). CEO power and nonconforming reference group selection. *Organizat. Sci.* 33, 831–853. doi: 10.1287/orsc.2020.1397

Baum, J. A. C., and Dahlin, K. B. (2007). Aspiration performance and railroads' patterns of learning from train wrecks and crashes. *Organizat. Sci.* 18, 337–545. doi: 10.1287/orsc.1060.0239

Baumann, O., Eggers, J., and Stiglitz, N. (2019). Colleagues and competitors: how internal social comparisons shape organizational search and adaptation. *Adm. Sci. Q.* 64, 275–309. doi: 10.1177/0001839218766310

Billinger, S., Srikanth, K., Stieglitz, N., and Schumacher, T. R. (2021). Exploration and exploitation in complex search tasks: how feedback influences whether and where human agents search. *Strateg. Manage. J.* 42, 361–385. doi: 10.1002/smj.3225

Boyle, E., and Shapira, Z. (2012). The liability of leading: battling aspiration and survival goals in the Jeopardy! Tournament of champions. *Organizat. Sci.* 23, 907–1211. doi: 10.1287/orsc.1110.0690

Bromiley, P. (1991). Testing a causal model of corporate risk taking and performance. *Acad. Managem. J.* 34, 37–59. doi: 10.2307/256301

Clough, D. R., and Piezunka, H. (2020). Tie dissolution in market networks: a theory of vicarious performance feedback. *Adm. Sci. Q.* 65, 972–1017. doi: 10.1177/0001839219899606

Cohen, M. D., and Bacdayan, P. (1994). Organizational routines are stored as procedural memory: evidence from a laboratory study. *Organizat. Sci.* 5, 479–625. doi: 10.1287/orsc.5.4.554

Cyert, R. M., and March, J. G. (1963). *A Behavioral Theory of the Firm.* Hoboken: Prentice-Hall Inc.

Denrell, J., and March, J. G. (2001). Adaptation as information restriction: the hot stove effect. *Organizat. Sci.* 12, 523–659. doi: 10.1287/orsc.12.5.523.10092

Dojback Hakonsson, D., Eskildsen, J. K., Argote, L., Monster, D., Burton, R. M., and Obel, B. (2016). Exploration versus exploitation: emotion and performance as antecedents and consequences of team decisions. *Strateg. Manage. J.* 37, 985–1001. doi: 10.1002/smj.2380

Feldman, M. S., Pentland, B. T., D'Adderio, L., and Lazaric, N. (2016). Beyond routines as things: introduction to the special issue on routine dynamics. *Organizat. Sci.* 27, 505–513. doi: 10.1287/orsc.2016.1070

Gaba, V., Lee, S., Meyer-Doyle, P., and Zhao Ding, A. (2023). Prior experience of managers and maladaptive responses to performance feedback: evidence from mutual funds. *Organizat. Sci.* 34, 509–986 doi: 10.1287/orsc.2022.1605

Gavetti, G., and Levinthal, D. (2000). Looking forward and looking backward: cognitive and experiential search. *Adm. Sci. Q.* 45, 113–137. doi: 10.2307/2666981

Gavetti, G., Levinthal, D., and Ocasio, W. (2007). Perspective – neo-Carnegie: the Carnegie school's past, present, and reconstructing the future. *Organizat. Sci.* 18, 337–545. doi: 10.1287/orsc.1070.0277

Greve, H. R. (1998). Managerial cognition and the mimetic adoption of market positions: What you see is what you do. *Strateg. Manage. J.* 19, 967–988.3.

Greve, H. R., and Zhang, C. M. (2017). Institutional logics and power sources: Merger and acquisition decisions. *Acad. Manag. J.* 60, 671–694. doi: 10.5465/amj.2015.0698

Guetzkow, H., and Simon, H. A. (1955). The impact of certain communication nets upon organizational performance in task-oriented groups. *Manage. Sci.* 1, 233–250. doi: 10.1287/mnsc.1.3-4.233

Jordan, A. H., and Audia, P. G. (2012). Self-enhancement and learning from performance feedback. *Acad. Manag. Rev.* 37, 211–231. doi: 10.5465/amr.2010.0108

Joseph, J., and Gaba, V. (2015). The fog of feedback: ambiguity and firm responses to multiple aspiration levels. *Strateg. Manage. J.* 36, 1960–1978. doi: 10.1002/smj.2333

Kahneman, D. (2011). *Thinking, Fast and Slow*. New York: Farrar, Straus, and Giroux.

Keil, T., Syrigos, E., Kostopoulos, K. C., Meissner, F. D., and Audia, P. G. (2023). (In)Consistent performance feedback and the locus of search. *J. Manage.* doi: 10.1177/01492063231185519

Lant, T. K. (1992). Aspiration level adaptation: an empirical investigation. *Manage. Sci.* 38, 623–644. doi: 10.1287/mnsc.38.5.623

Lauenstein, F., Newark, D., and Baumann, O. (2024). How mixed performance feedback shapes exploration: The moderating role of self-enhancement. *Organizat. Sci.* doi: 10.1287/orsc.2021.15676

Laureiro-Martinez, D., and Brusoni, S. (2018). Cognitive flexibility and adaptive decision making: Evidence from a laboratory study of expert decision makers. *Strateg. Manage. J.* 39, 1031–1058. doi: 10.1002/smj.2774

Laureiro-Martinez, D., Brusoni, S., Canessa, N., and Zollo, M. (2015). Understanding the exploration-exploitation dilemma: an fMRI study of attention control and decision-making performance. *Strateg. Manage. J.* 36, 319–338. doi: 10.1002/smj.2221

Levinthal, D., and March, J. G. (1993). The myopia of learning. *Strateg. Manage. J.* 14, 95–112. doi: 10.1002/smj.4250141009

Levinthal, D., and Rerup, C. (2021). The plural of goal: learning in a world of ambiguity. *Organizat. Sci.* 32, 527–543. doi: 10.1287/orsc.2020.1383

Levitt, B., and March, J. G. (1988). Organizational learning. *Annu. Rev. Sociol.* 14, 319–340. doi: 10.1146/annurev.so.14.080188.001535

Lovallo, D., and Kahneman, D. (2003). *Delusions of Success: How Optimism Undermines Executives' Decisions*. Brighton: Harvard Business Review.

Luger, J. (2023). Who depends on why: toward an endogenous, purpose-driven mechanism in organizations' reference selection. *Strateg. Manage. J.* 44, 2035–2059. doi: 10.1002/smj.3486

March, J. G. (1989). *Decisions and Organizations*. Oxford: Basil Blackwell Ltd.

March, J. G. (1994). *A Primer on Decision Making: How Decisions Happen*. New York: The Free Press.

March, J. G., and Olsen, J. P. (1989). *Rediscovering Institutions: the Organizational Basis of Politics.* New York: The Free Press.

March, J. G., and Shapira, Z. (1992). Variable risk preferences and the focus of attention. *Psychol. Rev.* 99, 172–183. doi: 10.1037/0033-295X.99.1.172

March, J. G., and Simon, H. A. (1958). *Organizations.* Hoboken: Wiley.

Mezias, S. J., Chen, Y. R., and Murphy, P. R. (2002). Aspiration level adaptation in an American financial services organization: a field study. *Manage. Sci.* 48, 1227–1368. doi: 10.1287/mnsc.48.10.1285.277

Newark, D. (2014). Indecision and the construction of self. *Organ. Behav. Hum. Decis. Process.* 134, 45–62. doi: 10.1016/j.obhdp.2014.07.005

Newark, D. (2018). Leadership and the logic of absurdity. *Acad. Manag. Rev.* 43, 198–216. doi: 10.5465/amr.2015.0186

Ocasio, W. (1997). Towards an attention-based view of the firm. *Strateg. Manage. J.* 18, 187–206.

Posen, H. E., Keil, T., Kim, S., and Meissner, F. D. (2018). Renewing research on problemistic search – A review and research agenda. *Acad. Manag. Ann.* 12, 208–251. doi: 10.5465/annals.2016.0018

Rerup, C. (2009). Attentional triangulation: Learning from unexpected rare crises. *Organizat. Sci.* 20, 876–893. doi: 10.1287/orsc.1090.0467

Scott, W. R., and Davis, G. (2015). *Organizations and Organizing: Rational, Natural, and Open Systems Perspective.* London: Routledge.

Shapira, Z. (1997). *Organizational Decision Making*. Cambridge: Cambridge University Press.

Simon, H. A. (1947). *Administrative Behavior*. New York: Macmillan.

Simon, H. A. (1955). A behavioral model of rational choice. *Q. J. Econ.* 99–118. doi: 10.2307/1884852

Simon, H. A. (1956). Rational choice and the structure of the environment. *Psychol. Rev.* 63, 129–138. doi: 10.1037/h0042769

Simon, H. A. (1964). "Theories of bounded rationality," *in working paper #66, March* 12.

Thaler, R. H., and Sunstein, C. R. (2021). *Nudge*. London: Penguin Books.

Thornton, P. H., and Ocasio, W. (1999). Institutional logics and the historical contingency of power in organizations: executive succession in higher education publishing industry, 1958-1990. *Am. J. Sociol.* 105, 801–843. doi: 10.1086/210361

Thornton, P. H., Ocasio, W., and Lounsbury, M. (2012). *The Institutional Logics Perspective*. Oxford: Oxford University Press.

frontiers | Frontiers in Psychology

TYPE Conceptual Analysis
PUBLISHED 27 October 2023
DOI 10.3389/fpsyg.2023.1165713

OPEN ACCESS

EDITED BY
Thorbjorn Knudsen,
Frankfurt School of Finance and Management, Germany

REVIEWED BY
Sheen S. Levine,
Columbia University, United States
Maciej Workiewicz,
ESSEC Business School, France

*CORRESPONDENCE
Daniel A. Newark
✉ newark@hec.fr

RECEIVED 14 February 2023
ACCEPTED 05 September 2023
PUBLISHED 27 October 2023

CITATION
Levinthal DA and Newark DA (2023) Putting the individual in the context of the organization: A Carnegie perspective on decision-making. *Front. Psychol.* 14:1165713. doi: 10.3389/fpsyg.2023.1165713

Putting the individual in the context of the organization: A Carnegie perspective on decision-making

Daniel A. Levinthal[1] and Daniel A. Newark[2]*

[1]Wharton School, University of Pennsylvania, Philadelphia, PA, United States, [2]HEC Paris, Jouy-en-Josas, France

The majority of decision research portrays decision-makers as largely decontextualized, separate from the institutional and social factors that influence their choosing. On the occasions when context is considered, it is rarely organizational, despite the prominence of organizations in people's lives. By contrast, the Carnegie perspective on decision-making emphasizes context, particularly that of organizations, as a central concern. We develop this contrast by first reviewing the limited role of context in neoclassical economic and psychological depictions of choice. Next, we present key elements of the organizational decision context in the Carnegie perspective: decision premises, standard operating procedures and decision rules, organizational structures, learning environments, and identity–situation interaction. We then consider the importance of interpretation to decision-making in context. In particular, rather than being given and clear, the meaning of decision context is often ambiguous and must be interpreted or constructed. The Carnegie perspective underscores the importance of this interpretive process to both decision-making and everyday life. We conclude by considering aspects of context that merit greater examination, as well as the implications for behavioral theorizing of acknowledging the contextualized nature of action.

KEYWORDS

organizational decision-making, judgement and decision-making, behavioral theory of the firm, organizational learning, decision-making in context

> *No man is an island,*
> *Entire of itself;*
> *Every man is a piece of the continent,*
> *A part of the main.*
> –Donne (1624/1987)

Introduction

John Donne's admonition to recall our connectedness notwithstanding, many of the core traditions within behavioral decision theory seem to have largely decontextualized action, judgment, and decision-making. In this sense, much of the scholarship on choice can be subject to Granovetter's (1985) broad critique of economic accounts of individuals and firms as under-embedded or under-socialized. Despite this general property of research on choice, we suggest that the Carnegie perspective has long been mindful of the importance of context to choice, while still preserving a fundamental belief in individual agency.

For the Carnegie perspective, the primary context is organizations. Simon (1948/1997) set out to understand administrative behavior, judgement, decision-making, and action in a hierarchical structure. Cyert and March (1963/1992) sought to understand and develop a parsimonious representation of firm decision-making. March (2010) and March and Olsen (1984, 1989, 1995, 2006) extended the notion of context to include broader social and cultural norms and values, as filtered through organizational life, as well as the need for decision-makers to interpret the context within which they operate.

We first put forward some of the important lines of decision-making research that we suggest serve as counterpoints to the Carnegie perspective, beginning with the classic conceptions of rational choice in the economics literature, followed by Kahneman and Tversky's alternative formulation of behavioral decision theory, the elaboration of choice architecture introduced by Thaler and colleagues (Thaler and Sunstein, 2008; Benartzi et al., 2017), and the research program of Gigerenzer and colleagues on ecological rationality (Gigerenzer and Gaissmaier, 2011; Todd and Gigerenzer, 2012). With these building blocks in place, we shift to a discussion of how the Carnegie perspective presents a contrasting, more richly contextualized view of choice. We consider some of the key ways in which an organization serves as a context that influences choice through decision premises (Simon, 1948/1997), standard operating procedures and decision rules (March and Simon, 1958; Cyert and March, 1963/1992), organizational structures (Dearborn and Simon, 1958; Cyert and March, 1963/1992; Cohen et al., 1972; Ocasio, 1997), learning environments (Levitt and March, 1988; Haunschild and Miner, 1997; Argote and Miron-Spektor, 2011), and the interaction between decision-makers' identities and the situations in which they find themselves (March, 1994; March and Olsen, 2006).

Furthermore, acknowledging the importance of context underscores the importance of interpretation, often in the face of ambiguity (March, 2010). Early work in the Carnegie tradition highlighted aspiration-based, dichotomous encoding of experience as either "success" or "failure" (March and Simon, 1958; Cyert and March, 1963/1992). However, subsequent work treats experience as having far greater ambiguity and latitude for interpretation than the success vs. failure dichotomy of aspiration learning suggests (March, 2010; Newark, 2014; Levinthal and Rerup, 2021). Individuals tell stories to themselves and others, creating narratives to give meaning to, and create understanding of, their lives and experiences. While such narratives can be over-determined, causal explanations are a powerful mechanism for sense-making in a complex and otherwise confusing world. These acts of interpretation are not only fundamental to decision-making but, as work from the Carnegie perspective has regularly suggested (Cyert and March, 1963/1992; March and Olsen, 1975, 1984; Feldman and March, 1981; March and Sevón, 1984; March, 1987, 1994, 1999, 2010; Newark, 2014, 2018, 2020), may be fundamental to our efforts to create meaning and understanding in our lives more broadly.

In sum, the Carnegie perspective gives us a conceptual apparatus with which to consider organizationally situated action. As Gavetti et al. (2007, p. 528) noted, "Any conception of an organization that omits a notion of individuals who are situated in distinct places in some structural arrangement will be hard pressed to engage much of what we commonly experience in organizational life... The original conception of organizations in the Carnegie School did in fact provide such a theoretical apparatus." We aim to bring forth this theoretical apparatus, both by contrasting alternative conceptions of decision-making and by highlighting the richness of contextualizing factors emphasized by the Carnegie perspective.

Neoclassical economics: context as markets

Both for work in psychology (Kahneman and Tversky, 1979) and for work within the Carnegie perspective (Simon, 1955), the conception of choice and action provided by neoclassical economics was a referent and touchstone in efforts to articulate a behaviorally grounded view. The neoclassical approach reduces decision-making to the mathematical operator of maximization: that is, maximization of a utility function for individuals and of profits for firms. Individuals may differ in the information available to them and in their preferences, but they are homogenous in their impeccable, consistent, Spock-like judgment processes. In that sense, the characterization of decision-making is divorced from the context of actual individual capabilities and vicissitudes.

However, context does enter the neo-classical framework in an important respect. While utility functions and firm profits are not observable, Samuelson (1947), in a key contribution of his *Foundations of Economic Analysis*, introduced the idea of comparative statics, which showed how the constrained optimization approach to economics that he developed could make empirical predictions even in the absence of knowledge of the objective function (utility or profit) to be maximized. Changes in relative prices (of goods and services for consumers, of capital and labor for firms) lead to predictable, qualitative (directional) changes in consumers' consumption choice as well as a firm's production technology. In this sense, context is critical to the neoclassical apparatus, as empirical predictions from the model only stem from changes in the "context" in which actors operate. Further, context is also present not only in market forces (in the form of prices of inputs and outputs), but also in focal others, especially in game-theoretic treatments of competitive interaction (Von Neumann and Morgenstern, 1944).

However, these "contexts" are external—encompassing market prices and other firms—and not internal with respect to the firm itself, as is central to the Carnegie perspective. Even agency theory (Jensen and Meckling, 1976), which slightly opened up the convenient "black box" of firms as owner-operator entities relied on by neoclassical economics, remains a theory of contractual relationships. Although there may be important distinctions between contractual relationships among actors within an enterprise and those external to it (Baker et al., 2002), the ultimate conception, as Holmstrom (1999) terms it, is the firm as a "subeconomy" of economic relationships.

Behavioral decision theory

Heuristics and biases: context as framing

Kahneman and Tversky posed a stark challenge to the neoclassical paradigm. While the rational choice framework imposes no restrictions on what might constitute individual

preferences, and in particular individuals' risk preferences, it does impose a constraint of consistency. Kahneman and Tversky showed that when facing choice problems with mathematically equivalent probabilistic payoffs, individuals vary their choice as a function of how the problem is framed or represented. These anomalies served as a behavioral puzzle and a starting point for their theorizing. Their aim, as manifest in their work on prospect theory, was to take the expected utility apparatus of neoclassical theory and modify it into a theory of choice that was consistent with the experimental data on the judgment tasks they and others had examined. In this regard, Kahneman and Tversky (1979) offered two key modifications of the expected utility apparatus. One was the characterization of an individual's perceived value over payoffs, postulating that individuals are risk averse in the domain of gains (a concave payoff function) and risk-seeking in the domain of losses (a convex function).[1] The other key modification was to introduce a subjective probability construct, with the property that small objective probabilities close to zero would be over-weighted and large objective probabilities close to one would be under-weighted. With these two modifications of the expected utility apparatus, Kahneman and Tversky were able to reconcile various anomalies, such as the Allais Paradox.

Clearly this was path-breaking work and helped set the course for a rich line of inquiry on behavioral decision theory. Context was critical in this framework in the sense of choice attributes or other aspects of what Thaler and his collaborators (Thaler and Sunstein, 2008; Benartzi and Thaler, 2013; Thaler et al., 2014; Benartzi et al., 2017) termed choice architecture (e.g., whether outcomes are framed as gains or losses, the order in which alternatives are presented, the presence of anchors, the setting of defaults, the presence of irrelevant alternatives that may nonetheless influence preferences). However, these were nonetheless experiments and theorizing around individual judgments, with decision-makers still largely removed from any kind of social or institutional context, such as other people, relationships, roles, places, or history. Decision-makers were depicted as islands of judgment. Thus, while the work on choice architecture brings to the fore the scaffolding surrounding judgment tasks, that scaffolding is not a social context, but rather quite specific features of the decision frame. Even more recent research on judgment and decision-making that has begun to pay greater attention to social context has tended to ignore the particular context of organizations in favor of broader cultures and norms (e.g., Miller, 1999; Weber and Morris, 2010; Yates and De Oliveira, 2016)—a practice consistent with social psychological research more generally (Lewin, 1951; Tajfel, 1972; Gergen, 1973; Markus and Kitayama, 1991; Heath and Sitkin, 2001; Staw, 2016), and one that underscores the uniqueness of Carnegie's organizational focus.

Ecological rationality: context as the familiar environment

Gigerenzer and his collaborators (Gigerenzer and Brighton, 2009; Gigerenzer and Gaissmaier, 2011; Todd and Gigerenzer, 2012) critique the work on prospect theory and the broader judgment and decision-making program for focusing excessively on the potential downsides of decision biases and heuristics, while neglecting their potential efficacy and efficiency. In doing so, they call for investigating "ecological rationality," which takes into account an individual's environment when assessing the desirability of a particular heuristic. Context clearly plays an important role in this line of research, generally in the form of an actor's familiarity with their environment or choice. For instance, it is possible to predict with 91% accuracy which of two cities in Germany has a larger population based on which city has a team in the Bundesliga, the German professional soccer league (Gigerenzer et al., 1991). Thus, when one city has a professional soccer team and one does not, presence of a professional soccer team is a good heuristic for predicting relative city size. In this way, the individual is no longer making choices in a "vacuum," but in a world in which they have lived and with which they have some familiarity. It is not a world, however, of organizational processes or even social interactions. This holds even when the choice context has organizational attributes, such as when an experienced manager may learn to classify a customer as active or inactive using the heuristic of how many months it has been since the customer's last purchase (Wübben and Wangenheim, 2008), or when a manager may make better hiring decisions using a heuristic rather than logistic regression (Luan et al., 2019). Further, the tasks, or empirical tests, are generally limited to ones of prediction or knowledge of basic facts, with clear right answers. They are not considerations of collective action and decision-making and, in that regard, fail to capture much of the dynamics of choice in organizations or other social contexts.

The Carnegie perspective: context as organizations

Decision premises

As Simon (1991) notes, while much of the discourse in economics focuses on the role of markets, most economic activity occurs within firms. Indeed, the prominent role of business organizations is a key characteristic of developed economies. For pre-industrial societies, families and clans were the primary social structure. In modern industrial (or post-industrial) societies, the business organization has become and remains a focal social structure in individuals' lives. From its beginnings with Simon's *Administrative Behavior* (Simon, 1948/1997), the focus of the Carnegie perspective has been on behaviorally grounded accounts of decision-making in the context of organizations.

1 While having some superficial similarity to the notion of aspiration levels in the Carnegie tradition, the two frameworks are quite distinct. Aspirations are a mechanism by which outcomes are encoded into a discrete category of success or failure. This is an ex-post mechanism—having experienced an outcome, how does an individual view it? Prospect theory looks ex-ante at the choices individuals face and how their view of potential gains and losses stemming from those choices influence those choices. Thus, while both frameworks entail a reference point, it is important to bear in mind the ex-post learning, interpretation focus of aspirations and the ex-ante risk–return assessment of prospect theory.

A central mechanism by which organizational context impacts individual action in Simon's (1948/1997) argument is decision premises. Higher-order actors within an organization provide what the contemporary literature would term logics (Thornton and Ocasio, 2008; Thornton et al., 2012) by which those working under their guidance and authority should act. These premises, or logics, do not delineate specific actions or decisions, but rather a basic framework within which those actions should be taken or choices made. There are some links to the work on choice architecture noted previously, but choice architecture generally references a rather specific and narrow element of a decision's framing, such as whether saving for retirement or donating one's organs is something one opts into or out of when filling out a form (Johnson and Goldstein, 2003; Benartzi and Thaler, 2013). In contrast, a decision premise serves as a less specific but far more robust mechanism by which choices are influenced. For instance, a decision premise might guide a product development team at a technology firm by providing a sense of the firm's values, such as the design aesthetic of Apple, the commitment to high technical performance of BMW, or the importance of sustainability at Patagonia. In this sense, decision premises help actors navigate the inevitable trade-offs that they face.

The notion of decision premises as developed in Simon's (1948/1997) early work suggests a hierarchical cascade from higher-order premises down to more specific goals across different facets of the organization. However, just as March (1962) problematizes the possibility of a superordinate goal for an organization, as one moves from more abstract, higher-order premises to the more concrete, lower-order goals intended to align with and effectuate them, these more granular lower-level goals may end up at odds with each other. Thus, while decision premises, like goals, are intended to help direct individual action and coordinate collective behavior (Greve, 2023), both mechanisms are subject to the possibility of inconsistencies and potentially conflicting implications. In our discussion of organizational structures below, we examine some of the key lines of argument within the Carnegie perspective on the quasi-resolution of goal conflict and the possibility of effective collective action despite its presence.

Standard operating procedures and decision rules

March and Simon (1958) and Cyert and March (1963/1992) shift from an emphasis on decision premises to the role of standard operating procedures and decision rules. This shift is particularly pronounced with Cyert and March—and was likely prompted in part by the desire to specify a computational model of organizational decision-making. *A Behavioral Theory of the Firm* presented a conceptual framework by which one could understand both a boundedly rational, goal-directed entity subject to some degree of internal conflict and corresponding computational models of such a structure. Decision-making in the model operates in the form of a series of "if–then" rules. If a certain condition holds, then a certain action is taken. In parallel to this effort, Newell and Simon (1972) pioneered early efforts in artificial intelligence in which domain experts presented with a choice situation would engage in protocol analysis as they were asked to verbalize the logic by which they made their judgements. These "protocols" were then codified computationally (Figenbaum, 1978).

Decision premises and decision rules are both mechanisms by which the social structure in which individuals operate—i.e., the organizational context—influences and guides action. They do not eliminate individual agency or reduce decision-makers to Tayloristic automatons. Discretion remains. But the decision calculus, as influenced by decision premises and standard operating rules, is deeply impacted. Further, while writings in the Carnegie perspective tend not to speak extensively of organizational culture and norms, decision premises and rules can be seen as mechanisms by which such factors influence decision-making and action.

Related to the idea of decision premises is the notion of a firm's strategic context: a line of argument introduced in the works of Simon and Cyert and March, and later elaborated by Bower (1970). Bower pointed to the role of the firm's strategic context in inducing action by managers, making it a mechanism by which managerial initiatives could be directed. Burgelman (1983) applied these ideas to corporate entrepreneurship and later developed the arguments further, highlighting the dual role of autonomous initiatives (not guided by the strategy context) and induced initiatives (guided by this context) in understanding the dynamics of strategic change (Burgelman, 1991). Levinthal's (2017, 2021) development of the firm as an "artificial selection" environment and the role of a "Mendelian executive" in molding this environment is a further elaboration of these ideas, and an effort to link the Carnegie perspective with that of evolutionary economics (Nelson and Winter, 1982).

Organizational structures

Adam Smith (1776) famously highlighted the division of labor as an engine of the development of individual expertise and overall economic progress. Interestingly, and perhaps an under-appreciated point, his argument for the division of labor did not hinge on some form of arbitrage or gains from trade, as later introduced by Ricardo (1817). Rather, Smith emphasized that specialization in a task would generate skill in that specialized function—a pin-maker was not born with a particular skill in one of the eighteen steps that Smith identifies in this, his motivating example, but rather became skilled through hours of experience in the task.

Task structures play a central role in the Carnegie perspective's conception of decision-making situated in organizations, as there is a close connection between the division of labor and the division, or specialization, of cognition (Dearborn and Simon, 1958; Cyert and March, 1963/1992). Similar to Smith's argument, Dearborn and Simon (1958) demonstrate how given roles and tasks influence actors' cognitive schema. The marketing manager, the production engineer, and the CFO see the world through qualitatively different lenses. In a similar vein, Chase and Simon (1973) demonstrate the different ways novices and experts interpret a common stimulus—in their case, the position of chess pieces on a game board. In particular, experts are able to "chunk" the

data in ways that allow them to more efficiently encode the information, while novices interpret the data as individual pieces on the board.[2]

Divergent roles not only create divergent cognitive schema, they also create potentially divergent goals (Cyert and March, 1963/1992). March (1962) addresses this challenge of organizational goals from the vantage point of what the contemporary management literature would term "stakeholders," considering the possibly divergent interests of front-line workers, management, investors, and others. In doing so, he illuminates the stark behavioral differences between an individual with a goal (a depiction common across decision-making research) and an individual with a goal in an organization populated by others with conflicting goals (a depiction relatively unique to the Carnegie perspective).

March begins with an argument in the spirit of Arrow's (1951) work on social choice and his "impossibility theorem" regarding the challenge of aggregating individual preferences into a coherent choice structure (i.e., one involving a transitive preference ranking). However, while Arrow stops with his impossibility result, March ventures further and poses the possibility of coalitions of actors and the associated possibility of coalition power and politics reconciling these divergent interests. Per the role of power, the viability of a coalition does not imply that all parties' interests are treated equally, but rather that all parties receive sufficient payoff relative to their outside options such that they are willing to participate in the coalition.

Cyert and March (1963/1992) point to facets of organizational processes and structures as contextual mechanisms that allow the organization to achieve some over-arching sense of direction and coordinated action in the face of these divergent interests. In particular, they note the potential power of sequential allocation of attention amongst otherwise non-reconcilable goals. For instance, an organization may seek both growth and efficiency. Addressing these two imperatives simultaneously may present challenging trade-offs and choices for managers. Alternatively, focusing first on growth, with efficiency as more a constraint than a goal, provides a higher degree of clarity of action and decision-making. Then subsequently, the organization might come to believe that it would be better served by shifting its focus toward efficiency. Neither objective is deemed intrinsically more important than the other; rather, each has its day.

A structural, rather than temporal, mechanism for contending with competing interests is having one organizational unit focus on a particular objective while another unit focuses on a different objective. Thus, there is not a unifying high-order goal, but rather there are local, unit-specific objectives. The degree to which a solution proves effective depends on how modular, or nearly decomposable, the task structures are across the organizational units (Ethiraj and Levinthal, 2004, 2009). If the pursuit by subunit A of its sub-goal materially impacts the payoffs to subunit B in terms of its own distinct sub-goal, then a specialized goal structure can lead to dysfunctional perturbance of one unit's problem-solving effort by another's (Ethiraj and Levinthal, 2004). While this work points to the importance of modularity, and essentially horizontal task division, Levinthal and Workiewicz (2018) note that a key aspect of Simon's (1962) notion of nearly decomposable systems was a vertical dimension of structure and the possibility of actions at a lower level being encapsulated in some summary fashion. Organizations as structures of decision-making, building on early work by Sah and Stiglitz (1986), has served as an important line of work that links two key pillars of the Carnegie perspective: decision-making and task structures (Knudsen and Levinthal, 2007; Christensen and Knudsen, 2010; Csaszar, 2012).

In their work on the "Garbage Can Model," Cohen et al. (1972) point to the possibility of more complex organization structures that allow for a more fluid mapping of actors, and even issues, to choice opportunities. While the Garbage Can Model is often associated with organized anarchy and the relatively free flow of people, problems, and solutions, the formal model itself makes no assumption about whether the flows are highly structured or lacking in structure. The model provides an analytical framework within which to consider how alternative structures influence these flows and the implications for organizational decision-making—including the potential absence of decision-making (i.e., decision by oversight or flight in the model). Ocasio (1997) builds on these ideas and develops what he terms an attention-based view of strategy. This line of work (Ocasio, 1997; Ocasio and Joseph, 2005; Joseph and Ocasio, 2012) explores how organizational structures and organizational restructuring impact the strategic decision-making process by making distinct agendas, markets, and actors more or less salient.

Learning in context

Organizational learning has been a central theme in the Carnegie tradition, and one intimately intertwined with choice (March and Olsen, 1975). The basic engine of learning processes is reinforcement—actions associated with positive reward are reinforced and those associated with negative outcomes tend to be avoided (Thorndike, 1932). Context is a central, though not always highlighted, feature of such learning processes. For instance, what one learns about being an effective employee with one manager may not translate well to another manager, let alone to a different organization. This role of context bears keeping in mind as management scholars increasingly turn to randomized controlled trials (RCTs) as a mechanism of learning. RCTs avoid the possible misleading implications one might draw from "natural" samples in which individuals and firms select into specific treatment conditions, creating problems of causal inference. However, as Levinthal (2021) observes, such studies often under-attend to the context-dependence of their findings by failing to consider the representativeness or generalizability of their samples. An RCT is itself a context-dependent mechanism of learning.

Levinthal and March (1993) point to important biases in feedback-driven processes, stemming from their tendency to be

2 Chase and Simon (1973) present an important and illuminating contingency. Experts have an advantage when pieces follow standard patterns of moves and counter-moves, but their advantage is eliminated if the pieces are arrayed at random. This contrast makes clear that it is not a difference in raw memory at work, but rather a difference in representations and schema.

myopic. Feedback that is more proximate in time and space within the organization is likely to be more salient. Cost-cutting measures in a focal unit give a clear and immediate signal of progress. Developing novel processes and products offers more distant possible returns that may not necessarily benefit the innovating unit. As a result, they argue that learning processes will tend to privilege exploitation over exploration.

A critical part of the learning context is the broader ecology of learning processes within which any learning occurs (Levitt and March, 1988). Levinthal and March (1981) introduce the pathology of competency traps, stemming from the fact that people in organizations are simultaneously learning what actions to take as well as developing efficacy in the actions they have chosen. As a result of this dual learning process, organizational actors may view as unattractive policies, initiatives, and technologies with which they are inexperienced, despite the latent superiority of these alternatives. Levinthal's (1997) work on fitness landscapes provides another mechanism for competence traps, stemming from the interdependencies of actions. As a result of these interdependencies, shifting an initiative of a single actor may seem unattractive even if shifting a broader set of initiatives could lead the organization to a superior peak in the landscape. Local search in a setting of high interdependence will tend to lead organizations to local, rather than global, peaks.

Argote and Miron-Spektor (2011) highlight additional ways in which features of the organization impact learning processes. They note that "a context where members share a superordinate identity has been found to lead to greater knowledge transfer (Kane et al., 2005). Similarly, contexts where members trust each other (Levin and Cross, 2004) or feel psychologically safe (Edmondson, 1999) have been found to promote organizational learning" (Argote and Miron-Spektor, 2011, p. 1125).

Another key contextual source of learning is other organizations (Levitt and March, 1988; Haunschild and Miner, 1997). Of course, other organizations can provide misleading lessons as well as useful insights. Diffusion processes may be driven by a practice's merit, but they may also be driven by processes of legitimacy and status (Haveman, 1993). Moreover, given the interdependence of practices and processes, what may be a useful practice in one context may prove less useful in another. Benchmarking, comparing the efficacy of practices across a set of organizations, assumes either highly homogenous entities or limited interdependencies—a world of universal "best practices" (Levinthal, 2021). Going beyond the specific confines of the Carnegie perspective, organizational sociology points to the role of network structures in influencing the knowledge of practices and behaviors across organizational populations (Burt, 1980; Davis and Greve, 1997; Beckman and Haunschild, 2002; Reagans and McEvily, 2003).

The logic of appropriateness: context as identity, situation, and their interaction

Organizations serve not only as structural arrangements, but also as bases of identity (Ashforth et al., 2011; Ashforth and Schinoff, 2016). To say that one works at Google or ExxonMobil both conveys information to others and influences one's image of oneself. Values and norms are ascribed to organizations, and those values and norms can both be attributed to individual members and also serve as templates for these members. Of course, even our professional identities are not wholly circumscribed by the organizations we are part of or our particular role in them. We have a variety of roles and identities, both professional and personal (Ramarajan, 2014), that originate beyond the organization's boundaries. For instance, professions—e.g., medicine, law, architecture—provide individuals with a set of norms and values quite apart from those of the particular organizations to which they belong. Moreover, one's values may stem in part from a commitment to a particular community, set of religious beliefs, or other broader social norms beyond one's professional life.

As work on the logic of appropriateness (March and Olsen, 1989, 1995, 2006; March, 1994; Messick, 1999; Weber et al., 2004; Newark and Becker, 2021) emphasizes, those identities may be central to understanding the behavior and motivations of individuals in organizations. This work makes an important distinction between the logic of appropriateness and the logic of consequences. The logic of consequences underlies the reasoning of intended rationality, such as expected value calculations and cost–benefit calculations. By contrast, the logic of appropriateness attends less to the desirability of potential outcomes and more to the accordance of actions and behaviors with one's identity or role, given the situation one is in. This means that the fundamental question of the logic of appropriateness is not "Which decision alternative has the most desirable or sufficiently desirable expected consequences?" but rather, "What does a person such as I do in a situation such as this?" (March, 1994). The context of both one's organizational identity or role and the organizational situation in which one finds oneself are paramount.

For instance, the logic of appropriateness suggests that an on-duty soldier would follow an order from their commanding officer not because of some calculation of the costs and benefits of adherence vs. disobedience, but because that is what an on-duty soldier does in that situation. The Hippocratic Oath and its modern variants, taken by new doctors around the world, are not business plans regarding healthcare reimbursements, but a series of commitments to what constitutes appropriate actions for a medical professional in situations of care. As work in organizational theory and psychology (Messick, 1999; Weber et al., 2004; March and Olsen, 2006; Newark and Becker, 2021) has noted, logics of appropriateness bring organizational context to the fore, calling for actors to consider what kind of person they are, what sort of situation they are in, and what such a situation demands of such a person.

Interpretation as input: giving meaning to context in order to make decisions

Thus far, we have explored various manifestations of context in the Carnegie perspective that have an important influence on individual choice behavior. But exactly what that influence is will depend not only on one's context in some objective sense, but also on one's subjective interpretation of that context. The Carnegie perspective has emphasized the construction of meaning from its

earliest days and, particularly with the post-1970s writings of March (1982/2005, 1987, 1994, 1999, 2010; see also March and Olsen, 1975, 1984; Feldman and March, 1981; March and Sevón, 1984; and Cyert and March, 1963/1992), the consideration of these processes grew increasingly rich. The key insight is that the meaning of the decision context is neither given nor unambiguous, but rather must be constructed and is often subject to multiple interpretations.

In early writings within the Carnegie tradition, the question of "meaning" was largely confined to the basic question of whether an observed outcome (e.g., a sales figure or profits) should be categorized as success or failure, with the aspiration level (March and Simon, 1958; Cyert and March, 1963/1992) demarcating these two domains. The dynamics of aspiration levels and their possible implications for organizational search have, as Gavetti et al. (2007) suggest, arguably been the most developed element of the behavioral theory of the firm (cf., Greve, 2003).

However, subsequent interest in the interpretation of context has gone well beyond this categorization of outcomes as successes or failures. To begin, all components of choice have to be interpreted and imbued with meaning. As March (1999, p. 25–26) put it,

> Theories of rational action assume that decision makers make sense of their situation by forming expectations about future consequences and preferences for those consequences. Theories of rule-based action assume that decision makers make sense of their situation by identifying situations as matching identities and rules and by interpreting the implications of those matches. Decisions are seen as predicated on these meanings that are established prior to action.

In addition to interpreting information to arrive at expected consequences and expected preferences for those consequences (in the case of a logic of consequences) and interpreting a multiplicity of potential identities, situations, and proper behaviors (in the case of a logic of appropriateness), decision-makers must also interpret experience. As March and Olsen (1975, p. 148) noted, "organizations adapt their behavior in terms of their experience, but that experience requires interpretation. People in organizations come to believe what happened, why it happened, and whether it was good; but the process by which those beliefs are established in the face of a quite problematic 'objective' world affects systematically what is learned."

A key technology for this interpretation of context is talk, particularly in the form of stories or narratives (March et al., 1991; March, 2010; Newark, 2014). Storytelling is fundamental to how context is not only interpreted and learned from, but also constituted. This makes understanding how stories are constructed and which stories are most likely to be adopted central to understanding how context shapes choice and how situated decision-making unfolds.

Interpretation as output: making decisions in order to give meaning to context

As March and Sevón (1984, p. 102) noted, "Perhaps interpretation is more a primary feature of human behavior than a servant of choice. From such a perspective, information is sought and considered because it contributes to understanding what is going on in life; and understanding what is going on is important independent of any purpose to which the knowledge might be put." The ephemerality of existence may tilt the balance of what is important away from achieving desirable decision outcomes and toward the interpretations of life we construct and the stories we share while we make decisions (March and Olsen, 1984; March, 1994; Newark, 2014, 2018, 2020, 2021). In this way, interpretation is seen less as an instrumental activity that facilities choosing (i.e., an input into the choice process) and more as an end in itself (i.e., an output of the choice process) (Feldman and March, 1981; March, 1999; Levinthal and Rerup, 2021).

This is a view that sees decision-making processes not primarily as a means for achieving desirable decision outcomes, but rather as an occasion, excuse, or catalyst for interpreting life. Choices provide an arena to contemplate and constitute our context, and in the end contemplating and constituting context may be as or more important than the alternatives we select or the outcomes in which those alternatives result. This view led March (1999, p. 28) to suggest that,

> "Decision making may, in many ways, be better conceived as a meaning factory than as an action factory. Decision outcomes are often not as central to an understanding of decision making as might be expected. Individuals and organizations write history and construct socially acceptable story lines about links between actions and consequences, identities and behaviors. Decision making is a prime arena for developing and enjoying an interpretation of life and one's position in it."

Conclusion

The 17th century French philosopher René Descartes famously said, "I think therefore I am." It is a deductive argument that cogitation is what constitutes and defines. However, as suggested by our opening reference to Donne's poem, individuals are not isolated and do not cogitate in vacuums. Individuals are part of institutional and social contexts, with organizations being one of the most central. And so, while Descartes proposed "I think therefore I am," Don Quixote, the protagonist of Miguel de Cervantes' classic eponymous novel, guides and justifies his behavior by asserting, "I know who I am" (March, 2011). To know who one is, one must understand where one is; one must understand the context in which one is situated.

While Quixote poses the contextualization of thought and action in a rather grand manner, this issue operates in more prosaic ways in our daily lives in organizations. A marketing manager knows what to do because their role and the task environment in which they operate provide strong guidance, and their years of experience in that role, in the focal organization and others, provide a lens and set of constructs that inform understanding. The Carnegie perspective brings the "Spock-like" creation of neoclassical economics and the isolated decision-maker of psychology to context—a context of organizations populated by rules and routines, challenged by conflicting goals and power

dynamics, and animated by values and identities, all of which require interpretation.

Recognizing the importance of context poses challenges for us in our role as social scientists and as social engineers. As scientists we seek understanding, ideally understanding that might be couched in terms of general "laws" or insights. Nevertheless, trade-offs between generalizability, accuracy, and parsimony are omnipresent. This means that, as social scientists, we are generally relegated to what Merton (1949) termed mid-range theories or March (2008, p. 5–9; see also Liu et al., 2015), even more modestly termed "little ideas": ideas that "provide propositions about a small set of phenomena within a small set of contexts" and that "identify and explore small mechanisms of limited scope capable of producing notable effects and possibly susceptible to empirical verification." From this perspective, "context" operates as a kind of rate-limiting property on social science progress and our capacity to give advice.

For many scholars, incorporating context often means making fairly elaborate contingency arguments. However, being mindful of context need not lead to contingent truths. Instead, one can offer specific insights, like that exploitation tends to drive out exploration, or general challenges, like the ambiguity of experience. These insights, while profound, are also partial; they do not form a single, grand unifying theory. As a result, there are reasons to be cautious regarding the application of such insights to a particular organization in its specific circumstances. Practices in a given organization might be foolish and ripe for improvement. However, they may also represent contextualized wisdom and the embodiment of situated experience. Organizational designers, consultants, and social architects should be informed and guided by scholarship's "little ideas," but modest about knowing their implications in any particular setting at any particular time, and appreciative of the possible wisdom of current practices. As March (2006, p. 84) noted, "If a manager asks an academic consultant what to do and that consultants answers, then the consultant should be fired. No academic has the experience to know the context of a managerial problem well enough to give specific advice about a specific situation."

While the Carnegie perspective has done much to bring context into our consideration of decision-making, and thereby has supplemented more decontextualized economic and psychological accounts, it could be useful to revisit Carnegie's micro-foundations. The psychology literature has made enormous strides since Simon in the mid-1950s sought to create a behaviorally grounded counterpoint to neoclassical economics. Work within the Carnegie tradition could benefit from an infusion of these contemporary insights from psychology. For instance, the conception of action has been largely devoid of the role of emotion. In that sense, the Carnegie perspective moved away from the Spock-like character of neoclassical economics, but offered instead something of a "Tin Man" sensibility of an actor without a heart. Better accounting for the role of affect (Barsade et al., 2003; Loewenstein and Lerner, 2003) in organizationally contextualized decision-making would provide a richer depiction of choice.

Scholars operating within the Carnegie perspective should also be leery of the possible competence traps of path-dependent learning, not letting origins in Simon's conception of bounded rationality prove overly deterministic. Indeed, one of the defining characteristics of the Carnegie perspective is operating as an open and living line of inquiry in which ideas and insights might diffuse and evolve (March, 2005; Gavetti et al., 2007, 2012; Beckman, 2021), rather than a more narrow, calcified "school of thought" with rules for what constitutes legitimate interpretation of the associated ideas and membership in the "school." At the same time, the organizations literature, and essential features of the Carnegie perspective in particular, enriches our understanding of decision-making, whose processes often do not occur on isolated islands of autonomous individuals, but rather in the context of social institutions and organizations.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Argote, L., and Miron-Spektor, E. (2011). Organizational learning: From experience to knowledge. *Organ. Sci.* 22, 1123–1137. doi: 10.1287/orsc.1100.0621

Arrow, K. J. (1951). *Social Choice and Individual Values*. New York, NY: Wiley.

Ashforth, B. E., Rogers, K. M., and Corley, K. G. (2011). Identity in organizations: exploring cross-level dynamics. *Organiz. Sci.* 22, 1144–1156. doi: 10.1287/orsc.1100.0591

Ashforth, B. E., and Schinoff, B. S. (2016). Identity under construction: How individuals come to define themselves in organizations. *Annu. Rev. Organ. Psychol. Organ. Behav.* 3, 111–137. doi: 10.1146/annurev-orgpsych-041015-062322

Baker, G., Gibbons, R., and Murphy, K. J. (2002). Relational contracts and the theory of the firm. *Quart. J. Econ.* 117, 39–84. doi: 10.1162/003355302753399445

Barsade, S. G., Brief, A. P., and Spataro, S. E. (2003). "The affective revolution in organizational behavior: The emergence of a paradigm," in *Organizational Behavior:*

The State of the Science, ed. J. Greenberg (Mahwah, NJ: Lawrence Erlbaum Associates Publishers), 3–52.

Beckman, C. M. (2021). "Alternatives and complements to rationality," in *Research in the Sociology of Organizations, 76: Carnegie Goes to California: Advancing and Celebrating the Work of James G. March*, ed. C. M. Beckman (New York, NY: Emerald Publishing Limited). doi: 10.1108/S0733-558X202176

Beckman, C. M., and Haunschild, P. R. (2002). Network learning: The effects of partners' heterogeneity of experience on corporate acquisitions. *Admin. Sci. Quart.* 47, 92–124. doi: 10.2307/3094892

Benartzi, S., Beshears, J., Milkman, K. L., Sunstein, C. R., Thaler, R. H., Shankar, M., et al. (2017). Should governments invest more in nudging? *Psychol. Sci.* 28, 1041–1055. doi: 10.1177/0956797617702501

Benartzi, S., and Thaler, R. H. (2013). Behavioral economics and the retirement savings crisis. *Science* 339, 1152–1153. doi: 10.1126/science.1231320

Bower, J. L. (1970). *Managing the Resource Allocation Process: A Study of Corporate Planning and Investment*. Homewood: Irwin.

Burgelman, R. A. (1983). A process model of internal corporate venturing in the diversified major firm. *Admin. Sci. Quart.* 28, 223–244. doi: 10.2307/2392619

Burgelman, R. A. (1991). Intraorganizational ecology of strategy making and organizational adaptation: Theory and field research. *Organiz. Sci* 2, 239–262. doi: 10.1287/orsc.2.3.239

Burt, R. S. (1980). Models of network structure. *Ann. Rev. Sociol.* 79–141. doi: 10.1146/annurev.so.06.080180.000455

Chase, W. G., and Simon, H. A. (1973). Perception in chess. *Cogn. Psychol.* 4, 55–81. doi: 10.1016/0010-0285(73)90004-2

Christensen, M., and Knudsen, T. (2010). Design of decision-making organizations. *Manage. Sci.* 56, 71–89. doi: 10.1287/mnsc.1090.1096

Cohen, M. D., March, J. G., and Olsen, J. P. (1972). A garbage can model of organizational choice. *Admin. Sci. Quart.* 17, 1–25. doi: 10.2307/2392088

Csaszar, F. A. (2012). Organizational structure as a determinant of performance: evidence from mutual funds. *Strat. Manage. J.* 33, 611–632. doi: 10.1002/smj.1969

Cyert, R. M., and March, J. G. (1963/1992). *A Behavioral Theory of the Firm.* Malden, MA: Blackwell Publishers Inc.

Davis, G. F., and Greve, H. R. (1997). Corporate elite networks and governance changes in the 1980s. *Am. J. Sociol.* 103, 1–37. doi: 10.1086/231170

Dearborn, D. C., and Simon, H. A. (1958). Selective perception: A note on the departmental identifications of executives. *Sociometry* 21, 140–144. doi: 10.2307/2785898

Donne, J. (1624/1987). *Devotions upon Emergent Occasions*. Oxford: Oxford University Press. doi: 10.1093/oseo/instance.00006058

Edmondson, A. (1999). Psychological safety and learning behavior in work teams. *Admin. Sci. Quart.* 44, 350–383. doi: 10.2307/2666999

Ethiraj, S. K., and Levinthal, D. (2004). Modularity and innovation in complex systems. *Manag. Sci.* 50, 159–173. doi: 10.1287/mnsc.1030.0145

Ethiraj, S. K., and Levinthal, D. (2009). Hoping for A to Z while rewarding only A: complex organizations and multiple goals. *Organiz. Sci.* 20, 4–21. doi: 10.1287/orsc.1080.0358

Feldman, M. S., and March, J. G. (1981). Information in organizations as signal and symbol. *Admin. Sci. Quart.* 26, 171–186. doi: 10.2307/2392467

Figenbaum, E. (1978). The art of artificial intelligence: Themes and case studies. *AFIPS Confer. Proc.* 47, 227.

Gavetti, G., Greve, H. R., Levinthal, D. A., and Ocasio, W. (2012). The behavioral theory of the firm: Assessment and prospects. *Acad. Manag. Ann.* 6, 1–40. doi: 10.5465/19416520.2012.656841

Gavetti, G., Levinthal, D., and Ocasio, W. (2007). Perspective—Neo-Carnegie: The Carnegie school's past, present, and reconstructing for the future. *Organiz. Sci.* 18, 523–536. doi: 10.1287/orsc.1070.0277

Gergen, K. J. (1973). Social psychology as history. *J. Person. Soc. Psychol.* 26, 309. doi: 10.1037/h0034436

Gigerenzer, G., and Brighton, H. (2009). Homo heuristicus: why biased minds make better inferences. *Topics Cogn. Sci.* 1, 107–143. doi: 10.1111/j.1756-8765.2008.01006.x

Gigerenzer, G., and Gaissmaier, W. (2011). Heuristic decision making. *Ann. Rev. Psychol.* 62, 451–482. doi: 10.1146/annurev-psych-120709-145346

Gigerenzer, G., Hoffrage, U., and Kleinbölting, H. (1991). Probabilistic mental models: a Brunswikian theory of confidence. *Psychol. Rev.* 98, 506. doi: 10.1037/0033-295X.98.4.506

Granovetter, M. (1985). Economic action and social structure: the problem of embeddedness. *Am. J. Sociol.* 91, 481–510. doi: 10.1086/228311

Greve, H. R. (2003). *Organizational Learning from Performance Feedback: A Behavioral Perspective on Innovation and Change*. Cambridge: Cambridge University Press. doi: 10.1017/CBO9780511615139

Greve, H. R. (2023). Structuring the situation: Organizational goals trigger and direct decision-making. *Front. Psychol.* 14, 1140408. doi: 10.3389/fpsyg.2023.1140408

Haunschild, P. R., and Miner, A. S. (1997). Modes of interorganizational imitation: The effects of outcome salience and uncertainty. *Admin. Sci. Quart.* 472–500. doi: 10.2307/2393735

Haveman, H. A. (1993). Follow the leader: Mimetic isomorphism and entry into new markets. *Admin. Sci. Quart.* 593–627. doi: 10.2307/2393338

Heath, C., and Sitkin, S. B. (2001). Big-B versus Big-O: what is organizational about organizational behavior? *J. Organiz. Behav.* 22, 43–58. doi: 10.1002/job.77

Holmstrom, B. (1999). The firm as a subeconomy. *J. Law, Econ. Organiz.* 15, 74–102. doi: 10.1093/jleo/15.1.74

Jensen, M. C., and Meckling, W. H. (1976). Theory of the firm: managerial behavior, agency costs and ownership structure. *J. Finan. Econ.* 3, 305–360. doi: 10.1016/0304-405X(76)90026-X

Johnson, E. J., and Goldstein, D. (2003). Do defaults save lives? *Science* 302, 1338–1339. doi: 10.1126/science.1091721

Joseph, J., and Ocasio, W. (2012). Architecture, attention, and adaptation in the multibusiness firm: General electric from 1951 to 2001. *Strat. Manag. J.* 33, 633–660. doi: 10.1002/smj.1971

Kahneman, D., and Tversky, A. (1979). Prospect theory: an analysis of decisions under risk. *Econometrica* 47, 263–291. doi: 10.2307/1914185

Kane, A. A., Argote, L., and Levine, J. M. (2005). Knowledge transfer between groups via personnel rotation: Effects of social identity and knowledge quality. *Organiz. Behav. Hum. Decis. Proc.* 96, 56–71. doi: 10.1016/j.obhdp.2004.09.002

Knudsen, T., and Levinthal, D. A. (2007). Two faces of search: alternative generation and alternative evaluation. *Organiz. Sci.* 18, 39–54. doi: 10.1287/orsc.1060.0216

Levin, D. Z., and Cross, R. (2004). The strength of weak ties you can trust: the mediating role of trust in effective knowledge transfer. *Manage. Sci.* 50, 1477–1490. doi: 10.1287/mnsc.1030.0136

Levinthal, D., and March, J. G. (1981). A model of adaptive organizational search. *J. Econ. Behav. Organiz.* 2, 307–333. doi: 10.1016/0167-2681(81)90012-3

Levinthal, D. A. (1997). Adaptation on rugged landscapes. *Manage. Sci.* 43, 934–950. doi: 10.1287/mnsc.43.7.934

Levinthal, D. A. (2017). Mendel in the C-suite: design and the evolution of strategies. *Strat. Sci.* 2, 282–287. doi: 10.1287/stsc.2017.0047

Levinthal, D. A. (2021). *Evolutionary Processes and Organizational Adaptation: A Mendelian Perspective on Strategic Management*. Oxford: Oxford University Press. doi: 10.1093/oso/9780199684946.001.0001

Levinthal, D. A., and March, J. G. (1993). The myopia of learning. *Strat. Manag. J.* 14, 95–112. doi: 10.1002/smj.4250141009

Levinthal, D. A., and Rerup, C. (2021). The plural of goal: Learning in a world of ambiguity. *Organiz. Sci.* 32, 527–543. doi: 10.1287/orsc.2020.1383

Levinthal, D. A., and Workiewicz, M. (2018). When two bosses are better than one: Nearly decomposable systems and organizational adaptation. *Organiz. Sci.* 29, 207–224. doi: 10.1287/orsc.2017.1177

Levitt, B., and March, J. G. (1988). Organizational learning. *Ann. Rev. Sociol.* 319–340. doi: 10.1146/annurev.so.14.080188.001535

Lewin, K. (1951). *Field Theory in Social Science: Selected Theoretical Papers.* New York: Harper & Brothers.

Liu, C., Maslach, D., Desai, V., and Madsen, P. (2015). The first 50 years and the next 50 years of a behavioral theory of the firm: an interview with James G. March. *J. Manag. Inquiry* 24, 149–155. doi: 10.1177/1056492614548487

Loewenstein, G., and Lerner, J. (2003). "The role of affect in decision making," in *Handbook of Affective Sciences*, eds. R. J. Davidson, K. R. Scherer, and H. H. Goldsmith (New York, NY: Oxford University Press).

Luan, S., Reb, J., and Gigerenzer, G. (2019). Ecological rationality: Fast-and-frugal heuristics for managerial decision making under uncertainty. *Acad. Manage. J.* 62, 1735–1759. doi: 10.5465/amj.2018.0172

March, J. G. (1962). The business firm as a political coalition. *J. Polit.* 24, 662–678. doi: 10.1017/S0022381600016169

March, J. G. (1982/2005). "Mundane organizations and heroic leaders," in *On Leadership*, ed. J. W. Gardner (Oxford: Blackwell Publishing), 113–121.

March, J. G. (1987). Ambiguity and accounting: the elusive link between information and decision making. *Account. Organiz. Soc.* 12, 153–168. doi: 10.1016/0361-3682(87)90004-3

March, J. G. (1994). *A primer on decision making: How decisions happen.* New York, New York: The Free Press.

March, J. G. (1999). *The Pursuit of Organizational Intelligence: Decisions and Learning in Organizations.* Malden, MA: Blackwell Publishers, Inc.

March, J. G. (2005). Parochialism in the evolution of a research community: The case of organization studies. *Manage. Organiz. Rev.* 1, 5–22. doi: 10.1111/j.1740-8784.2004.00002.x

March, J. G. (2006). Ideas as art. Interview by Dane Cutu. *Harv. Bus. Rev.* 84, 82–89.

March, J. G. (2008). *Explorations in Organizations*. Stanford, CA: Stanford University Press. doi: 10.1515/9781503627147

March, J. G. (2010). *The Ambiguities of Experience*. Ithaca, NY: Cornell University Press. doi: 10.7591/9780801459016

March, J. G. (2011). A scholar's quest. *J. Manag. Inquiry* 20, 355–357. doi: 10.1177/1056492611432803

March, J. G., and Olsen, J. P. (1975). The uncertainty of the past: organizational learning under ambiguity. *Eur. J. Polit. Res.* 3, 147–171. doi: 10.1111/j.1475-6765.1975.tb00521.x

March, J. G., and Olsen, J. P. (1984). The new institutionalism: organizational factors in political life. *Am. Polit. Sci. Rev.* 78, 734–749. doi: 10.2307/1961840

March, J. G., and Olsen, J. P. (1989). *Rediscovering Institutions: The Organizational Basis of Politic.* New York: Free Press.

March, J. G., and Olsen, J. P. (1995). *Democratic Governance.* New York: Free Press.

March, J. G., and Olsen, J. P. (2006). "The logic of appropriateness," in *The Oxford Handbook of Public Policy,* eds. M. Rein, M. Moran, R. E. Goodin (Oxford, UK: Oxford University Press).

March, J. G., and Sevón, G. (1984). Gossip, information and decision-making," in *Advances in Information Processing in Organizations,* eds. L. Sproull, and P. Crecine (Stamford, CT: Jai Press), 95–107.

March, J. G., and Simon, H. A. (1958). *Organizations*. New York: John Wiley.

March, J. G., Sproull, L. S., and Tamuz, M. (1991). Learning from samples of one or fewer. *Organiz. Sci.* 2, 1–13. doi: 10.1287/orsc.2.1.1

Markus, H. R., and Kitayama, S. (1991). Culture and the self: implications for cognition, emotion, and motivation. *Psychol. Rev.* 98, 224. doi: 10.1037/0033-295X.98.2.224

Merton, R. K. (1949). "On sociological theories of the middle range," in *Social Theory and Social Structure* (New York: The Free Press).

Messick, D. M. (1999). Alternative logics for decision making in social settings. *J. Econ. Behav. Organiz.* 39, 11–28. doi: 10.1016/S0167-2681(99)00023-2

Miller, D. T. (1999). The norm of self-interest. *Am. Psychol.* 54, 1053. doi: 10.1037/0003-066X.54.12.1053

Nelson, R. R., and Winter, S. G. (1982). *An Evolutionary Theory of Economic Change*. Cambridge, MA: Harvard University Press.

Newark, D. A. (2014). Indecision and the construction of self. *Organiz. Behav. Hum. Decis. Proc.* 125, 162–174. doi: 10.1016/j.obhdp.2014.07.005

Newark, D. A. (2018). Leadership and the logic of absurdity. *Acad. Manage. Rev.* 43, 198–216. doi: 10.5465/amr.2015.0186

Newark, D. A. (2020). Desire and pleasure in choice. *Ration. Soc.* 32, 168–196. doi: 10.1177/1043463120921254

Newark, D. A. (2021). "Pictures at an exhibition," in *Research in the Sociology of Organizations, 76: Carnegie Goes to California: Advancing and Celebrating the Work of James G. March*, ed. C. M. Beckman (New York, NY: Emerald Publishing Limited), 261–301. doi: 10.1108/S0733-558X20210000076014

Newark, D. A., and Becker, M. C. (2021). "Bringing the logic of appropriateness into the lab: An experimental study of behavior and cognition," in *Research in the Sociology of Organizations, 76: Carnegie Goes to California: Advancing and Celebrating the Work of James G. March*, ed. C. M. Beckman (New York, NY: Emerald Publishing Limited), 201–229. doi: 10.1108/S0733-558X20210000076009

Newell, A., and Simon, H. A. (1972). *Human Problem Solving*. Englewood Cliffs, NJ: Prentice-hall.

Ocasio, W. (1997). Towards an attention-based view of the firm. *Strat. Manage. J.* 18, 187–206. doi: 10.1002/(SICI)1097-0266(199707)18:1+<187::AID-SMJ936>3.0.CO;2-K

Ocasio, W., and Joseph, J. (2005). "An attention-based theory of strategy formulation: Linking micro-and macroperspectives in strategy processes," in *Strategy Process* (New York, NY: Emerald Group Publishing Limited).

Ramarajan, L. (2014). Past, present and future research on multiple identities: Toward an intrapersonal network approach. *Acad. Manag. Ann.* 8, 589–659. doi: 10.5465/19416520.2014.912379

Reagans, R., and McEvily, B. (2003). Network structure and knowledge transfer: the effects of cohesion and range. *Admin. Sci. Quart.* 48, 240–267. doi: 10.2307/3556658

Ricardo, D. (1817). *Principles of Political Economy and Taxation.* London: John Murray.

Sah, R. K., and Stiglitz, J. E. (1986). The architecture of economic systems: hierarchies and polyarchies. *Am. Econ. Rev.* 76, 716–727.

Samuelson, P. (1947). *Foundations of Economic Analysis*. Cambridge, MA: Harvard University Press.

Simon, H. A. (1948/1997). *Administrative Behavior: A Study of Decision-Making Processes in Administrative Organizations (4th ed.).* New York, NY: The Free Press.

Simon, H. A. (1955). A behavioral model of rational choice. *Quart. J. Econ.* 99–118. doi: 10.2307/1884852

Simon, H. A. (1962). The architecture of complexity. *Proc. Am. Philosoph. Soc.* 106, 467–482.

Simon, H. A. (1991). Organizations and markets. *J. Econ. Perspect.* 5, 25–44. doi: 10.1257/jep.5.2.25

Smith, A. (1776). *The Wealth of Nations*. London: Strahan and Cadell.

Staw, B. M. (2016). Stumbling toward a social psychology of organizations: An autobiographical look at the direction of organizational research. *Ann. Rev. Organiz. Psychol. Organiz. Behav.* 3, 1–19. doi: 10.1146/annurev-orgpsych-041015-062524

Tajfel, H. (1972). "Experiments in a vacuum," in *The context of social psychology: A critical assessment,* eds. J. Israel, and H. Tajfel (London: Academic Press).

Thaler, R. H., and Sunstein, C. R. (2008). *Nudge: Improving Decisions about Health, Wealth, and Happiness*. New Haven, CT: Yale University Press.

Thaler, R. H., Sunstein, C. R., and Balz, J. P. (2014). "Choice architecture," in *The Behavioral Foundations of Public Policy,* ed. E. Shafir (Princeton: Princeton University Press).

Thorndike, E. L. (1932). *The Fundamentals of Learning*. New York: Teachers College Press. doi: 10.1037/10976-000

Thornton, P. H., and Ocasio, W. (2008). "Institutional logics," in *The Sage Handbook of Organizational Institutionalism* (Thousand Oaks, CA: Sage), 99–128. doi: 10.4135/9781849200387.n4

Thornton, P. H., Ocasio, W., and Lounsbury, M. (2012). *The Institutional Logics Perspective: A New Approach to Culture, Structure and Process*. Oxford: Oxford University Press. doi: 10.1093/acprof:oso/9780199601936.001.0001

Todd, P. M., and Gigerenzer, G. E. (2012). *Ecological Rationality: Intelligence in the World*. Oxford: Oxford University Press. doi: 10.1093/acprof:oso/9780195315448.003.0011

Von Neumann, J., and Morgenstern, O. (1944). *Theory of Games and Economic Behavior*. Princeton, NJ: University of Princeton Press.

Weber, E. U., and Morris, M. W. (2010). Culture and judgment and decision making: the constructivist turn. *Perspect. Psychol. Sci.* 5, 410–419. doi: 10.1177/1745691610375556

Weber, J. M., Kopelman, S., and Messick, D. M. (2004). A conceptual review of decision making in social dilemmas: Applying a logic of appropriateness. *Person. Soc. Psychol. Rev.* 8, 281–307. doi: 10.1207/s15327957pspr0803_4

Wübben, M., and Wangenheim, F. V. (2008). Instant customer base analysis: Managerial heuristics often "get it right". *J. Market.* 72, 82–93. doi: 10.1509/jmkg.72.3.082

Yates, J. F., and De Oliveira, S. (2016). Culture and decision making. *Organiz. Behav. Hum. Decis. Proc.* 136, 106–118. doi: 10.1016/j.obhdp.2016.05.003

frontiers | Frontiers in Psychology

TYPE Conceptual Analysis
PUBLISHED 29 March 2023
DOI 10.3389/fpsyg.2023.1140408

OPEN ACCESS

EDITED BY
Pino Audia,
Dartmouth College,
United States

REVIEWED BY
Pasi Kuusela,
University of Groningen,
Netherlands
Daniela Blettner,
Simon Fraser University,
Canada

*CORRESPONDENCE
Henrich R. Greve
✉ henrich.greve@insead.edu

SPECIALTY SECTION
This article was submitted to Organizational Psychology, a section of the journal Frontiers in Psychology

RECEIVED 09 January 2023
ACCEPTED 03 March 2023
PUBLISHED 29 March 2023

CITATION
Greve HR (2023) Structuring the situation: Organizational goals trigger and direct decision-making.
Front. Psychol. 14:1140408.
doi: 10.3389/fpsyg.2023.1140408

Structuring the situation: Organizational goals trigger and direct decision-making

Henrich R. Greve*

Entrepreneurship and Family Enterprise, INSEAD, Singapore, Singapore

Organizational goals are assigned to individuals, and thus differ from goals that individuals voluntarily adopt. The Carnegie School has a significant research stream on how organizations are affected by goals, with a focus on how disappointing performance disrupts regular organizational behavior and triggers a search for alternative actions. We have a good understanding of the organization-level process of setting aspiration levels, triggering search for alternatives, and making decisions, but the individual-level mechanisms contributing to it are less well known. An assessment of the progress of Carnegie School research so far reveals a list of research questions that should be resolved in order to understand how individual updating of aspiration levels, triggering of search, directing of search, and decision-making help explain organizational responses to goals. The role of construal, or interpretation, in guiding these processes is a central theoretical mechanism that needs further investigation.

KEYWORDS

goals, Carnegie School, decision-making, organizations, problemistic search

Introduction

Study of goals in psychology is a rich theoretical and empirical enterprise. Much of it has been oriented toward goals that are personalized in the sense of either explicitly referring to personal goals or implicitly assuming some level of personal control over goal adoption and pursuit (e.g., Austin and Vancouver, 1996; Brandstätter and Bernecker, 2022). This has led to productive research streams on issues like goal selection (Heckhausen et al., 2010), goal pursuit (Locke and Latham, 2002; Richter et al., 2016), goal attention (Dijksterhuis and Aarts, 2010), and goal persistence (Brandstätter and Bernecker, 2022). In combination, these research streams produce a comprehensive view on how individuals select personal goals, pursue them, and either persist in this pursuit or instead disengage and pursue alternative goals (Brandstätter and Bernecker, 2022). Goals are also found in the psychology of decision-making under risk (Kahneman and Tversky, 1979; Heath et al., 1999).

The personalized view of goals is in striking contrast to how goals in organizations are seen by practicing managers and researchers. Although the conceptualization and use of goals is often blended, three branches can be identified. First, goals control people in regular organizational behavior through their connection to managerial evaluation and incentives. This effect of goals has been treated in the economic literature on incentives (Lazear, 2000) and the management literature on rewards (Ethiraj and Levinthal, 2009; Lee et al., 2018). Second, goals interfere in regular organizational behavior and trigger search for alternative courses of action (Greve, 2003b; Posen et al., 2018). This effect has been treated in the literature on organizational responses to performance feedback (Audia and Greve, 2021; Kotiloglu et al., 2021). Third, goals direct the search for alternative courses of actions by allowing interpretation of the problem (March and Simon,

1958; March and Olsen, 1975). This effect is yet to be fully explored because it requires examination of organizational responses to multiple goals, which has seen little examination so far (but see Audia and Brion, 2007; Greve, 2008; Gaba and Greve, 2019; Sobrepere et al., 2022).

In management practice, assigned goals are common and often used in combination (often denoted Key Performance Indicators). A popular practical application is the use of multiple goals that allow managers to monitor the performance of their organizational unit and its individual subordinates and direct attention to those who appear to be having low performance for review and improvement, and to those who appear to be having high performance for reward and promotion. This use of goals is taught in required MBA courses and embedded in managerial practice. It belies the idea of personalized goals chosen by the individual.

As a result, there is some mismatch between the use of goals in organizations and psychological research on goals. How goals control and regulate people has seen significant research in goal-setting theory (Locke and Latham, 1990, 2002) and the economics of incentives (e.g., Lazear, 2000), and is largely seen as a solved problem. Accordingly, current work in organizational theory is less interested in the controlling effect of goals than in how goal shortfalls interrupt regular organizational life and lead to search and decision-making that change organizational behaviors (Posen et al., 2018; Audia and Greve, 2021). Understanding when and how goals trigger change is an unsolved problem, as has been pointed out in recent articles discussing how much needs to be learned in order to fully understand organizational responses to low organizational performance (Posen et al., 2018; Audia and Greve, 2021) and their consequences for organizational strategy (Greve, 2021). To address this problem, the Carnegie School literature makes important theoretical distinctions with empirical import (Cyert and March, 1963). It differentiates between the goal dimension—what is the goal about—and the aspiration level—what is the performance level below which search for alternative behaviors may be initiated. It specifies a sequence in which performance on the goal variable below the aspiration level starts search for alternatives followed by a decision on whether each alternative should be implemented. Because the decision-makers seek to satisfice—find behaviors estimated to give performance above the aspiration level—alternatives are evaluated sequentially, and the search stops once a sufficiently promising has been found (Cyert and March, 1963).

How can we combine the concerns of psychology and organization theory and move toward a more integrated line of research? This paper takes three steps. First, it outlines major theoretical and empirical ideas of organizational theory and goal setting with a focus on insights from the Carnegie School, which is the pioneering and currently leading stream of research on organizational goals. Next, it discusses how research in the Carnegie School has revealed important gaps in our knowledge of individual responses to organizational goals. Finally, these point to areas of research in which Carnegie School research and psychology research have important complementarities, and to novel questions in psychology that derive naturally from the Carnegie School research on organizational goals. The goal is to invite a conversation of theory and evidence between two fields of research, each with expertise required to address this theoretical agenda and with obvious complementarities in knowledge foundation, theoretical approach, and empirical procedures.

A central feature of this discussion is that the common observation that organization theory and psychology produce theory and evidence at different levels of analysis, while correct, is not the main reason for the current mismatch of these two branches of goal research. Instead, the main reason is that organizational *use* of goals has consequences for the decision-making of their employees, which, in turn, *produces* organizational change. In this view of goals, the different levels of analysis are not problematic. The organization structures the situation faced by the individual. The individual behavior is oriented toward organizational goals and organizational actions, and the question to answer is what behaviors are produced.

Goals in the Carnegie School

The main origin of thinking about goals in organizational theory is the Carnegie School, which developed the idea of the organization as having sets of goals that can be independent, hierarchically organized, causally linked, or some combination of these (Simon, 1947; March and Simon, 1958; Cyert and March, 1963). Organizational decision-making is boundedly rational, meaning that the decision-maker seeks to choose alternatives that have expected beneficial outcomes but has limited capability to interpret the situation, construct alternatives, tally their possible consequences and associated likelihoods, and integrate this information (Simon, 1962). Because all these actions need to be executed to be fully rational, limits on the decision-maker capabilities place boundaries on the achievable degree of rationality, hence leading to boundedly rational decision-making.

The boundedly rational decision-maker is dependent on goals for the following reasons:

1. Goals allow satisficing through comparison of performance and aspiration levels, thus identifying areas of activity in which outcomes are good enough, so decisions are not needed. This reserves attention for areas in which search for alternatives and subsequent decision-making may be needed (Cyert and March, 1963).
2. Goals are turned into numeric specifications, so they can be tracked through accounting systems, and decision-makers can compare the performance with adaptive aspiration levels set through observation of peers or historical performance (Cyert and March, 1963). The same comparison can be used to guess whether an alternative is good enough to be adopted, and hence allows satisficing by stopping the search for additional alternatives.
3. Goals allow localization of the search for alternatives, as many (but not all) goals are indicative of what organizational activities are currently problematic and hence could be targeted for change (Cyert and March, 1963).

Through these three features, goals conserve the energy and direct the attention of the boundedly rational decision-maker by reducing the number of decision-making occasions, the scope of decisions, and the alternatives considered.

Just as organizations have structures, so do the goals defined by organizations and assigned to individuals. The effect of organizational goal structures depends on the degree to which the goals are designed for optimal organizational responses. An apparent minimum degree of design is to have multiple goals that each indicate some set of organizational activity, for example those belonging to a function or

division of the organization, and those are treated separately (Cyert and March, 1963). Research using this conceptualization has shown it to hold for broad goals such as profitability, safety, R&D progress, and alliances (Baum et al., 2005; Baum and Dahlin, 2007; Shipilov et al., 2011; Gaba and Greve, 2019). A higher degree of design is to have multiple goals that are hierarchically organized because the lower-level goals are thought to be causal in producing the higher-level goals (March and Simon, 1958). Research using this conceptualization has also shown some support (Gaba and Joseph, 2013; Mazzelli et al., 2019; Sobrepere et al., 2022). There is also significant research on a third and less designed goal structure in which an overarching goal such as profitability acts as a "master switch" to trigger changes across a broad range of activities (Greve, 2003b). Research using this conceptualization has very substantial support, showing that the organization-wide goal of profitability triggers changes across a wide range of organizational behaviors (see Shinkle, 2012; Kotiloglu et al., 2021).

Connecting these goal conceptualizations and their effects to individual action requires going through the details of the process, and this approach also helps identify gaps in the theory that require further attention. Let us start with a summary of the theoretical assumptions. First, although goals are commonly thought to be "organizational," each goal is assigned to an organizational unit, a manager leading the unit, or a specific person in the unit. Organizational goals are personalized through assignment to individuals, which is not quite analogous to personalized goals in psychology because personal commitment may be lacking. Incentives are commonly used to produce the same effect as personal commitment.

Second, goals are specified as numerical items in some accounting system and performance on the goal dimension is assessed periodically. An aspiration level for each numerical goal variable is held by the individual, and is updated through comparison with past performance outcomes and peer performance outcomes (Cyert and March, 1963; Lant, 1992; Blettner et al., 2015). Aspiration levels may also be explicitly specified by the organization, but as goal commitment research shows, ultimately the individual's commitment determines the actual aspiration level (Locke et al., 1988). The satisficing heuristic means that performance above the aspiration level is "good enough" and thus seen as insufficient reason to search for improvements in organizational behavior (Cyert and March, 1963; Levinthal and March, 1993).

Third, failure of performance to meet the aspiration level implies search for a solution, usually in the form of changed behaviors rather than greater effort. Organizations are typically operated at high workloads, so interruptions in the form of search for solutions can produce unpredictable and large delays in both regular work and the search progress (Glynn et al., 2019). Because performance on organizational goals results from routines involving multiple people and associated production assets, reorganizing the routines, replacing the individuals, and replacing technologies or assets are common solutions that decision-makers will search for (Gavetti et al., 2012; Shinkle, 2012).

Satisficing

The foundation of the satisficing heuristic in organizational decision-making was decision-making triggered by an environmental stimulus and resolved through finding an alternative estimated to meet or exceed the minimally satisfactory threshold on all relevant criteria (March and Simon, 1958). This theory was later extended to define performance below the aspiration level on an organizational goal as an internal stimulus that leads to search for alternatives (known as problemistic search) (Cyert and March, 1963). The theory assumes that multiple goals are in operation, and whatever part of the organization is responsible for one specific goal will devote time and resources to searching for alternative behaviors if performance falls below the aspiration level. Goals are independent, aspiration levels are adaptive through historical and peer comparison, and search follows a heuristic of starting near the performance shortfall and current behaviors before spiraling outward if no satisficing alternative can be found (Cyert and March, 1963).

The bulk of evidence testing this model examines the goal of firm profitability, usually operationalized as return on assets, and looks at a broad range of behaviors that are substantial enough to be viewed as solutions. Examples include increasing research and development expenditures (Greve, 2003a; Rudy and Johnson, 2016), new product launch or update (Giachetti and Lampel, 2010; Gaba and Joseph, 2013), investment in assets (Audia and Greve, 2006; Arrfelt et al., 2013), change of strategy (Schimmer and Brauer, 2012; Kolev and McNamara, 2022), and change in alliances (Shipilov et al., 2011; Lungeanu et al., 2016).

The total evidence is impressive, well in excess of 200 studies, but it also has unclear foundation in psychological processes and unclear implications for psychological research. Behaviors such as these result from search triggered either by the CEO as an individual or the top management team, the details are developed elsewhere in the organization, the search is likely to end with a choice among alternatives, and the approval of the final action is done by the top management team or board of directors. These elaborate processes are organizational in nature (Levinthal and March, 1993; Levinthal and Rerup, 2021), though individuals like the CEO or groups like the board of directors intervene with great impact.

Empirically, this research is very successful in documenting satisficing behavior with respect to the goal of profitability and an adaptive aspiration level. Theoretically, it leaves gaps open for further exploration. The first gap is that examination of an organizational profitability goal differs from the theory on organizations having multiple goals assigned to organizational units and decision-makers, with responses matching the goal showing performance below the aspiration level. There are studies showing such effects of specific goals, however, and these indicate a way forward. For example, market share below the aspiration level leads to changed market position (Greve, 1998), and accidents lead to improved safety (Baum and Dahlin, 2007; Madsen and Desai, 2010). The theoretical assumption that multiple goals exist and are addressed separately appears to be valid.

A second gap lies in documenting that aspiration levels are adaptive also for other goals than profitability. Firm profitability is a special goal that invites both tracking of past performance and comparison with peers because those are exactly the kind of comparisons that outsiders, especially equity analysts and investors, will make. Many internal goals do not have readily available peers, though some, such as division-level profitability measures, do. What we know about other types of goals should be an invitation for further examination. Mutual funds managers have goals that are readily

comparable over time and across peers, but the career implications of their performance relative to aspiration levels lead them to react differently from how firms react to profitability (Kacperczyk et al., 2015). Sports teams also have goals that are readily comparable, but these goals occur in a tournament context, which also alters responses (Moliterno et al., 2014). Similar responses are also seen for individuals engaged in tournaments (Boyle and Shapira, 2012). Whether such effects result from different adjustments of aspiration levels or different reactions to performance needs further examination, and extension to goals that are not readily comparable is a natural next step.

A third gap lies in documenting the process underlying aspiration-level updating and satisficing. Evidence that employees satisfice on organizationally assigned goals is currently scarce (but see Kacperczyk et al., 2015; Greve et al., 2019b). Such evidence is needed to know whether the observed satisficing is individually determined or enforced by organizational processes such as periodical performance reporting and reviews, which are often connected with direct incentives like pay and indirect incentives such as promotions or role expansions. A potential objection to the proposal that aspiration-level updating weighs peer comparison and own past performance is the mental effort of this operation, suggesting that this updating rule may not be a good prediction of individual updating. While this may be true, there is evidence of individuals engaging in goal-oriented behavior and complex mental accounting using performance feedback (Billinger et al., 2021; Bergenholtz et al., 2023) even without conscious deliberation (Dijksterhuis and Aarts, 2010), suggesting that individuals can be sophisticated. Clearly there is a tension between the sophisticated individual and the organization seeking to control aspiration levels through specifying numeric goals, and this needs to be explored further.

Numeric control

Organizations make extensive use of numeric specifications to measure progress toward goals. This practice has long been known to be problematic for goals that are ambiguous, qualitative, or multi-dimensional, including such seemingly simple goals as a healthy work environment, high-quality products, and good R&D progress. Typically giving goals numeric specifications cause decision-maker attention to collapse from the broader intended goal to the narrower measured goal (Kerr, 1975). Organizations still use this simplification because it fits accounting processes geared toward numeric outputs, enables management to impose stricter incentives, and is coupled with a general "magic numbers" belief that anything that truly matters should be measurable (March, 1996).

This view of organizations being primarily guided by numeric performance compared with aspiration levels aligns with much of what we know about organizations, but it is also narrow. The primary problem is that decision-makers may combine an emphasis on the numeric performance measure with awareness of the broader goals. Thus, the numeric specification of the goal triggers search, but an initial step in the search may be examination of how well the organization does on dimensions of the goal that are not readily measurable. Such broader assessment of the situation can direct the search for solutions in ways that current theory does not capture.

Directing search

The model of search specified by Cyert and March (1963) was, in their words, simple-minded, taking as a first step proximity to the problem (the goal variable) and the solution (current behaviors), followed by broad search or search in vulnerable areas of the organization if no satisficing solutions were found in the proximate search. Although this is a good initial description of how organizations search with some evidence in favor (Iyer et al., 2019), there are theoretical and empirical reasons to submit this model of search to closer scrutiny (Greve, 2018). We should start by noting that the evidence on search in response to focused goals such as low market share and low safety offers support to the simple-minded search model (Greve, 1998; Baum and Dahlin, 2007; Madsen, 2009), though it is support of the simplest kind because the match of problem and solution is so obvious.

Apart from the literature on responses to focused goals, the evidence on simple-minded search is remarkably limited. Many studies show that organizational search is more often local than distant (Laursen, 2012; Posen et al., 2018), but this support is weakened by the fact that most studies investigate organizational search in general rather than problemistic search specifically. Organizations also do routine search such as R&D (Cyert and March, 1963). The support is weakened even more by the common finding that local search tends to be more efficient than distant search, both during the routine R&D process and during problemistic search (Knudsen and Levinthal, 2007; Laursen, 2012), so organizations may favor local search simply because it is the best form of search.

Problemistic search may still be different because decision-makers can distinguish between problems that have proximate solutions and problems that require more distant search. As an example of the former, low profitability is addressed through resource conservation when the firm holds little financial resources, unlike when its financial reserves are great (Kuusela et al., 2017). As an example of the latter, a biopharmaceutical firm having fewer new product introductions than its aspiration level will not have innovative products ready for launch, and must instead take the long route of increasing R&D expenditures and R&D alliances (Tyler and Caner, 2016). Indeed, slow progress in R&D leads pharmaceutical firms to move from local to distant search (Hoang and Ener, 2015), just as the simple-minded model of search predicts. Early findings thus favor the model of simple-minded search, but more evidence is needed for a conclusive answer.

Answering this question requires consideration of the decision-maker construal of the situation. Construal processes are central in the Carnegie School (see March and Olsen, 1975), just as they are central in social psychology (Ross and Nisbett, 1991; Wilson, 2022),[1] but theoretical and empirical work has relied on the concept of simple-minded search to such an extent that less attention has been devoted to construal. This theoretical stance has resulted in studies that were not designed to examine the construal process and its effects, so we are currently left seeking to draw implications from studies that had different goals.

1 In most management research, the term "interpretation" is used instead of construal. The meanings are slightly different, but the common implication that interpretation is consciously done is not central to how it is used theoretically, so construal can be substituted.

One path toward understanding construal processes in organizations is to examine whether decision-makers integrate information from multiple goals and use it to direct search and make decisions. Recent work has yielded suggestive findings. There is good evidence that profitability is a goal that typically takes precedence over other goals (e.g., Greve, 2008; Smulowitz et al., 2020), so one might expect an airline with low profitability and a fleet with weak safety record not to make the aircraft purchases necessary to obtain a safer fleet. In fact, the opposite is true, possibly indicating that low profitability and high risk of accident is construed as a situation that threatens the existence of the airline (Gaba and Greve, 2019). Firms under siege for weak governance practices sorted themselves into low-profitability firms resisting efforts to improve governance, higher-profitability firms improving governance, and good-governance firm improving governance even further (Rowley et al., 2017). The findings are suggestive of construal directing organizational search, as this sorting suggests that governance was seen as a distraction, a shortcoming, or an advantage, depending on the configuration of profitability and governance in each firm. This conclusion is merely suggestive, however, as it derives from interpretations of firm reactions.

Clearer evidence can be drawn from analyses of sports, which often have simpler decision structures. Football team fourth-down plays suggest that teams were switching between viewing the situation as a short-term problem of continuing the drive or a long-term problem of winning the goal, making the likelihood of punting less continuously updated than would be rational (Sobrepere et al., 2022). Soccer players fouling after losing the ball similarly suggest switching the construal from normal team play to personal retaliation, with the risk to the team from fouling no longer affecting the foul decision if the player can foul the opposing player who had stripped him of the ball (Greve et al., 2019a). Again, the change away from decision-making based on team goals is obvious because greater probability of a referee calling a foul nearly always reduces the likelihood of fouling. This change resembles the evidence on individual decision-makers turning to self-enhancement when performance on goals suggests a need for problemistic search (Jordan and Audia, 2012; Audia et al., 2015).

Implications for psychology research

It follows from this review that the mismatch between much psychological research on individual goals and Carnegie School research on organizational goals is even greater than at first glance. We know much about personal goal selection and pursuit, but organizations assign goals to individuals and require or incentivize their pursuit. We know much about how broad and high-level goals trigger various organizational changes, but these changes are preceded by construal processes that determine whether the individual believes that change is needed and if so, what type of change. The microfoundation of current Carnegie School research owes more to observation of organizational decision-making than to psychological research.

Fortunately, the questions that currently most urgently require answers in the Carnegie School play to central strengths of social psychology. Organizational decision-makers are boundedly rational, and apply construal to accurately understand the situation while maintaining a sense of self-worth (e.g., Kunda, 1990). Applying this to Carnegie School research implies a closer look at how individuals process information on goals and performance, along with information on what actions are available, to form construals and make decisions. Inspiration for this research can be found in field research on decisions made by organizations (Clough and Piezunka, 2020; Lim and Audia, 2020; Hu et al., 2022), mostly with decision-makers and processes not observed by the researcher, along with analysis from areas such as sports (Raab et al., 2012; Greve et al., 2019a; Sobrepere et al., 2022), with superior documentation of who decides what, but still without experimental control. Social psychology has a research stream devoted to construal processes, and its experimental method is the most efficient causally oriented method for understanding them.

Satisficing

Each of the unanswered questions of the Carnegie School corresponds to existing or potential social psychological studies. First, what does satisficing mean? The Carnegie School views failure to meet goals as an interruption mechanism that triggers consideration of whether to initiate search. The role of overriding goals such as profitability and more focused goals (market share, safety, growth, customer satisfaction, and so on) relative to each other in triggering search and change needs additional empirical investigation from a construal perspective. For example, recent work shows that construal of low profitability either as a problem shared across firms or as one unique to the focal firm influences responses (Lucas et al., 2018; Goyal and Goyal, 2021). Also, self-enhancement research has documented that multiple goals or aspiration levels open for multiple forms of construal, and can lead to inaction in the face of performance levels that are low enough to indicate that problemistic search is needed (Audia and Brion, 2007; Audia and Greve, 2021). Recent research has documented that this relation is moderated by greater success or higher status, which gives sufficient confidence to reduce self-enhancement (Kostopoulos et al., 2022). Personal characteristics also matter, with overconfident CEOs being less likely to view low performance as a sign that the firm needs to change (Schumacher et al., 2020), possibly because they interpret ambiguous situations favorably and hence persist with current behaviors (Halper and Vancouver, 2016).

The research also needs better connection with research on how self-efficacy influences change, especially because there is a current debate on whether self-efficacy effects on confidence and effort add up to increased or decreased performance (Audia et al., 2000; Vancouver et al., 2002; Schmidt and DeShon, 2010). These studies and their potential relation to CEO experience give good reason to examine self-efficacy in organizations further (Tarakci et al., 2018). Status, success, confidence, and self-efficacy are a complex blend of similar characteristics with effects that appear to be in partial contrast to each other, and further work is needed to sort them out.

Numeric control

Second, how are aspiration levels updated and interpreted? The use of aspiration levels to assess whether there are shortfalls is so important for the individuals responsible for the goals that it is clearly

a case of motivated inference influenced by a wish to correctly understand the situation, but also to maintain a positive self-assessment. It is not well known how organizations explicitly stated numeric targets affects this process because most research so far has ignored numeric targets, and instead tracked adaptive aspiration levels. Experimental evidence on updating aspiration levels is available (Lant, 1992), but recent work on how aspiration levels are updated in organizations has suggested more mechanisms that require additional research, with greater emphasis on experiments than most current research (Bromiley and Harris, 2014; Moliterno et al., 2014; Blettner et al., 2015; Kacperczyk et al., 2015). Importantly, although the effects of organizational updating of aspiration levels are well-documented and regular, individual updating and response to aspiration levels is more heterogeneous (Banerjee et al., 2019; Bergenholtz et al., 2023). To transition from a performance shortfall to a search decision, individuals need to infer a meaning from the performance shortfall.

Another unexplored question is whether decision-makers switch from the "magic numbers" assessment of numerically specified goals to a broader goal conception when the performance is below the aspiration level, thus producing either a more informed decision—or another reason for self-enhancement. Here, a useful observation is that ambiguity complicates the search for meaning (Plambeck and Weber, 2010; Joseph and Gaba, 2015), so before the firm can search for solutions it may collect additional information that helps classify the problem it is facing (Glynn et al., 2019). Whether such information collection occurs also involves construal because it involves the perceived urgency of a resolution (Liberman and Trope, 1998). Broader goal conceptions also matter because the organizational environment increasingly includes external goals such as those on environmental, social, and governance dimensions. External goals can intervene at unpredictable times (Kölbel et al., 2017), complicating the decision-making. More work on how ambiguous performance feedback triggers search for meaning is needed.

Directing search

Third, how is search directed? Search direction implies selecting a specific goal shortfall and pursuing its resolution. The organizational decision-maker faces information on shortfalls in one or multiple goals, and these goals differ in importance and in specificity for attributing the reason for the shortfall and its potential solution. Again, construal processes are central, with attributions of events taking a central role, perhaps combined with heuristics (Gigerenzer and Gaissmaier, 2011; Wilson, 2022). Work so far has yielded promising findings on how search is directed. For example, similar profitability shortfalls can be construed as excess or insufficient resources depending on the overall resource endowment of the organization (Kuusela et al., 2017). Similar levels of failure in corporate acquisitions are less likely to lead to divestment when they can only be construed as the responsibility of the current CEO (Hayward and Shimizu, 2006). Sports teams pursue goals of revenue and status, and direct search toward recruitment of famous, versus effective, players depending on which goal sees shortfalls (Ertug and Castellucci, 2013).

Research has also shown that distant search is not only initiated after proximate search fails (e.g., Iyer et al., 2019), as predicted, but also by severe performance shortfalls (Billinger et al., 2021). Shortfalls in organizational goals are particularly consequential for managers identifying strongly with the organization (Tarakci et al., 2018). Also, difficulty in construal due to perceived ambiguity leads to more distant search and greater variety of organizational changes (Plambeck and Weber, 2009). Clearly, decisions to make radical departures from current behaviors are motivated by difficult circumstances. These findings demonstrate the power of the situation in directing search, with significant consequences for organizations. Currently there are so many interesting ideas and unresolved questions that understanding the process of directing search and its underlying construal requires a significant investment in experimental research.

When examining how search is directed, it is important to keep in mind an important lesson from the field research of the Carnegie School: Directing search is also influenced by the organizational past. Organizational learning directs search by giving information helpful for forming construal and determining response (Argote and Greve, 2007). In the long run, organizational responses are learned and retained through processes such as storytelling (Myers, 2022), routine formation (Bresman, 2013), and job creation (Miner, 1990). In the short run, information from the environment shapes construal processes and influences the response. Organizational networks influence organizational actions directly (Brass et al., 2004) or through modifying the salience of alternatives considered when initiating search (Hu et al., 2022). These learning processes are well-documented and can be a source of ideas when designing experiments (Gavetti et al., 2012).

Conclusion

It is central to Carnegie School research that goals control the behaviors of the organization and its members. They do so by structuring the situation facing each decision-maker. Goals and the associated aspiration levels define what is important, how it is measured, what performance level is satisfactory, when to look for alternative behaviors, and what alternatives are good enough. This is a very high degree of situational control obtained through a simple metric. The Carnegie School has produced abundant research showing the practical consequences of goals, and the effects have significant magnitude in most studies.

Now would be a good time to see research that lays out the psychological processes that underlie these effects. Is there a straightforward connection between the evidence on goals that individuals choose for themselves and goals that organizations impose on them? Do we understand the difference between situations that compel the decision-maker to engage in problem-solving behaviors and situations that allow self-enhancement or construal that permit inaction? Can we tell how goals and other situational factors influence construal so that search is initiated—and directed? Scholarship on organizational responses has been quite person-less for a long time and has made significant progress even so. Imagine how much further research on organizational goals could go if the insights from the Carnegie School were used as a starting point for additional research to fill the gaps outlined in this paper. We would understand the underlying micro-processes and we would be better positioned to explain how search is directed and suitable solutions are found.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The handling editor, PA, declared a past co-authorship with the author, HG.

Publisher's note

References

Argote, L., and Greve, H. R. (2007). A behavioral theory of the firm—40 years and counting: introduction and impact. *Organ. Sci.* 18, 337–349. doi: 10.1287/orsc.1070.0280

Arrfelt, M., Wiseman, R. M., and Hult, T. M. G. (2013). Looking backward instead of forward: aspiration-driven influences on the efficiency of the capital allocation process. *Acad. Manag. J.* 56, 1081–1103. doi: 10.5465/amj.2010.0879

Audia, P. G., and Brion, S. (2007). Reluctant to change: self-enhancing responses to diverging performance measures. *Organ. Behav. Hum. Decision Process.* 102, 255–269. doi: 10.1016/j.obhdp.2006.01.007

Audia, P. G., Brion, S., and Greve, H. R. (2015). Self-assessment, self-enhancement, and the choice of comparison organizations for evaluating organizational performance. *Adv. Strat. Manag. Cogn. Strat.* 32, 89–118.

Audia, P. G., and Greve, H. R. (2006). Less likely to fail? Low performance, firm size, and factory expansion in the shipbuilding industry. *Manag. Sci.* 52, 83–94. doi: 10.1287/mnsc.1050.0446

Audia, P. G., and Greve, H. R. (2021). *Organizational learning from performance feedback: a behavioral perspective on multiple goals*. Cambridge University Press, Cambridge.

Audia, P. G., Locke, E. A., and Smith, K. G. (2000). The paradox of success: an archival and a laboratory study of strategic persistence following a radical environmental change. *Acad. Manag. J.* 43, 837–853. doi: 10.2307/1556413

Austin, J. T., and Vancouver, J. B. (1996). Goal constructs in psychology: structure, process, and content. *Psychol. Bull.* 120, 338–375. doi: 10.1037/0033-2909.120.3.338

Banerjee, A., Lampel, J., and Bhalla, A. (2019). Two cheers for diversity: an experimental study of micro-level heterogeneity in problemistic search. *Strateg. Organ.* 17, 450–469. doi: 10.1177/1476127018815467

Baum, J. A. C., and Dahlin, K. B. (2007). Aspiration performance and railroads' patterns of learning from train wrecks and crashes. *Organ. Sci.* 18, 368–385. doi: 10.1287/orsc.1060.0239

Baum, J. A. C., Rowley, T. J., Shipilov, A. V., and Chuang, Y.-T. (2005). Dancing with strangers: aspiration performance and the search for underwriting syndicate partners. *Adm. Sci. Q.* 50, 536–575. doi: 10.2189/asqu.50.4.536

Bergenholtz, C., Vuculescu, O., and Amidi, A. (2023). Microfoundations of adaptive search in complex tasks: the role of cognitive abilities and styles. Organ. Sci. 32. doi: 10.1287/orsc.2023.1654.

Billinger, S., Srikanth, K., Stieglitz, N., and Schumacher, T. R. (2021). Exploration and exploitation in complex search tasks: how feedback influences whether and where human agents search. *Strateg. Manag. J.* 42, 361–385. doi: 10.1002/smj.3225

Blettner, D. P., He, Z.-L., Hu, S., and Bettis, R. A. (2015). Adaptive aspirations and performance heterogeneity: attention allocation among multiple reference points. *Strateg. Manag. J.* 36, 987–1005. doi: 10.1002/smj.2260

Boyle, E., and Shapira, Z. (2012). The liability of leading: battling aspiration and survival goals in the jeopardy! Tournament of champions. *Organ. Sci.* 23, 1100–1113. doi: 10.1287/orsc.1110.0690

Brandstätter, V., and Bernecker, K. (2022). Persistence and disengagement in personal goal pursuit. *Annu. Rev. Psychol.* 73, 271–299. doi: 10.1146/annurev-psych-020821-110710

Brass, D. J., Galaskiewicz, J., Greve, H. R., and Tsai, W. (2004). Taking stock of networks and organizations: a multi-level perspective. *Acad. Manag. J.* 47, 795–817. doi: 10.2307/20159624

Bresman, H. (2013). Changing routines: a process model of vicarious group learning in pharmaceutical R & D. *Acad. Manag. J.* 56, 35–61. doi: 10.5465/amj.2010.0725

Bromiley, P., and Harris, J. D. (2014). A comparison of alternative measures of organizational aspirations. *Strateg. Manag. J.* 35, 338–357. doi: 10.1002/smj.2191

Clough, D. R., and Piezunka, H. (2020). Tie dissolution in market networks: a theory of vicarious performance feedback. *Adm. Sci. Q.* 65, 972–1017. doi: 10.1177/0001839219899606

Cyert, R. M., and March, J. G. (1963). *A behavioral theory of the firm*. Prentice-Hall, Englewood Cliffs, NJ.

Dijksterhuis, A., and Aarts, H. (2010). Goals, attention, and (un) consciousness. *Annu. Rev. Psychol.* 61, 467–490. doi: 10.1146/annurev.psych.093008.100445

Ertug, G., and Castellucci, F. (2013). Getting what you need: how reputation and status affect team performance, hiring, and salaries in the NBA. *Acad. Manag. J.* 56, 407–431. doi: 10.5465/amj.2010.1084

Ethiraj, S. K., and Levinthal, D. (2009). Hoping for a to Z while rewarding only a: complex organizations and multiple goals. *Organ. Sci.* 20, 4–21. doi: 10.1287/orsc.1080.0358

Gaba, V., and Greve, H. R. (2019). Safe or profitable? The pursuit of conflicting goals. *Organ. Sci.* 30, 647–667. doi: 10.1287/orsc.2018.1280

Gaba, V., and Joseph, J. (2013). Corporate structure and performance feedback: aspirations and adaptation in M-form firms. *Organ. Sci.* 24, 1102–1119. doi: 10.1287/orsc.1120.0788

Gavetti, G., Greve, H. R., Levinthal, D. A., and Ocasio, W. (2012). The behavioral theory of the firm: assessment and prospects. *Acad. Manag. Ann.* 6, 1–40. doi: 10.5465/19416520.2012.656841

Giachetti, C., and Lampel, J. (2010). Keeping both eyes on the competition: strategic adjustment to multiple targets in the UK mobile phone industry. *Strateg. Organ.* 8, 347–376. doi: 10.1177/1476127010391235

Gigerenzer, G., and Gaissmaier, W. (2011). Heuristic decision making. *Annu. Rev. Psychol.* 62, 451–482. doi: 10.1146/annurev-psych-120709-145346

Glynn, P. W., Greve, H. R., and Rao, H. (2019). Relining the garbage can of organizational decision-making: modeling the arrival of problems and solutions as queues. *Ind. Corp. Chang.* 29, 125–142. doi: 10.1093/icc/dtz069

Goyal, L., and Goyal, V. (2021). Performance shortfall, feedback interpretation and R & D search: the differential effects of peers' performance below historical and social aspirations. *Br. J. Manag.* 33, 1584–1608. doi: 10.1111/1467-8551.12532

Greve, H. R. (1998). Performance, aspirations, and risky organizational change. *Adm. Sci. Q.* 44, 58–86.

Greve, H. R. (2003a). A behavioral theory of R & D expenditures and innovation: evidence from shipbuilding. *Acad. Manag. J.* 46, 685–702. doi: 10.2307/30040661

Greve, H. R. (2003b). *Organizational learning from performance feedback: a behavioral perspective on innovation and change*. Cambridge University Press, Cambridge, UK.

Greve, H. R. (2008). A behavioral theory of firm growth: sequential attention to size and performance goals. *Acad. Manag. J.* 51, 476–494. doi: 10.5465/amj.2008.32625975

Greve, H. R. (2018). Where to search? *Adv. Strateg. Manag.* 39, 91–100. doi: 10.1108/S0742-332220180000039007

Greve, H. R. (2021). The resource-based view and learning theory: overlaps, differences, and a shared future. *J. Manag.* 47, 1720–1733. doi: 10.1177/0149206320967732

Greve, H. R., Rudi, N., and Walvekar, A. (2019a). Rational fouls? Loss aversion on organizational and individual goals influence decision quality. Organ. Stud., 42, 1031–1051, doi: 10.1177/0170840619878462.

Greve, H. R., Rudi, N., and Walvekar, A. (2019b). Strategic rule breaking: time wasting to win soccer games. *PLoS One* 14:e0224150. doi: 10.1371/journal.pone.0224150

Halper, L. R., and Vancouver, J. B. (2016). Self-efficacy's influence on persistence on a physical task: moderating effect of performance feedback ambiguity. *Psychol. Sport Exerc.* 22, 170–177. doi: 10.1016/j.psychsport.2015.08.007

Hayward, M. L. A., and Shimizu, K. (2006). De-commitment to losing strategic action: evidence from the divestiture of poorly performing acquisitions. *Strateg. Manag. J.* 27, 541–557. doi: 10.1002/smj.526

Heath, C., Larrick, R. P., and Wu, G. (1999). Goals as reference points. *Cogn. Psychol.* 38, 79–109. doi: 10.1006/cogp.1998.0708

Heckhausen, J., Wrosch, C., and Schulz, R. (2010). A motivational theory of life-span development. *Psychol. Rev.* 117, 32–60. doi: 10.1037/a0017668

Hoang, H., and Ener, H. (2015). Unpacking experience effects in developing novel products for new markets. *Strateg. Organ.* 13, 261–283. doi: 10.1177/1476127015590141

Hu, S., Gu, Q., and Xia, J. (2022). Problemistic search of the embedded firm: the joint effects of performance feedback and network positions on venture capital firms' risk taking. *Organ. Sci.* 33, 1889–1908. doi: 10.1287/orsc.2021.1513

Iyer, D. N., Baù, M., Chirico, F., Patel, P. C., and Brush, T. H. (2019). The triggers of local and distant search: relative magnitude and persistence in explaining acquisition relatedness. *Long Range Plan.* 52:101825. doi: 10.1016/j.lrp.2018.03.001

Jordan, A. H., and Audia, P. G. (2012). Self-enhancement and learning from performance feedback. *Acad. Manag. Rev.* 37, 211–231. doi: 10.5465/amr.2010.0108

Joseph, J., and Gaba, V. (2015). The fog of feedback: ambiguity and firm responses to multiple aspiration levels. *Strateg. Manag. J.* 36, 1960–1978. doi: 10.1002/smj.2333

Kacperczyk, A., Beckman, C. M., and Moliterno, T. P. (2015). Disentangling risk and change: internal and external social comparison in the mutual fund industry. *Adm. Sci. Q.* 60, 228–262. doi: 10.1177/0001839214566297

Kahneman, D., and Tversky, A. (1979). Prospect theory: an analysis of decision under risk. *Econometrica* 47, 263–291. doi: 10.2307/1914185

Kerr, S. (1975). On the folly of rewarding a, while hoping for B. *Acad. Manag. J.* 18, 769–783. doi: 10.2307/255378

Knudsen, T., and Levinthal, D. A. (2007). Two faces of search: alternative generation and alternative evaluation. *Organ. Sci.* 18, 39–54. doi: 10.1287/orsc.1060.0216

Kölbel, J. F., Busch, T., and Jancso, L. M. (2017). How media coverage of corporate social irresponsibility increases financial risk. *Strateg. Manag. J.* 38, 2266–2284. doi: 10.1002/smj.2647

Kolev, K. D., and McNamara, G. (2022). The role of top management teams in firm responses to performance shortfalls. *Strateg. Organ.* 20, 541–564. doi: 10.1177/1476127020962683

Kostopoulos, K., Syrigos, E., and Kuusela, P. (2022). Responding to inconsistent performance feedback on multiple goals: the contingency role of decision maker's status in introducing changes. *Long Range Plann.* 56:102269. doi: 10.1016/j.lrp.2022.102269

Kotiloglu, S., Chen, Y., and Lechler, T. (2021). Organizational responses to performance feedback: a meta-analytic review. *Strateg. Organ.* 19, 285–311. doi: 10.1177/1476127019883361

Kunda, Z. (1990). The case for motivated reasoning. *Psychol. Bull.* 108, 480–498. doi: 10.1037/0033-2909.108.3.480

Kuusela, P., Keil, T., and Maula, M. (2017). Driven by aspirations, but in what direction? Performance shortfalls, slack resources, and resource-consuming vs. resource-freeing organizational change. *Strateg. Manag. J.* 38, 1101–1120. doi: 10.1002/smj.2544

Lant, T. K. (1992). Aspiration level adaptation: an empirical exploration. *Manag. Sci.* 38, 623–644. doi: 10.1287/mnsc.38.5.623

Laursen, K. (2012). Keep searching and you'll find: what do we know about variety creation through firms' search activities for innovation? *Ind. Corp. Chang.* 21, 1181–1220. doi: 10.1093/icc/dts025

Lazear, E. P. (2000). Performance pay and productivity. *Am. Econ. Rev.* 90, 1346–1361. doi: 10.1257/aer.90.5.1346

Lee, J. M., Park, J. C., and Folta, T. B. (2018). CEO career horizon, corporate governance, and real options: the role of economic short-termism. *Strateg. Manag. J.* 39, 2703–2725. doi: 10.1002/smj.2929

Levinthal, D. A., and March, J. G. (1993). The myopia of learning. *Strateg. Manag. J.* 14, 95–112. doi: 10.1002/smj.4250141009

Levinthal, D. A., and Rerup, C. (2021). The plural of goal: learning in a world of ambiguity. *Organ. Sci.* 32, 527–543. doi: 10.1287/orsc.2020.1383

Liberman, N., and Trope, Y. (1998). The role of feasibility and desirability considerations in near and distant future decisions: a test of temporal construal theory. *J. Pers. Soc. Psychol.* 75, 5–18. doi: 10.1037/0022-3514.75.1.5

Lim, E., and Audia, P. G. (2020). Problem-solving or self-enhancing? Influences of diversification and bright spot on corporate resource allocation responses to performance shortfalls. *Strat. Sci.* 5, 348–368. doi: 10.1287/stsc.2020.0117

Locke, E. A., and Latham, G. P. (1990). *A theory of goal setting and task performance*. Prentice-Hall, Englewood Cliffs, NJ.

Locke, E. A., and Latham, G. P. (2002). Building a practically useful theory of goal setting and task motivation: a 35-year odyssey. *Am. Psychol.* 57, 705–717. doi: 10.1037/0003-066X.57.9.705

Locke, E. A., Latham, G. P., and Erez, M. (1988). The determinants of goal commitment. *Acad. Manag. Rev.* 13, 23–39. doi: 10.2307/258352

Lucas, G. J., Knoben, J., and Meeus, M. T. (2018). Contradictory yet coherent? Inconsistency in performance feedback and R & D investment change. *J. Manag.* 44, 658–681. doi: 10.1177/0149206315584821

Lungeanu, R., Stern, I., and Zajac, E. J. (2016). When do firms change technology-sourcing vehicles? The role of poor innovative performance and financial slack. *Strateg. Manag. J.* 37, 855–869. doi: 10.1002/smj.2371

Madsen, P. M. (2009). These lives will not be lost in vain: organizational learning from disaster in U.S. coal mining. *Organ. Sci.* 20, 861–875. doi: 10.1287/orsc.1080.0396

Madsen, P. M., and Desai, V. M. (2010). Failing to learn? The effects of failure and success on organizational learning in the global orbital launch vehicle industry. *Acad. Manag. J.* 53, 451–476. doi: 10.5465/amj.2010.51467631

March, J. G. (1996). Continuity and change in theories of organizational action. *Adm. Sci. Q.* 41, 278–287. doi: 10.2307/2393720

March, J. G., and Olsen, J. P. (1975). The uncertainty of the past: organizational learning under ambiguity. *Eur J Polit Res* 3, 147–171. doi: 10.1111/j.1475-6765.1975.tb00521.x

March, J. G., and Simon, H. (1958). *Organizations*. Wiley, New York.

Mazzelli, A., Nason, R. S., De Massis, A., and Kotlar, J. (2019). Causality rules: performance feedback on hierarchically related goals and capital investment variability. *J. Manag. Stud.* 56, 1630–1654. doi: 10.1111/joms.12432

Miner, A. S. (1990). Structural evolution through idiosyncratic jobs: the potential for unplanned learning. *Organ. Sci.* 1, 195–210. doi: 10.1287/orsc.1.2.195

Moliterno, T. P., Beck, N., Beckman, C. M., and Meyer, M. (2014). Knowing your place: social performance feedback in good times and bad times. *Organ. Sci.* 25, 1684–1702. doi: 10.1287/orsc.2014.0923

Myers, C. G. (2022). Storytelling as a tool for vicarious learning among air medical transport crews. *Adm. Sci. Q.* 67, 378–422. doi: 10.1177/00018392211058426

Plambeck, N., and Weber, K. (2009). CEO ambivalence and responses to strategic issues. *Organ. Sci.* 20, 993–1010. doi: 10.1287/orsc.1090.0471

Plambeck, N., and Weber, K. (2010). When the glass is half full and half empty: CEOs' ambivalent interpretations of strategic issues. *Strateg. Manag. J.* 31, n/a–710. doi: 10.1002/smj.835

Posen, H. E., Keil, T., Kim, S., and Meissner, F. D. (2018). Renewing research on problemistic search—a review and research agenda. *Acad. Manag. Ann.* 12, 208–251. doi: 10.5465/annals.2016.0018

Raab, M., Gigerenzer, G., and Gula, B. (2012). The hot hand exists in volleyball and is used for allocation decisions. *J. Exp. Psychol. Appl.* 18, 81–94. doi: 10.1037/a0025951

Richter, M., Gendolla, G. H., and Wright, R. A. (2016). Three decades of research on motivational intensity theory: what we have learned about effort and what we still don't know. *Adv. Motiv. Sci.* 3, 149–186. doi: 10.1016/bs.adms.2016.02.001

Ross, L., and Nisbett, R. E. (1991). *The person and the situation: perspectives of social psychology*. New York: Mcgraw-Hill Book Company.

Rowley, T. I., Shipilov, A. V., and Greve, H. R. (2017). Board reform versus profits: the effect of rankings on the adoption of governance practices. *Strateg. Manag. J.* 38, 815–833. doi: 10.1002/smj.2545

Rudy, B. C., and Johnson, A. F. (2016). Performance, aspirations, and market versus nonmarket investment. *J. Manag.* 42, 936–959. doi: 10.1177/0149206313503017

Schimmer, M., and Brauer, M. (2012). Firm performance and aspiration levels as determinants of a firm's strategic repositioning within strategic group structures. *Strateg. Organ.* 10, 406–435. doi: 10.1177/1476127012457983

Schmidt, A. M., and DeShon, R. P. (2010). The moderating effects of performance ambiguity on the relationship between self-efficacy and performance. *J. Appl. Psychol.* 95, 572–581. doi: 10.1037/a0018289

Schumacher, C., Keck, S., and Tang, W. (2020). Biased interpretation of performance feedback: the role of CEO overconfidence. *Strateg. Manag. J.* 41, 1139–1165. doi: 10.1002/smj.3138

Shinkle, G. A. (2012). Organizational aspirations, reference points, and goals. *J. Manag.* 38, 415–455. doi: 10.1177/0149206311419856

Shipilov, A. V., Li, S. X., and Greve, H. R. (2011). The prince and the pauper: search and brokerage in the initiation of status-Heterophilous ties. *Organ. Sci.* 22, 1418–1434. doi: 10.1287/orsc.1100.0594

Simon, H. (1947). *Administrative behavior*. McMillan, New York.

Simon, H. A. (1962). The architecture of complexity. *Proc. Am. Philos. Soc.* 106, 467–482.

Smulowitz, S. J., Rousseau, H. E., and Bromiley, P. (2020). The behavioral theory of the (community-oriented) firm: the differing response of community-oriented firms to performance relative to aspirations. *Strat. Manag. J.* 41, 1023–1053.

Sobrepere, X., Keil, T., and Kuusela, P. (2022). The two blades of the scissors: performance feedback and intrinsic attributes in organizational risk taking. *Adm. Sci. Q.* 67, 1012–1048. doi: 10.1177/00018392221117996

Tarakci, M., Ateş, N. Y., Floyd, S. W., Ahn, Y., and Wooldridge, B. (2018). Performance feedback and middle managers' divergent strategic behavior: the roles of social comparisons and organizational identification. *Strateg. Manag. J.* 39, 1139–1162. doi: 10.1002/smj.2745

Tyler, B. B., and Caner, T. (2016). New product introductions below aspirations, slack and R & D alliances: a behavioral perspective. *Strateg. Manag. J.* 37, 896–910. doi: 10.1002/smj.2367

Vancouver, J. B., Thompson, C. M., Tischner, E. C., and Putka, D. J. (2002). Two studies examining the negative effect of self-efficacy on performance. *J. Appl. Psychol.* 87, 506–516. doi: 10.1037/0021-9010.87.3.506

Wilson, T. D. (2022). What is social psychology? The construal principle. *Psychol. Rev.* 129, 873–889. doi: 10.1037/rev0000373

frontiers | Frontiers in Psychology

TYPE Review
PUBLISHED 14 November 2023
DOI 10.3389/fpsyg.2023.1227966

OPEN ACCESS

EDITED BY
Pino Audia,
Dartmouth College, United States

REVIEWED BY
Songcui Hu,
University of Arizona, United States
Daniel Levinthal,
University of Pennsylvania, United States

*CORRESPONDENCE
John Joseph
✉ johnj2@uci.edu

RECEIVED 24 May 2023
ACCEPTED 17 October 2023
PUBLISHED 14 November 2023

CITATION
Gaba V and Joseph J (2023) Content and process: organizational conflict and decision making.
Front. Psychol. 14:1227966.
doi: 10.3389/fpsyg.2023.1227966

Content and process: organizational conflict and decision making

Vibha Gaba[1] and John Joseph[2]*

[1]Entrepreneurship and Family Enterprise, INSEAD Singapore, Singapore, Singapore, [2]Strategy and Entrepreneurship, University of California, Irvine, Irvine, CA, United States

The foundational work in the Carnegie perspective established conflict as endemic to organizations and a driver of organizing behavior and decision making. Organizations as a system of coordinated action among interdependent individuals and groups with different preferences, interests, information, or knowledge create the potential for pervasive and ongoing latent goal conflict. At the same time, extant psychology research has devoted considerable attention to identifying the content and intensity of conflict, focusing on the relationship between different types of conflict and their impact on group outcomes. The Carnegie perspective also assumes that the need for joint decision-making and the differences in goals or perception of reality are never fully resolved. As a result, it has paid attention to the processes through which conflict is addressed - by attending sequentially to goals, decentralizing information, accumulating excess resources, and forming coalitions rather than formal mediating procedures. The assessment of the psychology and organizational theory research also suggests that future work focusing on organizational conflict as latent, situated, and dynamic would enable greater clarity on how organizations make decisions.

KEYWORDS

Carnegie perspective, conflict, decision making, organizational structure, slack, coalitions, sequential attention

Introduction

The Carnegie perspective established intra-organizational conflict as a fundamental issue for organizations and a driver of organizing behavior, information processing, and decision making (Joseph and Gaba, 2020). March and Simon (1958) defined conflict as the "*breakdown in the standard mechanisms of decision-making so that an individual or group experiences difficulty in selecting an action alternative*" (p. 132). An important insight from this research is that when multiple preferences and goals must be addressed simultaneously, the potential for organizational conflict arises. Conflict can interact with various other behavioral mechanisms, such as aspiration adaptation, problemistic search, and attention allocation, making it a central concept for a behavioral theory of decision making, and the Carnegie perspective more broadly.[1]

1 We mention the Behavioral Theory of the Firm to refer to the foundational texts: Simon, 1947; March and Simon, 1958; Cyert and March, 1963. The Carnegie perspective refers to a behaviorally plausible, decision-centered perspective on organizations which was inspired by these foundational texts and subsequently developed across a diverse set of literatures and studies.

Conflict is also a central concern of psychology, but this research has differed from that in organizational theory and strategy. Although early psychology work on conflict shared the BTOF's focus on goal conflict, the emphasis changed in the 1990s. The psychology literature largely relegated goal conflict to the background and focused on situations where goals were shared, but conflict still existed (Jehn, 1995). The subsequent stream of psychology research on conflict – which follows from perceived incompatibilities or differences among group members (De Dreu and Gelfand, 2008) – focuses on identifying the content and intensity of conflict. This work made construct validity and empirical testing a priority. It focused on the relationship between three types of individual-level conflict – task, relationship, and procedural conflict—their expression (Weingart et al., 2015) and their impact on group outcomes (e.g., Jehn and Mannix, 2001; De Dreu, 2006; Jehn et al., 2008). This research is concerned with accurately measuring different types of conflict and the contingencies that promote or limit conflict's use as a problem solving and information processing mechanism (cf. de Wit et al., 2012).

However, far from being an organizational problem that needs "solving," conflict in the Carnegie perspective is viewed as an inherent characteristic of organizations that is never fully resolved (Cyert and March, 1963, p. 75). This perspective emphasizes that the generation and presence of conflict are endemic to organizations and that conflict is inevitable in multiple-actor decision-making processes. As Pondy relates, "Organization is a means for internalizing conflicts, for bringing them within a bounded structure so that they can be confronted and acted out. Suppose we treat organizations as arenas for staging conflicts and managers as fight promoters who organize bouts and as referees who regulate them. Far from being a "breakdown" in the system, conflict … is the very essence of what an organization is." (Pondy, 1992).

As a result, the focus of research based on the Carnegie perspective has been the conflict-related processes that link multiple goals, aspiration levels, and performance with behavioral and decision-making outcomes (cf. Shinkle, 2012). For example, in the many studies that connect performance feedback with decision making, the generative mechanisms are described as expressions or functions of latent conflict. Also, the specific responses to feedback are primarily attributed to some form of conflict resolution (e.g., goal prioritization, interactions between subunits, or utilization of slack). Throughout this stream, the content of the conflict has remained constant (that of goal conflict). However, the emphasis on process – a hallmark of the Carnegie perspective – and the study of the empirical regularities in decision-making - not only focuses on a particular decision in time but also connects decisions over time as situational or contextual factors evolve and adapt (Beckman, 2015).

In what follows, we attempt to highlight the process-oriented lens of the Carnegie perspective, which may offer psychology scholars new directions for their theories of conflict. To do so, we first examine the role of conflict in the foundational works of the Behavioral Theory of the Firm. We pay particular attention to the processes that generate ongoing latent conflict. We consider the conditions where conflict occurs and the implications for organizational decision-making. Second, we examine the processes by which the Carnegie perspective allows organizations to function even amidst perpetual latent conflict. These processes are not meant to eliminate conflict but to promote the efficient and effective functioning of the organizations, even as tensions continue to exist. Third, we feature three characteristics of conflict that both organization theory and psychology scholars have more recently recognized as important for advancing insights into conflict as an organizational phenomenon and as a determinant of decision making: conflict as latent, contextual, and dynamic.

Conflict in the behavioral theory of the firm

A central contribution of the Carnegie perspective is the view of organizations as shifting political coalitions with different goals and characterized by latent organizational conflict. This perspective presents a theory of organizational decision making that highlights the organization as a system of coordinated action among interdependent individuals and groups with different preferences, interests, information, or knowledge. The view is directly concerned with the contributions made by members of the political coalition to the firm's survival and the observation that the political coalition must continually negotiate coalition membership and the subgoals that define the priorities of the firm. As such, they recognized that the stability of the coalition is fragile and that latent conflict is always present.

Although central to Carnegie perspective, the subject of conflict receives unequal treatment in foundational work. Each contribution focuses on different aspects of conflict and different features of conflict resolution. For example, Simon (1947) emphasizes conflict based on different goals and imperfect knowledge. He says, "Discrepancies arise out of the cognitive inability of decision making to deal with the entire problem as a set of simultaneous relations" (p. 160). Resolution is based on the division of labor (specialization) and corresponding local rationality associated with subgoal attention, leaving the conflict to be resolved through the hierarchy of authority. Hierarchical authority gives implicit weight to various demands in decision making and prioritizes overall organizational well-being.

March and Simon (1958) emphasize organizations as settings where individuals and groups with different goals participate in organizational decision making. The potential for conflict within an organization is expected to vary with not only differences in goals but also task interdependencies among coalition members and variations in the perceptions of the organization and its environment. Problem solving, persuasion, bargaining, and politics are likely to emerge as solutions to organizational conflict. The solution depends on whether goals are assumed to differ, and the extent to which agreements reached must be public. However, in any case, it must involve some form of continuous negotiation. Relatedly, the formation of coalitions – specifically, which coalitions are likely to form and how stable these coalitions are likely to be – is reflective of how decision-makers respond to conflict.

Cyert and March (1963) further develop the idea that organizations are shifting political coalitions and focus on the processes by which individuals with different goals participate in organizational decision making. Conflict is persistent because of the inability to write complete contracts (Pitelis, 2007) and because diverse interests and attention patterns do not allow for the full adjudication of different policy demands on the organization and require the continuous negotiation of such demands. Further, they offer a quasi-resolution of conflict through the decentralization of decision making and goal attention, sequential attention to goals, and

adjustment in organizational slack. Through these mechanisms, the organization yields decisions that accommodate potential conflict.

Notably, while Cyert and March's (1963) *Behavior Theory of the Firm* formalizes the generative processes behind joint decision making and conflict at the *organizational level* only, March and Simon's (1958) *Organization* elaborates on both individual and organizational decision making. The literature has primarily proceeded along separate lines, with some studies focusing on individuals (e.g., Mount and Baer, 2022) and others theorizing group or aggregated decision-making processes (e.g., Bromiley, 2009).

Antecedents of latent conflict

Of particular interest to Carnegie scholars are the conditions needed for the presence of conflict: *the need for joint decision making* and *differences in goals* or *differing perceptions of reality* (March and Simon, 1958, p. 156). These differences are not fully resolved, so pervasive latent conflict persists in organizations (Cyert and March, 1963, pp. 214–215). According to the Carnegie perspective, joint decision-making is needed when individuals, groups, or subunits face interdependent activities and must coordinate to achieve a unity of effort (Lawrence and Lorsch, 1967; Thompson, 1967). Joint decision-making is also often called for when subunits share a common pool of resources and are linked in the resource allocation process (e.g., Joseph and Wilson, 2018). Studies using a Carnegie perspective lens have operationalized this joint decision-making in terms of interdependent goals or aspirations (e.g., Hu et al., 2017), performance feedback (Joseph and Gaba, 2015) as well as the rules governing those interactions (Siggelkow, 2002; Rivkin and Siggelkow, 2007; Albert et al., 2015).

Differences in goals

Difficulties in joint decision-making arise in the presence of multiple goals. According to the Carnegie perspective, organizational decision-makers face an array of goals when making choices. Multiple preferences within the firm form organizational goals and determine how the attention and energy of decision-makers will be allocated based on those preferences. For example, conflict may arise between the corporate headquarters and constituent subunits, with the corporate office focusing on goals related to the performance of the entire enterprise and subunits with their parochial interests and goals, which can lead to tension between the two (Gaba and Joseph, 2013). Also, conflict may arise between divisions of a large multidivisional firm (Vissa et al., 2010; Arrfelt et al., 2013). As Hu et al. (2017) remark, "Divisions and division managers in multidivisional firms tend to differ in preferences and goals, resulting in internal conflicts within the firm" (p. 1438). Organizational subunits with distinct functions are expected to develop their own goals and compete for scarce resources with other units, even though they must cooperate to support decisions. Subunits may engage in social comparisons that play up their strengths (and discount their weaknesses) vis-à-vis other subunits (Jordan and Audia, 2012; Kacperczyk et al., 2015; Baumann et al., 2019), which can serve as a source of unchecked tensions.

Compounding these issues is the observation that goals are often correlated (Ethiraj and Levinthal, 2009; Gaba and Greve, 2019). Although correlated or interdependent goals may be congruent and mutually reinforcing (positively correlated), they are more commonly divergent, whereby one goal's satisfaction comes at the expense of achieving one or more other goals (negatively correlated). By extension, decision-makers may face negatively correlated aspiration levels and feedback (Joseph and Gaba, 2015). Problem-solving behavior is, therefore, affected by the goals on which decision-makers choose to focus and the interdependencies among those goals.

The complexity associated with multiple interdependent goals may create difficulties in establishing decision-making criteria (Sundaram and Inkpen, 2004). Multiple goals may create tensions over the direction of the organization and, therefore, fuel ongoing debate and produce delays. Thus, coordination challenges are significant in the presence of multiple goals (Hu and Bettis, 2018; Audia and Greve, 2021). Problems associated with multiple goals are likely to increase with the number of goals a firm pursues (Ethiraj and Levinthal, 2009), as each additional goal substitutes effort and attention from previously established goals (Stevens et al., 2015). This was confirmed empirically by Obloj and Sengul (2020), who found that the likelihood of increased performance on any given performance dimension decreased with the number of other concurrently pursued goals. However, they also found that this applies to most but not all goals. The multiplicity of objectives negatively impacts market share, cost, and export goals but not revenue and margin goals, which are presumed to have a comparatively lower level of interdependence with other goals and ostensibly limit ongoing tensions.

Various studies have examined the processes associated with the direct or indirect effects of goal interdependencies. For example, Gaba and Greve (2019) consider the airline industry's dual focus on safety and profitability and how it affects decisions regarding fleet changes. In the airline industry, safety and profitability have clear conflicts (at least in the short term) owing to the costs of replacing aircraft models with poor safety records. They show that the pursuit of safety goals cannot be understood in isolation from profitability goals, and responsiveness to safety goals is strengthened by low profitability. The reason is that performance shortfalls on multiple goals can trigger survival concerns, leading decision-makers to respond to goals differently. In such situations, the goal perceived as essential for survival gets priority and triggers stronger reactions. In their study, responsiveness to safety goals is strengthened by low profitability because low safety means a risk of accidents, which could lead to organizational failure. Their work suggests that managerial focus on survival rather than shifting attention among multiple goals is another approach to reconciling goal conflict.

Hu and Bettis (2018) study three product-level goals (safety, efficiency, and reliability) with shared technological task environments in the automobile industry. In their study, goal fulfillment becomes interdependent because of a shared task environment. As a result, actions in one task environment to improve the performance of a particular operational goal can simultaneously impede or enhance the performance of other operational goals in the same task environment. They conclude that such interdependencies can lead to severe confusion and stall the coordination efforts, further complicating the problem-solving process. Although not a primary focus, they recognize that in such environments, assigning credit will be increasingly cognitively intractable (Minsky, 1961), leading to potential conflict and disruption of response to feedback.

Salvato and Rerup (2018) examine the conflict arising from the simultaneous pursuit of design and efficiency goals in new product development. Here, they highlight March and Simon's (1958) emphasis on performance programs (or routines) theorized as a stable pattern of action, predictably performed and oriented toward a particular organizational goal. However, they also highlight that the conflict-mitigating benefits of these programs or routines break down in the presence of multiple goals. That is, while the individuals enacting a program to support a particular goal implicitly consent to perform their role and enact a truce (Nelson and Winter, 1982), multiple goals render the truce through routine ineffective.

Organizations are embedded in various industry and institutional contexts, and each may impose goals that are likely to be cognitively available in the course of decision making along with the internal goals (Gavetti et al., 2007; Greve and Teh, 2018; Keum and Eggers 2018; Joseph and Gaba, 2020). For example, Rowley et al. (2016) examined the conflict arising from externally imposed goals, such as public ratings and rankings, the pursuit of which can potentially divert resources from internally established goals. Because rating systems can positively or negatively affect firms' reputations, it can increase organizational pressures to adopt changes that such ratings are designed to promote. They study the adoption of governance practices in response to performance feedback on both financial profitability and position on a governance rating and find that firms with both poor profitability and poor performance on the external governance rating are least likely to adopt the rating-consistent practices. Their study suggests a hierarchical ordering of goals to resolve conflict, reflecting decision makers' choices on which problems to pursue.

In related work, Birkinshaw and Lingblad (2005) find that the potential for intra-organizational competition increases with the extent to which subunits have overlapping intra-firm charters. Charters are the technologies, products, or customer groups the subunit is oriented toward and the organizational domain the subunit has staked out. While such overlap can serve as a source of motivation, it can also serve as a source of conflict as coordination costs and the battle for resources increase. Similarly, Joseph and Wilson (2018) found that intra-organizational conflict can occur between separate subunits (that are horizontally coupled) who compete for similar internal (e.g., corporate) and external (e.g., customer) resources with different technologies; the sales of one unit's output may be threatened by the output from other units. Making the distinction between *coordinative tensions* – intra-firm conflicts over routines and activities – and *cooperative tensions* – intra-firm conflicts over resources and control, they note that when the coupling is tight and the actions are directed toward similar objectives, the conflict that arises stems from differences in opinion about resource allocation and decision-making control (i.e., autonomy).

Another source of conflict may stem from the variation in aspiration levels that firms compare themselves to and the performance feedback they receive. Joseph and Gaba (2015) recognize that feedback from these comparisons may be consistent, inconsistent, or ambiguous. Divergent aspiration level comparisons can reflect different social and historical aspirations (Baum et al., 2005; Lucas et al., 2018), forward- and backward-looking aspirations (Chen, 2008), internal and external social aspirations (e.g., Kacperczyk et al., 2015; Hu et al., 2017; Baumann et al., 2019), short-term and long-term aspirations (e.g., Cheng et al., 2022), and aspiration comparisons over time (Joseph and Gaba, 2015). Divergence may occur even amidst consistent performance feedback – for example, *peer* overperformance can demotivate search, but *historical* overperformance can motivate search (Ye et al., 2021).

Both inconsistent and ambiguous feedback can distort performance assessment and decision-making processes, which, in turn, may increase internal tensions. First, dual comparisons can confound information processing and shape decision-making in terms of search and performance (Baumann et al., 2019), as well as change and risk-taking (Kacperczyk et al., 2015). For example, conflict can arise when managers face divergent feedback from comparing performance to two different social aspiration levels – that of external peers and that of other internal divisions or what is known as a political reference point (Hu et al., 2017).

Second, decision-makers may disagree on whether there is a problem to begin with. Accordingly, conflict arises because poor performance prompts problem-solving efforts in some but self-enhancing behavior in others (Audia and Brion, 2007; Jordan and Audia, 2012; Audia et al., 2015). Self-enhancement refers to the interpretation of performance in a favorable way and has been shown to hinder problemistic search (Argote and Greve, 2007; Kacperczyk et al., 2015; Lv et al., 2019). At the same time, managers will take advantage of feedback inconsistency and attribute problems to factors beyond managerial control, negatively impacting problemistic search (Arrfelt et al., 2013), putting those decision-makers at odds with those attempting to find real solutions to problems. This dynamic is contingent on factors such as different types of CEO power (Blagoeva et al., 2020), family control (Lv et al., 2019), and stakeholder demands (Dye et al., 2014).

Third, if decision-makers agree that a problem is present, they may disagree on the appropriate response, increasing divisiveness. Inconsistency in performance feedback can lead to an intense and ongoing debate among decision-makers concerning the appropriate solution (Joseph and Gaba, 2015; Desai, 2016) and interfere with alternative selection and implementation (Cyert and March, 1963).

Differences in perceptions

Conflict may also arise when differences in perceptions of the internal or external environment occur or when perceptions of performance feedback and objective performance measures differ (Saraf et al., 2022). Researchers interested in cognition (cf. Posen et al., 2018) note that organizational members develop cognitive representations of an organization's internal and external environment, referred to as representational complexity (Csaszar and Ostler, 2020) and assumed interaction structure, variously interdependence representations (Martignoni et al., 2016) or logics of organizing (Alexy et al., 2021). However, these representations may or may not align – with differences persisting between individuals and across the organization. Differences have implications for variation in approaches to problemistic search and related decision-making.

Managers will find it easier to cooperate if their perceptions reflect the similar encoding of the internal and external environment. Shared conceptions of problem-solving activities have been argued to be an essential mechanism for coordination within the firm (Okhuysen and Bechky, 2009; Leonardi, 2011) and may keep conflict within an optimal range (Eisenhardt and Schoonhoven, 1990; Jehn and Mannix, 2001). This accords with research arguing for overarching strategic

goals or direction (Stieglitz and Heine, 2007; Leiponen and Helfat, 2010; Gulati et al., 2012a) and models of shared cognition that focus on the performance implications of broadly diffused mental models, schemas, frames, and logics (Eggers and Kaplan, 2009, 2013).

However, differences may exist between perceptions of performance feedback and objective measures of performance (Saraf et al., 2022). Individual cognitive representations often differ from the true underlying interdependence structure (e.g., interactions among internal activities or goals) or external complexity (e.g., interactions between the firm and its environment), as well as differ between individuals or groups. Differences in individual or shared group perceptions stem from a variety of sources: political processes (Tarakci et al., 2014; Hu et al., 2017), changes in the competitive environment (Porac and Thomas, 1990), regulatory focus (Higgins, 1998; Gamache et al., 2015), cognitive frames (Osiyevskyy and Dewald, 2015) and location in the organization (Gavetti, 2005; Vissa et al., 2010; Gaba and Joseph, 2013; Rhee et al., 2019).

Differences in perceptions based on location may differ because (1) Problem-solving is motivated in areas considered important by decision-makers and their constituents, which may differ with the individual's role in the organization (e.g., senior vs. lower-level managers, engineering vs. marketing, line vs. staff); (2) Problem-solving is shaped by managers' experiences and by the information available to them for decision making. Different roles bring different biases to problem-solving efforts, shaped by each manager's background and experience (Gaba et al., 2023). (3) Problem solutions are sought "near the symptoms," meaning that individuals with different causal models may disagree on the cause of and solutions to the problems (Gaba and Joseph, 2013). For example, lower-level roles reflect simple or parochial causal models, motivating local search. More senior roles may reflect more complex cognitive models, which reflect interdependent problems that senior managers must manage simultaneously. As a result, these managers seek broader solutions that cover various problems across the organization.

Illustratively, Joseph and Wilson (2018) document the conflict that arose at Motorola due to different perceptions of new technology. The corporate office and the division dedicated to the new technology saw the technology as an opportunity. However, one of the legacy units viewed the technology as a threat, which fueled conflict over whether and how the new technology should be developed. Research shows that more favorable perceptions will weaken the impact of negative performance feedback on problemistic search and, consequently, decision making (Saraf et al., 2022).

Processes of conflict resolution

The BTOF and its progeny (e.g., organizational learning, attention, performance feedback) have dedicated much scholarly effort to the processes for resolving conflict. Herein lies the significant potential for the Carnegie perspective to add unique value to other psychological theories of conflict. While psychological studies mainly establish or manipulate goal alignment to focus on the implications of different types of conflict, the Carnegie perspective assumes that true goal alignment never occurs. The theory assumes that "except at the operational level, there is no internal consensus. The procedures for "resolving" such conflict do not reduce all goals to a common dimension or even make them internally consistent" (Cyert and March, 1963, p. 117). Given the pervasiveness of intra-organizational conflict, the focus is not on explicit mediation procedures to resolve conflict. Instead, organizations tend towards a quasi-resolution of conflict, "the tendency of organizations to address different goals through coalitions that represent temporary compromises between different goals" (Gavetti et al., 2012, p. 6). Conflict is ameliorated by attending sequentially to goals, decentralizing information, accumulating excess resources, and forming coalitions (March and Simon, 1958; Cyert and March, 1992). In that sense, the theory aims to provide a process-oriented and more behaviorally plausible account of organizational decision-making.

Sequential attention

Foundational BTOF work establishes that to deal with the cognitive burden and potential discord commonly associated with multiple goals (Jensen, 2002; Sundaram and Inkpen, 2004; Ethiraj and Levinthal, 2009), attention to goals will be sequential (Greve, 2008; Gaba and Greve, 2019). Sequential attention is the idea that to process multiple goals, decision-makers switch their attention back and forth between them (March and Shapira, 1992; Stevens et al., 2015). Many of these goals are assumed to be essential, continuous, and operative, which means they can pose problems—in the form of potential conflict—for the organization.

Goals are evoked and pursued when performance problems or attainment discrepancies arise; consequently, they motivate action toward resolving the most pressing problem or gap between performance and a particular goal (Greve, 2003). When performance on a particular goal is above the aspiration level, decision-makers move on to the next goal, which requires attention and action (Cyert and March, 1963, p. 117–119). Behavioral researchers have tested this sequential attention assumption and found that low performance on a lower-priority goal spurs reactions only when performance on a higher-priority goal signals success (e.g., Greve, 2008; Stevens et al., 2015). As Greve (2008, p. 480) noted, "Sequential attention is a form of quasi-resolution of conflict that lets decision-makers treat different goals as constraints to be satisfied in some order of priority rather than as tradeoffs that need to be weighed against each other. It reduces cognitive effort and political strife and thus yields easier, but possibly suboptimal, organizational decision making."

The capacity for sequential attention to alleviate potential tensions comes in many forms. When contrasting signals are present – decision-makers may often lean more heavily on those that provide clearer signals/information. Managers focus on dimensions with more concrete causal implications. For example, Zhang and Gong (2018) find that prior years' sales growth provides clearer signals than prior years' stock market returns to managers regarding the firm's standing in the product market and customer and competitive information. Another pattern of sequential attention is that firms focus on the short term over the long term. Feedback from short-term goals is likely to provide clearer signals about a logical course of action when performance is below aspirations and external oversight is high (Cheng et al., 2022).

Sequential attention may also come in the form of focusing on historical or social aspirations rather than both at once. Research shows that attention to social and historical aspirations can vary over time, with more attention going to historical aspirations in turbulent environments due to the lower information requirement (Greve, 2003)

and more attention to social than historical when decision-making is higher in the organization – or more centralized – due to greater demands from and attention to the external environment (Joseph and Wilson, 2018; Dutt and Joseph, 2019; Berchicci and Tarakci, 2022). Sequential attention may also be resolved by creating routines that offer opportunities to address multiple goals at once. Salvato and Rerup (2018) found that by creating routines that offered opportunities to focus on a particular goal while lowering the contention among decision-makers, the organization could reduce conflict and allow the new product development process to proceed.

These studies on multiple goals and aspirations are important because they highlight how organizations problem-solve through goal prioritization, managerial focus, and the temporal separation of goals. However, this work is also based on the strong assumption that goal prioritization is stable and uncontested (Greve and Gaba, 2017). It also does not account for what happens when multiple goals are difficult to prioritize or signal conflicting courses of action, whereby the satisfaction of one goal comes at the expense of achieving one or more other goals. Likewise, the role of the external environment in providing goals and when these goals conflict with internally established goals needs more attention. Given the ubiquity of goal conflict in organizations, much more work is needed to understand the subtle connections between goal conflict and complexity and the tradeoffs by which such conflicts are resolved in organizations.

Specializing and differentiating through structure

Another way to deal with conflict that may arise from multiple goals is through the organizational structure. Organizational structure –the division of labor and specialization – focuses decision-maker attention on problems and subgoals corresponding to organizational subunits, divisions, departments, or groups (March and Simon, 1958; Cohen, 1984; Ethiraj and Levinthal, 2009).

The division of labor is effective at conflict mitigation because it establishes a local rationality of decision-making in that individuals will deal with only a limited set of problems (subgoals) at a time (at the limit, one each). The advantage stems from simplifying the decision-making environment for subunit managers and limiting the cognitive complexity associated with many interacting goals and activities. Narrowing cognition will lead to a corresponding change in the nature and interdependencies of subgoals, reflecting the dynamics of organizational structure. The division of labor can occur along the vertical hierarchy between the corporate office and constituent subunits (e.g., Gaba and Joseph, 2013) or across multiple subunits or groups (Vissa et al., 2010; Rhee et al., 2019). Accordingly, attention allocation, aspiration formation, search processes, and responses to performance feedback will also vary.

Such divisionalization benefits the organization by confining most interdependencies within self-contained subunits and minimizing the interdependencies between them. As a result, local decisions need to satisfy local demands only. In this way, differentiation keeps the perturbations in one unit from negatively affecting other units (Fang and Kim, 2018). By decomposing the organization and corresponding subgoals, unit managers may readily acquire, process, and utilize information necessary for achieving those subgoals while limiting the impact of any disruptions to the unit on other units.

For example, Joseph and Wilson (2018) found that explicit conflict between division heads and the demands to resolve the tension caused the separation of organizational units. In particular, two interdependent subunits were competing for similar internal (e.g., corporate) and external (e.g., customer) resources with different technologies, and the achievement of one unit's goal was threatened by the other unit, which led to the separation of the units. The overall effect of separating the subunits was to transform destructive *intra-organizational* conflict into constructive *inter-organizational* competition. For example, the separation allowed each subunit to focus on its respective technologies even though their market opportunities were similar. The separation also alleviated the attention load of the legacy unit and allowed their managers to focus on previously underemphasized aspects of their technology and customer base.

Another structural mechanism to deal with conflict resolution is the organizational hierarchy. Firms may vest decision-making authority with subunits at higher levels of the corporate hierarchy to alleviate conflict, which has several implications (benefits) for managing multiple goals. First, the corporate hierarchy is less concerned than divisional or functional managers with any single performance dimension. For corporate executives, the performance of any one business, product, or technology is less critical to assessments of their performance, so when the subunit experiences a failure in one domain, belief in the attractiveness of alternatives may be relatively more favorable. As a result, they will be more willing in general to abandon failures (Eggers and Kaul, 2018; Joseph et al., 2018) and redirect resources toward successes. Also, corporate managers have the full remit to reallocate resources. They have the authority and capacity to redirect resources from unsuccessful to successful markets and avoid internecine feuds.

Second, vesting decisions at higher levels allows for a shift of attention to a broader range of goals. Such a shift of attention reflects the need of firms to meet the aspirations of different supporters (Ahn et al., 2017; Kotlar and Chrisman, 2019). As the composition of interest groups becomes diverse, firms attempt to adjust the aspiration level regarding a broader range of goals to avoid conflicts between groups (Greve, 2008; Vissa et al., 2010). Although such a shift inhibits the firm's response to serious negative feedback and weakens the role of negative feedback in triggering problemistic searches – it may avoid the deleterious effects of conflict.

Third, corporate executives or other high-status individuals are likely to be more responsive amidst conflicting goals (Kostopoulos et al., 2023). High-status decision-makers can better search within a broader solution space and initiate more changes when experiencing poor performance because of their access to resources and opportunities. Moreover, the status may work against their propensity to self-enhance amidst conflicting goals and reduce perceptions of threat when performance is below aspirations on a primary goal (and above on a secondary goal) that gives rise to self-enhancement. Further, diversification provides executives a means to self-enhance – to focus on corporate performance if subunit performance is poor or vice versa (Lim and Audia, 2020).

Utilization of slack

Slack is the third mechanism used to alleviate intra-organizational conflict. Slack is defined as the "use of administrative

resources beyond what is necessary for the short-term operation and maintenance of the organization" (Greve, 2003, p. 688) and typically follows from higher performance (Titus et al., 2022). The Carnegie perspective articulates multiple benefits of slack (Bourgeois, 1981). Although agency theorists and organizational economists associate slack with inefficiency (Williamson, 1963, 1964; Jensen and Meckling, 1976), slack is a mechanism by which the political coalition of the firm maintains power. Because slack reflects the difference between resources needed to maintain routine operations and the resources received by a coalition in the organization, slack can be used to mitigate conflict that naturally arises from scarcity. Projects with different goals can coexist because resource competition is less intense (Kuusela et al., 2017). Moreover, a single project can accommodate more demands, alleviating concerns that "pet projects" will not be funded. Slack lowers the chance that an organization would have to take unwanted actions (George, 2005), reducing opportunities for tensions to develop.

By extension, slack – because it is typically present in successful organizations—can help fuel search and innovation. For example, research shows that slack increases R&D intensity because it allows for pursuing projects, although this research usually omits direct references to conflict (Greve, 2003). Slack moderates firm responses to performance shortfalls and can lead to higher investment in innovative outcomes following performance below aspirations.

Slack can lead to more novel and risky actions (e.g., Greve, 2003; Baum et al., 2005; Baum and Dahlin, 2007; Chen and Miller, 2007) and exploration, especially when there is an environmental threat (Voss et al., 2008). By buffering organizations from the threat of failure, slack resources permit managers to respond to low performance by increasing investments in innovative competencies (Lungeanu et al., 2016). Although, others have shown a curvilinear relationship between slack and innovation (Nohria and Gulati, 1996), R&D investments (Kim et al., 2008), and performance (George, 2005).

The creation of slack and its uses is primarily positioned as a natural outcome of bargaining and decision-making processes, and its generation and application are therefore not theorized as explicit. Cyert and March (1963, p. 44) explicitly remark that it does not arise from "conscious intent" and is used to absorb excess resources and serve as emergency resources. Moreover, its usefulness and qualities as side payments are generally expressed in terms of its impact on aspiration levels; slack has not received much consideration regarding its impact on the content of the aspirations itself. Collectively, the BTOF is unclear on when slack may be used to reduce intra-firm conflict and when it might be channeled toward other outcomes, such as innovation. That is, the foundational theory and subsequent work do not provide a clear understanding of when slack is likely to be applied toward conflict reduction by the political coalition and when it is expected to be channeled toward innovation activities. We do not fully comprehend the motivational components behind the use of slack, the conditions that enable the political coalition to maintain peace or pursue innovation, and those that will induce one action or the other. For example, such situations could be related to the type or intensity of conflict (e.g., task, process, or relationship) or whether innovation opportunities are short-term or long-term, but more work is needed.

Coalition formation

The concept of organizational coalitions is foundational in BTOF and essential for understanding the perpetual nature of conflict and compromises in organizations. According to Simon (1964), the goal of an action is not necessarily unitary but may emerge from a series of demands the actions must satisfy. Organizational goals are thus formed by multiple demands and preferences within the firm and determine how the attention and energy of decision-makers will be allocated based on those preferences. An important implication of this view is that organizational goals are contested overall and in specific decisions, so political coalition building is essential for resolving goal conflict (Cyert and March, 1992).

Coalitions are often issue-based (March, 1994) and act as a means of political influence within the organization. Each issue has a distinct set of alternatives, and decision-makers seek to build and retain coalitions to influence decisions related to the issue. The individual participants in a coalition may have different preferences concerning those issues that may never be fully reconciled but only subjugated in anticipation of actual or potential gains (Cyert and March, 1992, p. 31). This enables reconciling incompatible preference ordering without eliminating underlying differences.

In these political models, decision-making results from exercising power and influence among the coalition participants. Coalitions divide complex and interrelated problems into a "number of simple problems," reducing the cognitive effort of comprehending and responding to issues and controlling latent conflict between coalitions by reducing their interdependence (Cyert and March, 1963). This line of research establishes the importance of top executives as both political brokers and integrators, with neither CEOs nor other executives asserting full control over decision-making and outcomes (Zald, 1970; Pfeffer and Salancik, 1978). As issues shift, so does the power balance, such that some coalition members become more critical than others (Zald, 1962). Power accrues to those who control access to resources valued by others (Pfeffer and Salancik, 1978) and those who can resolve important contingencies facing the firm (Hickson et al., 1971).

Although empirical research on this topic remains sparse, some studies show that distinct coalitions of decision-makers may jointly influence organizational decision-making, or a dominant coalition may emerge situationally and guide responses aligned with their preferences. For example, Desai (2016) examined the joint influence of distinct coalitions of decision-makers, such as board members and managers, on organizations' responses to the performance below aspirations. He argued that although different coalitions may vary in their preferences regarding organizational responses to poor performance, such situations increase the board's involvement and influence in decision-making aligned with their preferences. While a dominant coalition of top managers could implement actions aligned with their priorities during routine periods, performance shortfalls force managers to seek compromises, ultimately affecting the extent of organizational change. Similarly, Greve and Zhang (2017) examined how the elements of the external environment – multiple institutional

logics that embody value judgments – affect the choice of goals and connect a coalition of decision-makers with sources of support that increase its power, thereby affecting organizations' decisions. They found that the coexistence of competing logics—state socialism and market capitalism—during China's economic transition affected firms' M&A decisions via the coalition building by advocates of each logic. In another study, Zhang and Greve (2019) showed that organizational coalitions could coalesce around experience-based preferences and include neutral or ambivalent members who may be recruited as allies. They further found that such coalitions strongly affected decision-making, and their solutions to organizational problems were consistent with the experienced-based preferences of the decision-making group. While these studies provide important insights into how coalitions are formed and influence organizational choices, more work is needed to understand the motivations and intentions of the coalition participants and how they structure their activities.

One omission in the Carnegie perspective is that the mechanisms to reduce conflict are assumed to have similar implications for problems of cooperation and coordination. Cooperation refers to an alignment of interests; coordination refers to an alignment of actions or tasks (Gulati et al., 2012b; Castañer and Oliveira, 2020). However, the mechanisms for conflict reduction may have different implications for cooperation versus coordination-based conflict. For example, both sequential attention to goals and structural differentiation reduce potential conflict stemming from cooperation requirements since lack of consistency between goals is not observed, and tradeoffs are not required by organizational members (i.e., they go left, and then they go right). These two mechanisms also reduce coordination-based conflict since corresponding attentional patterns mean task complexity is not observed. However, this is only true if the underlying task structure is modular (Ethiraj and Levinthal, 2004). Coordination-based conflict may be especially sensitive to reciprocal, parallel, or otherwise interdependent tasks which cannot be decomposed.

Similarly, slack has an ameliorating impact on cooperation- and coordination-based conflict but for different reasons. For the former, slack reduces potential conflict since individual demands can be met. For the latter, slack reduces potential conflict since buffers limit interdependencies. Along the same lines, coalitional behavior reduces cooperation-based conflict since the coalition may focus on goals that are non-operational (i.e., do not conflict with specific objectives) or which are held in common. Coalitional behavior may also be beneficial for coordination problems. However, in this case, it is because the coalition, operating at the highest levels of the organization, can make decisions that are mutually reinforcing and avoid conflicting courses of action. Of course, these relationships are more complex than we have articulated above and bear greater scrutiny in future research.

Conflict as latent, contextual, and dynamic

The endemic nature of the Carnegie perspective's treatment of conflict has been met by psychology's greater attention to both content and process. In particular, psychology's focus on interactions and episodes of conflict (Weingart et al., 2015; Cronin and Bezrukova, 2019) and Carnegie's embrace of latency, situatedness, and dynamic processes point to new avenues of research for both fields and significant opportunities for cross-pollination of ideas and theory.

First, conflict in the Carnegie perspective is latent. That conflict is latent reflects initial antecedent conditions (i.e., multiple goals, scarce resources, policy debates, task interdependencies). For example, organizational theorists recognize that overt conflict is uncommon in top management teams. Despite the diverse goals, interests, and preferences among coalition members, conflict among those members is often covert, as participants selectively attend to the firm's issues and opportunities and intermittently mobilize their power and influence (Cyert and March, 1963; Morrill et al., 2003). While explicit conflict is plausible in top management teams, much research has shown the influence of intra-organizational norms and rules in shaping elite truces (Useem, 1984; Hirsch, 1986; Ocasio, 1999; Westphal and Khanna, 2003) and standard operating procedures in limiting more widespread breakdown in the cooperative organizational system (Jehn and Bendersky, 2003).

Tensions rarely erupt in explicit conflict or spillover into visible battles. Nevertheless, internal tensions may be possible. Remarkably, much of the theorized impact of conflict is that of latent conflict, which makes conflict influential in decision-making but challenging to measure. Conflict is often "assumed" and diverges from the psychological literature, which has devoted significant attention to measurement validity and empirical research (cf. de Wit et al., 2012). Explicit conflict is rarely captured in behavioral models (much less the type of conflict involved). At the same time, psychology research's focus on measuring direct conflict can also easily miss the underlying frictions and sources of tensions in joint decision-making with substantive impact on individual, group, and organizational outcomes. A fruitful way forward, for example, could be to measure the antecedent conditions that likely generate breakdowns as the decision-making progresses.

Second, conflict is situational in the Carnegie perspective. The BTOF established that conflict is situational and depends on various conditions to make it apparent. This aspect of conflict is perhaps the most developed in behavioral theory. It is partly due to the emphasis on situational factors to assess whether or not conflict is likely to be present. Organizations are subject to pressures from various external and internal stakeholders, some of which may conflict with each other. As noted above, new goals may emerge in the organization's environment, creating conflict with the established internal goals, especially when the achievement of these externally generated goals requires the diversion of resources from the fulfillment of internal goals. Similarly, divergent goals or inconsistent feedback creates the context for disagreements on whether problems exist and solutions are needed. In these studies, conflict is never measured but inferred from the nature of the choice situation. Only in a few case studies (e.g., Joseph and Wilson, 2018; Salvato and Rerup, 2018) is conflict treated directly and empirically in any meaningful way. Many more quantitative studies are still needed in this vein.

The situational nature of conflict in the Carnegie perspective has meant that scholars have relied heavily on such conditions to infer the presence or absence of conflict. The focus is on goal conflict, for example, rather than the actual expression of conflict between individuals, groups, or subunits. It is important because work in psychology has recognized not only the particular type of conflict (task, process, and relationship) but also that the directness and oppositional intensity of conflict may play a vital role in the relationship between conflict and outcomes. Recent work on conflict expression recognizes that the situated nature of communication

between two people and the specific content of the exchange can determine whether and how the conflict will be realized and responded to (Weingart et al., 2015). The theory foregrounds the notion that the characteristics of the conflict being experienced influence the approaches to conflict management and the outcomes.

A third aspect of Carnegie's theorization of conflict – and a problem that it shares with the psychological literature - is that even if theorized as a process, it is often studied as a single-point measure in a variance study (Okhuysen and Richardson, 2007, p. 146). In other words, the treatment of conflict lacks process dynamics. As parties attempt to manage conflict, the nature of conflict itself changes regarding the issues considered (Carver and Scheier, 1990) and the emotions surrounding the conflict (Van Kleef and Cote, 2018). In fact, Pondy's early approach was essentially a dynamic model of conflict, which established conflict as a series of episodes. The first was latent conflict, as described above. The second was "felt conflict," where affective states (i.e., stress, hostility) and cognitive states (perceived conflict) were activated. At this point, conflict was salient to the individual, which led to explicit displays of aggression or resistance.

Understanding and studying conflict as a dynamic process would better allow Carnegie scholars to recognize and account for a more significant role of communication in conflict (Weingart et al., 2015) and the differences between conflict states and processes (Cronin and Bezrukova, 2019). For example, Weingart et al. (2015) offer a model that emphasizes verbal and nonverbal communication of opposition between people: the reflected directness and oppositional intensity might offer some insights as to when certain types of conflict may hurt decision-making. Understanding conflict interactions can provide information about inconsistencies and related emotions among people, which in turn influences their ability to perform tasks and resolve conflicts. Likewise, the endogenous nature of conflict relies on the feedback loop between the state and processes as the moves made to address the conflict alter the state of the conflict, and the new state then changes the subsequent processes, and the cycle continues (Cronin and Bezrukova, 2019). This view speaks to the importance of capturing the temporal dynamics of conflict, which are rarely represented in the current process frameworks of conflict studies.

A dynamic approach would also help unpack the link between conflict emerging from multiple organizational goals and decision making. In particular, we could better understand how goals are activated and used in decision-making. Theories of loose coupling suggest that organizational goals do not always affect decision-making and are used to justify action (Cohen et al., 1972; Weick, 1976; Kaplan, 2008) rather than explain purposeful decision-making (Eisenhardt and Zbaracki, 1992). From this perspective, goals are not necessarily stabilized or agreed upon before considering alternatives but are drawn from a pool of existing goals as the decision-making process proceeds. Such loose coupling would increase the possibilities for goal satisfaction (Simon, 1964) and limit the possibility of conflict. In any case, a more dynamic approach would provide a better understanding of how organization manage multiple goals.

Conclusion

Conflict is central to the theory of organizational decision-making. The Carnegie School perspective acknowledges that organizations are not merely cooperative systems for inducing collective action toward a common purpose (Barnard, 1938); organizations are also systems of subunits headed by decision-makers who have conflicting goals and interests while competing for status and power (March and Simon, 1958; Cyert and March, 1992). In particular, the potential for conflict is greatest when there are interdependencies, differences in goals and interests, and divergent perceptions of the external and internal environment (Hayward and Boeker, 1998). Interdependences and variations in the information held (and hence perceptions) to a general sense of uncertainty introduce coordination and cooperation challenges and create latent or overt conflict within the organization (Pondy, 1967).

Although overt conflict is rare, internal tensions from divergent or ambiguous goals or feedback are likely to disrupt information-processing efficiency and learning, given that clashing managers will not be motivated to cooperate. These results are consistent with previous work on individual-level conflict, which indicates that high levels of conflict are disruptive and counterproductive to the performance of routine and creative tasks (De Dreu, 1997). Cyert and March (1963) established the so-called quasi-resolution of conflict as a central tenet of the BTOF. These authors argue for the existence of logical differences between the demands of different organizational actors and claim that dealing with the conflict inherent to these differences requires that organizations decentralize, attend sequentially to demands (goals), regulate slack resources, and form coalitions.

Both streams of work would benefit from greater attention to conflict as latent, situated, and dynamic. Such an approach may provide insights into areas that demand greater research focus, such as: What are alternatives to sequential attention to goals? When is conflict productive, and when is it not? Moreover, what motivates the use of slack resources for stabilization vs. change? In other words, approaching conflict as latent, situated, and dynamic would enable greater clarity on how individuals, groups, and organizations make decisions.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

Ahn, J. M., Minshall, T., and Mortara, L. (2017). Understanding the human side of openness: the fit between open innovation modes and CEO characteristics. *R&D Manag.* 47, 727–740. doi: 10.1111/radm.12264

Albert, D., Kreutzer, M., and Lechner, C. (2015). Resolving the paradox of interdependency and strategic renewal in activity systems. *Acad. Manage. Rev.* 40, 210–234.

Alexy, O., Poetz, K., Puranam, P., and Reitzig, M. (2021). Adaptation or persistence? Emergence and revision of organization designs in new ventures. *Organ. Sci.* 32, 1439–1472. doi: 10.1287/orsc.2021.1431

Argote, L., and Greve, H. R. (2007). A behavioral theory of the firm—40 years and counting: introduction and impact. *Organ. Sci.* 18, 337–349. doi: 10.1287/orsc.1070.0280

Arrfelt, M., Wiseman, R. M., and Hult, G. T. M. (2013). Looking backward instead of forward: aspiration-driven influences on the efficiency of the capital allocation process. *Acad. Manag. J.* 56, 1081–1103. doi: 10.5465/amj.2010.0879

Audia, P. G., and Brion, S. (2007). Reluctant to change: self-enhancing responses to diverging performance measures. *Organ. Behav. Hum. Decis. Process.* 102, 255–269. doi: 10.1016/j.obhdp.2006.01.007

Audia, P. G., Brion, S., and Greve, H. R. (2015). *Self-assessment, self-enhancement, and the choice of comparison organizations for evaluating organizational performance, cognition and strategy*, vol. *32*. Bingley, United Kingdom: Emerald Group Publishing Limited, 89–118.

Audia, P. G., and Greve, H. R. (2021). *Organizational learning from performance feedback: a behavioral perspective on multiple goals: a multiple goals perspective.* Cambridge, United Kingdom: Cambridge University Press.

Barnard, C. I. (1938). *The functions of the executive.* London, England, UK: Harvard university press.

Baum, J. A., and Dahlin, K. B. (2007). Aspiration performance and railroads' patterns of learning from train wrecks and crashes. *Organ. Sci.* 18, 368–385. doi: 10.1287/orsc.1060.0239

Baum, J. A., Rowley, T. J., Shipilov, A. V., and Chuang, Y.-T. (2005). Dancing with strangers: aspiration performance and the search for underwriting syndicate partners. *Adm. Sci. Q.* 50, 536–575. doi: 10.2189/asqu.50.4.536

Baumann, O., Eggers, J., and Stieglitz, N. (2019). Colleagues and competitors: how internal social comparisons shape organizational search and adaptation. *Adm. Sci. Q.* 64, 275–309. doi: 10.1177/0001839218766310

Beckman, C. (2015). The spawning of more "little ideas". *Management* 24, 324–325.

Berchicci, L., and Tarakci, M. (2022). Aspiration formation and attention rules. *Strateg. Manag. J.* 43, 1575–1601. doi: 10.1002/smj.3371

Birkinshaw, J., and Lingblad, M. (2005). Intrafirm competition and charter evolution in the multibusiness firm. *Organ. Sci.* 16, 674–686. doi: 10.1287/orsc.1050.0142

Blagoeva, R. R., Mom, T. J., Jansen, J. J., and George, G. (2020). Problem-solving or self-enhancement? A power perspective on how CEOs affect R&D search in the face of inconsistent feedback. *Acad. Manag. J.* 63, 332–355. doi: 10.5465/amj.2017.0999

Bourgeois, L. J. III. (1981). On the measurement of organizational slack. *Acad. Manag. Rev.* 6, 29–39. doi: 10.2307/257138

Bromiley, P. (2009). *The behavioral foundations of strategic management*. Hoboken, NJ: John Wiley & Sons.

Carver, C. S., and Scheier, M. F. (1990). Origins and functions of positive and negative affect: a control-process view. *Psychol. Rev.* 97:19. doi: 10.1037/0033-295X.97.1.19

Castañer, X., and Oliveira, N. (2020). Collaboration, coordination, and cooperation among organizations: establishing the distinctive meanings of these terms through a systematic literature review. *J. Manag.* 46, 965–1001. doi: 10.1177/0149206320901565

Chen, (2008). Determinants of firms' backward-and forward-looking R&D search behavior. *Organ. Sci.* 19, 609–622. doi: 10.1287/orsc.1070.0320

Chen, W. R., and Miller, K. D. (2007). Situational and institutional determinants of firms' R&D search intensity. *Strateg. Manag. J.* 28, 369–381. doi: 10.1002/smj.594

Cheng, L., Xie, E., Fang, J., and Mei, N. (2022). Performance feedback and firms' relative strategic emphasis: the moderating effects of board independence and media coverage. *J. Bus. Res.* 139, 218–231. doi: 10.1016/j.jbusres.2021.09.021

Cohen, M. D. (1984). Conflict and complexity: goal diversity and organizational search effectiveness. *Am. Polit. Sci. Rev.* 78, 435–451. doi: 10.2307/1963374

Cohen, M. D., March, J. G., and Olsen, J. P. (1972). A garbage can model of organizational choice. *Adm. Sci. Q.* 17, 1–25. doi: 10.2307/2392088

Cronin, M. A., and Bezrukova, K. (2019). Conflict management through the lens of system dynamics. *Acad. Manag. Ann.* 13, 770–806. doi: 10.5465/annals.2017.0021

Csaszar, F. A., and Ostler, J. (2020). A contingency theory of representational complexity in organizations. *Organ. Sci.* 31, 1198–1219. doi: 10.1287/orsc.2019.1346

Cyert, R. M., and March, J. G. (1963). *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.

Cyert, R. M., and March, J. G. (1992). *A behavioral theory of the firm* (*2nd Ed.*): Blackwell, Oxford.

De Dreu, C. K. (1997). Productive conflict: the importance of conflict management and conflict issue. *Using Conf. Organ.* 9:22.

De Dreu, C. K. (2006). When too little or too much hurts: evidence for a curvilinear relationship between task conflict and innovation in teams. *J. Manag.* 32, 83–107. doi: 10.1177/0149206305277795

De Dreu, C. K., and Gelfand, M. J. (2008). Conflict in the workplace: Sources, functions, and dynamics across multiple levels of analysis.

De Wit, F. R., Greer, L. L., and Jehn, K. A. (2012). The paradox of intragroup conflict: a meta-analysis. *J. Appl. Psychol.* 97:360. doi: 10.1037/a0024844

Desai, V. M. (2016). The behavioral theory of the (governed) firm: corporate board influences on organizations' responses to performance shortfalls. *Acad. Manag. J.* 59, 860–879. doi: 10.5465/amj.2013.0948

Dutt, N., and Joseph, J. (2019). Regulatory uncertainty, corporate structure, and strategic agendas: evidence from the US renewable electricity industry. *Acad. Manag. J.* 62, 800–827. doi: 10.5465/amj.2016.0682

Dye, K. C., Eggers, J., and Shapira, Z. (2014). Tradeoffs in a tempest: stakeholder influence on hurricane evacuation decisions. *Organ. Sci.* 25, 1009–1025. doi: 10.1287/orsc.2013.0890

Eggers, J. P., and Kaplan, S. (2009). Cognition and renewal: comparing CEO and organizational effects on incumbent adaptation to technical change. *Organ. Sci.* 20, 461–477. doi: 10.1287/orsc.1080.0401

Eggers, J. P., and Kaplan, S. (2013). Cognition and capabilities: a multi-level perspective. *Acad. Manag. Ann.* 7, 295–340. doi: 10.5465/19416520.2013.769318

Eggers, J., and Kaul, A. (2018). Motivation and ability? A behavioral perspective on the pursuit of radical invention in multi-technology incumbents. *Acad. Manag. J.* 61, 67–93. doi: 10.5465/amj.2015.1123

Eisenhardt, K. M., and Schoonhoven, C. B. (1990). Organizational growth: linking founding team, strategy, environment, and growth among US semiconductor ventures, 1978-1988. *Adm. Sci. Q.* 35, 504–529. doi: 10.2307/2393315

Eisenhardt, K. M., and Zbaracki, M. J. (1992). Strategic decision making. *Strateg. Manag. J.* 13, 17–37. doi: 10.1002/smj.4250130904

Ethiraj, S. K., and Levinthal, D. (2004). Bounded rationality and the search for organizational architecture: an evolutionary perspective on the design of organizations and their evolvability. *Adm. Sci. Q.* 49, 404–437. doi: 10.2307/4131441

Ethiraj, S. K., and Levinthal, D. (2009). Hoping for A to Z while rewarding only a: complex organizations and multiple goals. *Organ. Sci.* 20, 4–21. doi: 10.1287/orsc.1080.0358

Fang, C., and Kim, J. (2018). The power and limits of modularity: a replication and reconciliation. *Strateg. Manag. J.* 39, 2547–2565. doi: 10.1002/smj.2918

Gaba, V., and Greve, H. R. (2019). Safe or profitable? The pursuit of conflicting goals. *Organ. Sci.* 30, 647–667. doi: 10.1287/orsc.2018.1280

Gaba, V., and Joseph, J. (2013). Corporate structure and performance feedback: aspirations and adaptation in M-form firms. *Organ. Sci.* 24, 1102–1119. doi: 10.1287/orsc.1120.0788

Gaba, V., Lee, S., Meyer-Doyle, P., and Zhao-Ding, A. (2023). Prior experience of managers and maladaptive responses to performance feedback: evidence from mutual funds. *Organ. Sci.* 34, 894–915. doi: 10.1287/orsc.2022.1605

Gamache, D. L., McNamara, G., Mannor, M. J., and Johnson, R. E. (2015). Motivated to acquire? The impact of CEO regulatory focus on firm acquisitions. *Acad. Manag. J.* 58, 1261–1282. doi: 10.5465/amj.2013.0377

Gavetti, G. (2005). Cognition and hierarchy: rethinking the microfoundations of capabilities' development. *Organ. Sci.* 16, 599–617. doi: 10.1287/orsc.1050.0140

Gavetti, G., Greve, H. R., Levinthal, D. A., and Ocasio, W. (2012). The behavioral theory of the firm: assessment and prospects. *Acad. Manag. Ann.* 6, 1–40. doi: 10.5465/19416520.2012.656841

Gavetti, G., Levinthal, D., and Ocasio, W. (2007). Perspective—neo-carnegie: the carnegie school's past, present, and reconstructing for the future. *Org. Sci.* 18, 523–536.

George, G. (2005). Slack resources and the performance of privately held firms. *Acad. Manag. J.* 48, 661–676. doi: 10.5465/amj.2005.17843944

Greve, H. R. (2003). A behavioral theory of R&D expenditures and innovations: evidence from shipbuilding. *Acad. Manag. J.* 46, 685–702. doi: 10.2307/30040661

Greve, H. R. (2008). A behavioral theory of firm growth: sequential attention to size and performance goals. *Acad. Manag. J.* 51, 476–494. doi: 10.5465/amj.2008.32625975

Greve, H. R., and Gaba, V. (2017). Performance feedback in organizations and groups: Common themes.

Greve, H. R., and Teh, D. (2018). Goal selection internally and externally: a behavioral theory of institutionalization. *Int. J. Manag. Rev.* 20, S19–S38.

Greve, H. R., and Zhang, C. M. (2017). Institutional logics and power sources: merger and acquisition decisions. *Acad. Manag. J.* 60, 671–694. doi: 10.5465/amj.2015.0698

Gulati, R., Puranam, P., and Tushman, M. (2012a). Meta-organization design: rethinking design in interorganizational and community contexts. *Strateg. Manag. J.* 33, 571–586. doi: 10.1002/smj.1975

Gulati, R., Wohlgezogen, F., and Zhelyazkov, P. (2012b). The two facets of collaboration: cooperation and coordination in strategic alliances. *Acad. Manag. Ann.* 6, 531–583. doi: 10.5465/19416520.2012.691646

Hayward, M. L., and Boeker, W. (1998). Power and conflicts of interest in professional firms: evidence from investment banking. *Adm. Sci. Q.* 43, 1–22. doi: 10.2307/2393589

Hickson, D. J., Hinings, C. R., Lee, C. A., Schneck, R. E., and Pennings, J. M. (1971). A strategic contingencies' theory of intraorganizational power. *Adm. Sci. Q.* 16, 216–229. doi: 10.2307/2391831

Higgins, E. T. (1998). *Promotion and prevention: Regulatory focus as a motivational principle, advances in experimental social psychology*, vol. *30*. Amsterdam, Netherlands: Elsevier, 1–46.

Hirsch, P. M. (1986). From ambushes to golden parachutes: corporate takeovers as an instance of cultural framing and institutional integration. *Am. J. Sociol.* 91, 800–837. doi: 10.1086/228351

Hu, S., and Bettis, R. A. (2018). Multiple organization goals with feedback from shared technological task environments. *Organ. Sci.* 29, 873–889. doi: 10.1287/orsc.2018.1207

Hu, S., He, Z. L., Blettner, D. P., and Bettis, R. A. (2017). Conflict inside and outside: social comparisons and attention shifts in multidivisional firms. *Strateg. Manag. J.* 38, 1435–1454. doi: 10.1002/smj.2556

Jehn, K. A. (1995). A multimethod examination of the benefits and detriments of intragroup conflict. *Adm. Sci. Q.* 40, 256–282. doi: 10.2307/2393638

Jehn, K. A., and Bendersky, C. (2003). Intragroup conflict in organizations: a contingency perspective on the conflict-outcome relationship. *Res. Organ. Behav.* 25, 187–242. doi: 10.1016/S0191-3085(03)25005-X

Jehn, K. A., Greer, L., Levine, S., and Szulanski, G. (2008). The effects of conflict types, dimensions, and emergent states on group outcomes. *Group Decis. Negot.* 17, 465–495. doi: 10.1007/s10726-008-9107-0

Jehn, K. A., and Mannix, E. A. (2001). The dynamic nature of conflict: a longitudinal study of intragroup conflict and group performance. *Acad. Manag. J.* 44, 238–251. doi: 10.2307/3069453

Jensen, M. C. (2002). Value maximization, stakeholder theory, and the corporate objective function. *Bus. Ethics Q.* 12, 235–256. doi: 10.2307/3857812

Jensen, M. C., and Meckling, W. H. (1976). Theory of the firm: managerial behavior, agency costs and ownership structure. *J. Financ. Econ.* 3, 305–360. doi: 10.1016/0304-405X(76)90026-X

Jordan, A. H., and Audia, P. G. (2012). Self-enhancement and learning from performance feedback. *Acad. Manag. Rev.* 37, 211–231. doi: 10.5465/amr.2010.0108

Joseph, J., Baumann, O., Burton, R. M., and Srikanth, K. (2018). *Organization design*. Bingley, United Kingdom: Emerald Group Publishing.

Joseph, J., and Gaba, V. (2015). The fog of feedback: ambiguity and firm responses to multiple aspiration levels. *Strateg. Manag. J.* 36, 1960–1978. doi: 10.1002/smj.2333

Joseph, J., and Gaba, V. (2020). Organizational structure, information processing, and decision-making: a retrospective and road map for research. *Acad. Manag. Ann.* 14, 267–302. doi: 10.5465/annals.2017.0103

Joseph, J., and Wilson, A. J. (2018). The growth of the firm: an attention-based view. *Strateg. Manag. J.* 39, 1779–1800. doi: 10.1002/smj.2715

Kacperczyk, A., Beckman, C. M., and Moliterno, T. P. (2015). Disentangling risk and change: internal and external social comparison in the mutual fund industry. *Adm. Sci. Q.* 60, 228–262. doi: 10.1177/0001839214566297

Kaplan, S. (2008). Framing contests: strategy making under uncertainty. *Organ. Sci.* 19, 729–752. doi: 10.1287/orsc.1070.0340

Keum, D. D., and Eggers, J. (2018). Setting the bar: the evaluative and allocative roles of organizational aspirations. *Organ. Sci.* 29, 1170–1186. doi: 10.1287/orsc.2018.1224

Kim, H., Kim, H., and Lee, P. M. (2008). Ownership structure and the relationship between financial slack and R&D investments: evidence from Korean firms. *Organ. Sci.* 19, 404–418. doi: 10.1287/orsc.1080.0360

Kostopoulos, K., Syrigos, E., and Kuusela, P. (2023). Responding to inconsistent performance feedback on multiple goals: the contingency role of decision maker's status in introducing changes. *Long Range Plan.* 56:102269. doi: 10.1016/j.lrp.2022.102269

Kotlar, J., and Chrisman, J. J. (2019). Point: how family involvement influences organizational change. *J. Chang. Manag.* 19, 26–36. doi: 10.1080/14697017.2017.1419804

Kuusela, P., Keil, T., and Maula, M. (2017). Driven by aspirations, but in what direction? Performance shortfalls, slack resources, and resource-consuming vs. resource-freeing organizational change. *Strateg. Manag. J.* 38, 1101–1120. doi: 10.1002/smj.2544

Lawrence, P. R., and Lorsch, J. W. (1967). Differentiation and integration in complex organizations. *Adm. Sci. Q.* 12, 1–47. doi: 10.2307/2391211

Leiponen, A., and Helfat, C. E. (2010). Innovation objectives, knowledge sources, and the benefits of breadth. *Strateg. Manag. J.* 31, 224–236. doi: 10.1002/smj.807

Leonardi, P. M. (2011). Innovation blindness: culture, frames, and cross-boundary problem construction in the development of new technology concepts. *Organ. Sci.* 22, 347–369. doi: 10.1287/orsc.1100.0529

Lim, E., and Audia, P. G. (2020). Problem-solving or self-enhancing? Influences of diversification and bright spot on corporate resource allocation responses to performance shortfalls. *Strategy Sci.* 5, 348–368. doi: 10.1287/stsc.2020.0117

Lucas, G. J., Knoben, J., and Meeus, M. T. (2018). Contradictory yet coherent? Inconsistency in performance feedback and R&D investment change. *J. Manag.* 44, 658–681. doi: 10.1177/0149206315584821

Lungeanu, R., Stern, I., and Zajac, E. J. (2016). When do firms change technology-sourcing vehicles? The role of poor innovative performance and financial slack. *Strateg. Manag. J.* 37, 855–869. doi: 10.1002/smj.2371

Lv, D. D., Chen, W., Zhu, H., and Lan, H. (2019). How does inconsistent negative performance feedback affect the R&D investments of firms? A study of publicly listed firms. *J. Bus. Res.* 102, 151–162. doi: 10.1016/j.jbusres.2019.04.045

March, J. G. (1994). *Primer on decision making: How decisions happen*. New York, NY: Simon and Schuster.

March, J. G., and Shapira, Z. (1992). Variable risk preferences and the focus of attention. *Psychol. Rev.* 99:172. doi: 10.1037/0033-295X.99.1.172

March, J. G., and Simon, H. A. (1958). *Organizations*. New York: John Wiley & Sons.

Martignoni, D., Menon, A., and Siggelkow, N. (2016). Consequences of misspecified mental models: contrasting effects and the role of cognitive fit. *Strateg. Manag. J.* 37, 2545–2568. doi: 10.1002/smj.2479

Minsky, M. (1961). Steps toward artificial intelligence. *Proc. IRE* 49, 8–30. doi: 10.1109/JRPROC.1961.287775

Morrill, C., Zald, M. N., and Rao, H. (2003). Covert political conflict in organizations: challenges from below. *Annu. Rev. Sociol.* 29, 391–415. doi: 10.1146/annurev.soc.29.010202.095927

Mount, M. P., and Baer, M. (2022). CEOs' regulatory focus and risk-taking when firms perform below and above the bar. *J. Manag.* 48, 1980–2008. doi: 10.1177/01492063211016029

Nelson, R. R., and Winter, S. G. (1982). The Schumpeterian tradeoff revisited. *Am. Econ. Rev.* 72, 114–132.

Nohria, N., and Gulati, R. (1996). Is slack good or bad for innovation? *Acad. Manag. J.* 39, 1245–1264. doi: 10.2307/256998

Obloj, T., and Sengul, M. (2020). What do multiple objectives really mean for performance? Empirical evidence from the French manufacturing sector. *Strateg. Manag. J.* 41, 2518–2547. doi: 10.1002/smj.3198

Ocasio, W. (1999). Institutionalized action and corporate governance: the reliance on rules of CEO succession. *Adm. Sci. Q.* 44, 384–416. doi: 10.2307/2667000

Okhuysen, G. A., and Bechky, B. A. (2009). Coordination in organizations: an integrative perspective. *Acad. Manag. Ann.* 3, 463–502. doi: 10.5465/19416520903047533

Okhuysen, G., and Richardson, H. A. (2007). Group conflict as an emergent state: temporal issues. Conflict in organizational groups: New directions in theory and practice: 145–180.

Osiyevskyy, O., and Dewald, J. (2015). Explorative versus exploitative business model change: the cognitive antecedents of firm-level responses to disruptive innovation. *Strateg. Entrep. J.* 9, 58–78. doi: 10.1002/sej.1192

Pfeffer, J., and Salancik, G. R. (1978). *The external control of organizations: a resource dependence perspective*. Redwood City, CA: Stanford University Press.

Pitelis, C. N. (2007). A behavioral resource-based view of the firm: the synergy of Cyert and March (1963) and Penrose (1959). *Organ. Sci.* 18, 478–490. doi: 10.1287/orsc.1060.0244

Pondy, L. R. (1967). Organizational conflict: concepts and models. *Adm. Sci. Q.* 12, 296–320. doi: 10.2307/2391553

Pondy, L. R. (1992). Reflections on organizational conflict. *J. Organ. Behav.* 13, 257–261. doi: 10.1002/job.4030130305

Porac, J. F., and Thomas, H. (1990). Taxonomic mental models in competitor definition. *Acad. Manag. Rev.* 15, 224–240. doi: 10.2307/258155

Posen, H. E., Keil, T., Kim, S., and Meissner, F. D. (2018). Renewing research on problemistic search—a review and research agenda. *Acad. Manag. Ann.* 12, 208–251. doi: 10.5465/annals.2016.0018

Rhee, L., Ocasio, W., and Kim, T.-H. (2019). Performance feedback in hierarchical business groups: the cross-level effects of cognitive accessibility on R&D search behavior. *Organ. Sci.* 30, 51–69. doi: 10.1287/orsc.2018.1237

Rivkin, J. W., and Siggelkow, N. (2007). Patterned interactions in complex systems: implications for exploration. *Manag. Sci.* 53, 1068–1085. doi: 10.1287/mnsc.1060.0626

Rowley, T. I., Shipilov, A. V., and Greve, H. R. (2016). Board reform versus profits: the effect of rankings on the adoption of governance practices. *Strateg. Manag. J.* 38, 815–833. doi: 10.1002/smj.2545

Salvato, C., and Rerup, C. (2018). Routine regulation: balancing conflicting goals in organizational routines. *Adm. Sci. Q.* 63, 170–209. doi: 10.1177/0001839217707738

Saraf, N., Dasgupta, S., and Blettner, D. P. (2022). How do managerial perceptions of performance feedback affect innovation? *Strateg. Organ.* 20, 451–480. doi: 10.1177/14761270211019484

Shinkle, G. A. (2012). Organizational aspirations, reference points, and goals: building on the past and aiming for the future. *J. Manag.* 38, 415–455. doi: 10.1177/0149206311419856

Siggelkow, N. (2002). Misperceiving interactions among complements and substitutes: organizational consequences. *Manag. Sci.* 48, 900–916. doi: 10.1287/mnsc.48.7.900.2820

Simon, H. A. (1947). *Administrative behavior.* New York, NY: Macmillian.

Simon, H. A. (1964). On the concept of organizational goal. *Adm. Sci. Q.* 9, 1–22. doi: 10.2307/2391519

Stevens, R., Moray, N., Bruneel, J., and Clarysse, B. (2015). Attention allocation to multiple goals: the case of for-profit social enterprises. *Strateg. Manag. J.* 36, 1006–1016. doi: 10.1002/smj.2265

Stieglitz, N., and Heine, K. (2007). Innovations and the role of complementarities in a strategic theory of the firm. *Strateg. Manag. J.* 28, 1–15. doi: 10.1002/smj.565

Sundaram, A. K., and Inkpen, A. C. (2004). The corporate objective revisited. *Organ. Sci.* 15, 350–363. doi: 10.1287/orsc.1040.0068

Tarakci, M., Ates, N. Y., Porck, J. P., van Knippenberg, D., Groenen, P. J., and de Haas, M. (2014). Strategic consensus mapping: a new method for testing and visualizing strategic consensus within and between teams. *Strateg. Manag. J.* 35, 1053–1069. doi: 10.1002/smj.2151

Thompson, J. D. (1967). *Organizations in action*: New York: McGraw-Hill.

Titus, V. Jr., O'Brien, J. P., and Dixit, J. (2022). Does performance breed slack? Ownership as a contingency to the performance feedback and slack relationship. *J. Manag.* 48, 1270–1298. doi: 10.1177/01492063211014263

Useem, M. (1984). *The inner circle: Large corporations and the rise of business political activity in the US and UK*. Oxford, United Kingdom: Oxford University Press.

Van Kleef, G. A., and Cote, S. (2018). Emotional dynamics in conflict and negotiation: individual, dyadic, and group processes. *Annu. Rev. Organ. Psych. Organ. Behav.* 5, 437–464. doi: 10.1146/annurev-orgpsych-032117-104714

Vissa, B., Greve, H. R., and Chen, W.-R. (2010). Business group affiliation and firm search behavior in India: responsiveness and focus of attention. *Organ. Sci.* 21, 696–712. doi: 10.1287/orsc.1090.0475

Voss, G. B., Sirdeshmukh, D., and Voss, Z. G. (2008). The effects of slack resources and environmentalthreat on product exploration and exploitation. *Acad. Manag. J.* 51, 147–164. doi: 10.5465/amj.2008.30767373

Weick, K. E. (1976). Educational organizations as loosely coupled systems. *Adm. Sci. Q.* 21, 1–19. doi: 10.2307/2391875

Weingart, L. R., Behfar, K. J., Bendersky, C., Todorova, G., and Jehn, K. A. (2015). The directness and oppositional intensity of conflict expression. *Acad. Manag. Rev.* 40, 235–262. doi: 10.5465/amr.2013.0124

Westphal, J. D., and Khanna, P. (2003). Keeping directors in line: social distancing as a control mechanism in the corporate elite. *Adm. Sci. Q.* 48, 361–398. doi: 10.2307/3556678

Williamson, O. E. (1963). Managerial discretion and business behavior. *Am. Econ. Rev.* 53, 1032–1057.

Williamson, O. E. (1964). *The economics of discretionary behavior: Managerial objectives in a theory of the firm.* Hoboken, NJ: Prentice-Hall.

Ye, Y., Yu, W., and Nason, R. (2021). Performance feedback persistence: comparative effects of historical versus peer performance feedback on innovative search. *J. Manag.* 47, 1053–1081. doi: 10.1177/0149206320916225

Zald, M. N. (1962). Power balance and staff conflict in correctional institutions. *Adm. Sci. Q.* 7, 22–49. doi: 10.2307/2390632

Zald, M. N. (1970). Organizational change: The political economy of the YMCA.

Zhang, Y., and Gong, Y. (2018). Stock return or sales growth? Multiple performance feedback and strategic investments under securities analysts' earnings

Zhang, C. M., and Greve, H. R. (2019). Dominant coalitions directing acquisitions: different decision makers, different decisions. *Acad. Manag. J.* 62, 44–65. doi: 10.5465/amj.2017.0323

frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 05 July 2023
DOI 10.3389/fpsyg.2023.1166185

OPEN ACCESS

EDITED BY
Pino Audia,
Dartmouth College, United States

REVIEWED BY
Horacio Rousseau,
Florida State University, United States
Konstantinos Kostopoulos,
University of Piraeus, Greece

*CORRESPONDENCE
Daniela Blettner
✉ daniela_blettner@sfu.ca

RECEIVED 14 February 2023
ACCEPTED 12 June 2023
PUBLISHED 05 July 2023

CITATION
Blettner D, Kotiloglu S and Lechler TG (2023) Unfinished business: integrating individual decision-makers' experience and incentives to organizational performance feedback theory. *Front. Psychol.* 14:1166185. doi: 10.3389/fpsyg.2023.1166185

Unfinished business: integrating individual decision-makers' experience and incentives to organizational performance feedback theory

Daniela Blettner[1]*, Serhan Kotiloglu[2] and Thomas G. Lechler[3]

[1]Beedie School of Business, Simon Fraser University, Burnaby, BC, Canada, [2]College of Business Administration, California State University San Marcos, San Marcos, CA, United States, [3]School of Business, Stevens Institute of Technology, Hoboken, NJ, United States

In this study, we analyze the role of individual decision-makers in organizational decision-making that is described by the Carnegie perspective. In particular, building on the Behavioral Theory of the Firm, we analyze the influence of decision-makers on organizational responses to performance feedback. Managers in organizations can influence the performance feedback process through their individual experiences. Moreover, they are motivated and controlled by incentives, which is another mechanism by which organizational decision-making can be influenced by individuals. While the Carnegie perspective acknowledges that decision-makers interpret performance feedback and initiate organizational responses, individuals are not as closely integrated to the organizational performance feedback process as some other—mostly organizational—conditions. Recently, several intriguing empirical studies have addressed the role of experience and incentives in the performance feedback process. However, their *cumulative* effect remained impossible to assess. We meta-analytically review 205 BTOF studies to test our hypotheses on the influence of decision-makers' experience and incentives on organizational responses to performance feedback. We show that decision-makers' job experience and domain expertise influence organizational responses to performance below aspirations, while incentives and compensation become relevant when performance is above aspirations. These results highlight the importance of individual decision-makers in explaining variations in organizational performance feedback decisions, offering exciting venues for psychology scholars to contribute to the Carnegie perspective.

KEYWORDS

behavioral theory of the firm, Carnegie perspective, decision making, individual-level, meta-analysis, organizational-level, performance feedback

1. Introduction

The study of Cyert, March, and Simon, the founders of the Carnegie perspective, sought to understand and theorize how individuals in organizations make decisions (Simon, 1947; March and Simon, 1958; Cyert and March, 1992)[1]. One of the core theories of this perspective, The Behavioral Theory of the Firm (BTOF) (Cyert and March, 1992), explains how organizational decision-makers interpret organizational performance feedback and respond with strategic actions. The theory predicts that organizations routinely engage in problemistic search (a search for solutions) if organizational performance is below their aspirations and that they stop searching if their performance is above aspirations. This has been shown to be the case for many diverse strategic actions (e.g., change, risk-taking, and innovation), but empirical results are inconsistent (Posen et al., 2018). For performance below aspirations, many studies find support for problemistic search (Greve, 2003), but others do not find such evidence (Audia and Greve, 2006). For performance above aspirations, some studies find a decrease in responses as a result of inertia, but others demonstrate an increase in responses (Kotiloglu et al., 2021). To refine the specificity of the initial theory, researchers have started investigating how individual differences of key decision-makers in organizations, such as their levels of narcissism, overconfidence, or power, impact their interpretation of performance feedback and strategic responses (Schumacher et al., 2020; Audia and Greve, 2021). This study contributes to this research stream by focusing on the role of individual decision-makers.

Managers in organizations can influence the performance feedback process in various ways, and one important way is through their individual experiences (Blagoeva et al., 2020; Gaba et al., 2022). Experience plays a central role in both learning from feedback and decision-making, which are central themes of the Carnegie perspective (Cyert and March, 1992; March, 2008, 2010). Experience can take many forms. Performance feedback is a form of experience (Cyert and March, 1992). Learning curves is a form of experience that stems from the history of costs and efficiencies (Argote, 1999). The outcomes experienced by similar others are another form of experience (Cyert and March, 1992). Nonetheless, there is still much that we do not know about the influence of decision-makers' experience. In this study, we distinguish between job experience (i.e., knowledge gained on the job as CEO/key decision-maker through trial-and-error learning) and domain expertise (i.e., knowledge gained during their education, training, and prior functional experience). While domain expertise is based on norms and knowledge generated by society, an individual's job experience is more open to their cognitive biases as it is dependent on personal experiences. We argue that decision-maker job experience and decision-maker domain expertise differ in their effect on how decision-makers interpret feedback information and the range of strategic actions that they consider.

In the process of making decisions about strategic actions in response to performance feedback, decision-makers are motivated and controlled by incentives. While the impact of incentives on the individual decision-maker is conceptualized by the BTOF, it has only recently found its way into the empirical literature (Harris and Bromiley, 2007; Lim and McCann, 2014). In our study, we differentiate performance-based incentives (such as options and bonuses) from compensation (such as salary). Performance-based incentives address the agency problem and are designed to motivate decision-makers to increase risk-taking on behalf of the organization (Wiseman and Gomez-Mejia, 1998). We argue that performance-based incentives and compensation motivate risk-taking and strategic action, proposing stronger responses for performance-based incentives, but that performance-based incentives and compensation inhibit risk-taking above aspirations.

Recently, a sufficient number of studies that include experience and incentives in performance feedback have been published, enabling us to use meta-analytic methods to test their influences on organizational responses to performance feedback. Meta-analytic methods allow us to assess the overall cumulative effect of these individual-level factors on organizational responses, which is not possible with other research designs that are constrained with specific individual-level variables and organizational responses studied. In this study, we draw on cumulative empirical evidence from 205 BTOF studies to systematically analyze the effect of the individual decision-maker on organizational responses (Aguinis et al., 2011). In our analyses, we include studies that analyzed many diverse strategic actions, including organizational search, risk-taking, strategic change, and R&D intensity.

Our study calls attention to empirical patterns that can be drawn from accumulated evidence of four decision-maker centric variables that are highly relevant to organizations.

2. Theoretical context

2.1. Organizational responses to performance feedback in the BTOF

Understanding how decision-makers in firms respond to performance feedback is one of the core concerns of the Carnegie perspective (Gavetti et al., 2007). To explain the process, the BTOF draws on the concept of bounded rationality. Building on this premise, performance feedback research within the BTOF proposes that firms respond differently to performance below and above aspirations (Greve, 2003). Empirical evidence generally supports that firms engage in problemistic search for solutions to their performance shortfalls, resulting in increased responses (Greve, 2003), but some empirical studies report reduced search (Audia and Greve, 2006). Audia and Greve (2021) suggest two accounts for variations in responsiveness to low performance: either organizations switch their attention from the aspiration level to the survival point; or they assess low performance in a self-enhancing way (Audia and Brion, 2007; Jordan and Audia, 2012). Such a self-serving interpretation of feedback reduces the need to act in response to performance feedback below aspirations (Audia and Brion, 2007; Jordan and Audia, 2012).

1 There are two editions of Cyert and March's book "A Behavioral Theory of the Firm", namely the original edition from 1963 and a new edition from 1992. While the two editions are very similar, we are using the 1992 version in our study for consistency.

For responses above aspirations, the BTOF predicts that organizations do not search or engage in strategic actions, relying instead on the exploitation of their competencies (Levinthal and March, 1993). A firm's aspiration level is a highly salient marker differentiating success from failure. When the risk of falling below the aspiration level is higher than the perceived gain from performance above the aspiration level, firms tend to become inert or complacent. In line with this argumentation, many empirical studies demonstrate that firms decrease their responses if they reach or exceed their aspiration level: for instance, organizations are less likely to change (Greve, 1998) or launch fewer products (Greve, 2003). Audia and Greve (2006) also found that firms are relatively insensitive to performance above the aspiration level and attribute this to inertia (particularly with large firms). However, empirical results are also controversial (e.g., Shinkle, 2012): Firms may also increase risk-taking (e.g., Singh, 1986), innovation (e.g., Nohria and Gulati, 1996; Chen and Miller, 2007), and change (e.g., Kraatz and Zajac, 2001) responses.

Overall, the empirical discourse on organizational responses to performance above aspirations is convoluted: organizations may increase or decrease responses to performance above aspirations depending on several contingencies (Blettner et al., 2019). Some researchers have addressed these variations in responses to performance above aspirations from an organizational perspective and had identified firm size and slack (Singh, 1986; Greve, 2003) as well as variations in past performance (Ref and Shapira, 2017) as possible contingencies that influence responses to performance above aspirations. However, while the Carnegie perspective acknowledges that such decisions are initiated by the key decision-makers in organizations (Cyert and March, 1992), the role of individuals in organizational decision-making processes is not fully integrated in the theory. Like other researchers, who have recently begun to address this lack of integration, we are interested in analyzing the role of individuals in this process.

2.2. Prospect theory from the Carnegie perspective

Boundedly rational behavior is assumed in the Carnegie perspective when theorizing that decision-makers become loss averse when they perform below aspirations (Gavetti et al., 2007). This theorizing is in line with prospect theory which predicts loss aversion for performance below aspirations and risk aversion for performance above aspirations, with the value function being concave for gains and convex for losses and about twice as steep for losses as for gains (Kahneman and Tversky, 1979; Greve, 2003; Kahneman, 2011). In both theories, comparisons with a reference point influence behavior. It is important to note the Carnegie perspective allows for variation in responsiveness while prospect theory assumes a choice between two invariant alternatives. Kahneman (2011) summarizes this research by saying that the "great majority of people" are risk averse and "most people" are loss averse (Kahneman, 2011: 280). Kahneman and Tversky (1979)'s original experiments on prospect theory show that between 58% and 92% of subjects are prone to prospect theory. Gächter et al. (2022) show that "71% of people displayed loss aversion in risky choice." Nearly 79% show this decision behavior repeatedly, from one decision to the next (Glockner and Pachur, 2012). Accordingly, we can assume that prospect theory is widespread decision-making behavior. However, decision behavior is likely also influenced by individual differences. Such differences can be demographic, for instance, the decision-maker's age, gender, education, disposition, affect, mood, or information processing (Trepel et al., 2005; Pachur et al., 2008, 2017; Hönl et al., 2017; Gächter et al., 2022). One of the differences between the Carnegie perspective and prospect theory is that the Carnegie perspective is an organizational-level theory that considers experience and incentives of the individuals within the organization while prospect theory is a theory of individual choice.

Risk-taking plays a role in decisions in response to organizational feedback. Scholars have proposed and found evidence that individual differences among decision-makers—such as their self-efficacy (Audia et al., 2000), power (Blagoeva et al., 2020; Audia and Greve, 2021), narcissism (Chatterjee and Hambrick, 2011; Jordan and Audia, 2012; Steinberg et al., 2022), regulatory focus (Ahn et al., 2020), and overconfidence (Schumacher et al., 2020)—influence how they interpret organizational performance feedback and how much risk they take in response to this feedback. Individual personal factors (such as overconfidence, hubris, and narcissism) can motivate decision-makers to self-enhance; this means they increase the positivity of their self-views to protect themselves from negative feedback—which leads to less risk-taking and responsiveness to performance feedback (Sedikides and Strube, 1997; Audia and Brion, 2007; Jordan and Audia, 2012). Decision-makers' experience also influences the processing of feedback information (Blagoeva et al., 2020; Gaba et al., 2022). Blagoeva et al. (2020) suggested that experience reduces the need to self-enhance. However, their empirical evidence does not support this reasoning.

Decision-makers' motivation to respond to performance feedback is also likely affected by external conditions such as the incentives intended to reward effort, risk-taking, and attained performance. In experiments, Etchart-Vincent and l'Haridon (2010) tested three monetary incentive schemes and found differences among the incentive schemes for the gain domain but not for the loss domain. Gächter et al. (2022) showed that loss aversion increases with income and wealth. In the organizational context, incentives can also influence the weighing of risk and thus affect responses to performance feedback (Harris and Bromiley, 2007; Lim and McCann, 2014).

3. Hypothesis development

A central theme in the Carnegie perspective is experience (Levitt and March, 1988; Cyert and March, 1992). March (2008: 90) proposes that decision-makers gain in two important ways from experience: they gain knowledge about the world and confidence in their experiential knowledge. The argumentation in recent empirical BTOF studies on the role of experience with respect to responses to performance feedback has centered on the (over)confidence decision-makers gain from experience. Gaba et al. (2022) have shown that prior career experience impedes decision-makers' ability to recognize and respond to performance feedback below aspirations. They attribute this process to overconfidence,

i.e., an overestimation of knowledge that decision-makers gain from experience. In contrast, Blagoeva et al. (2020) hypothesized that, when performance falls below aspirations, decision-makers become more confident and more responsive to performance feedback. However, their results showed the opposite: Experience was associated with reduced responses.

3.1. Decision-makers' job experience and domain expertise

In this study, we differentiate between decision-maker job experience and decision-maker domain expertise because they differ in their effect on the interpretation of performance feedback. We see differences in the (over)confidence mechanism, arguing that job experience is associated with overconfidence, while domain expertise is related to confidence. Importantly, we also see differences between job experience and domain expertise in terms of what knowledge about the world decision-makers gain, arguing that job experience is narrow and highly sensitive to biases while domain expertise allows for broader and less biased knowledge. For job experience and domain expertise, we develop hypotheses only for performance below aspirations. While we do not have theoretical predictions on the influences of job experience and domain expertise for performance above aspirations, we explore these relationships empirically and report the results.

3.1.1. Decision-makers' job experience

As decision-makers (e.g., CEOs) constantly face novel and uncertain situations, they need to rely on trial-and-error or experiential learning. In this situation, "learners are dealing with small samples of poorly designed experiments" (March, 2008, p. 89). When learning experientially from small samples, decision-makers are prone to biases, for example, sampling bias since they tend to extrapolate from a very small sample of experiences during their tenure as CEO and under-sample rare events (March, 1991; Fox and Hadar, 2006). They also suffer from status quo bias due to their strong belief in the current strategy (Finkelstein and Hambrick, 1990; Wangrow et al., 2019). Over time, decision-makers tend to become myopic, focusing on successful actions and sampling these again (Levinthal and March, 1993). As their information processing is restricted by limited possibilities (Miller, 1991), decision-makers develop a particular repertoire of responses (Finkelstein and Hambrick, 1990). The rules that decision-makers derive through learning from experience are embedded in the context from which they originate. This makes them less sensitive to situation-specific factors (Ert, 2012). Their information processing is biased, further leading to biased analyses of the situation they are facing. In short, experiential learning limits the quality (e.g., reliability and validity) of the knowledge gained.

The more experienced decision-makers are in their job, and the more they become identified and enmeshed with previous decisions, the more they are subject to attribution bias (Alicke and Sedikides, 2009), especially when confronting low performance (Gaba et al., 2022). For this reason, we expect that decision-makers become less responsive to performance below aspirations as their job experience increases. Having a deeper pool of experiences means having a variety of successful experiences in the past (Gaba et al., 2022), which decreases the urgency of reacting to a recent performance shortfall and facilitates inaction.

Most decision-makers are not fully aware of the extent to which the knowledge base they acquired through experiential learning is biased and thus overestimate the amount and quality of knowledge that they gained, despite the biases that undermine it. Because their faith in their knowledge base and prior actions is high, they become overconfident and less responsive to performance feedback. Thus, we expect a weaker increase in responses to performance below aspirations when job experience is considered. We propose the following hypothesis:

> ***Hypothesis 1:*** *Studies that include decision-makers' job experience show a weaker increase in responses to performance below aspirations than those that do not include job experience.*

3.1.2. Decision-makers' domain expertise

Decision-makers also have domain expertise, consisting of the knowledge and skills that they acquired in a particular knowledge domain, either accumulated through functional expertise or educational expertise. This knowledge is built on a specific discipline, and it is based on the norms of the profession or educational background. The rules that constitute this knowledge body are dissociated from the context in which they were created (March, 2008). Therefore, this body of knowledge is more generalizable, and it provides a more comprehensive understanding of situations, strategic options in response to feedback, and their potential consequences. This enables decision-makers to gain a more comprehensive understanding, generating multiple strategic options in response to feedback. Domain expertise gives them access to a wider range of beliefs. Their knowledge is broader, and this is reflected in a broader set of options for strategic responses to performance feedback.

As they gain more competence through accumulating domain expertise, they become increasingly confident in their abilities. As opposed to on-the-job experiential learning, domain expertise is accumulated in more diverse, educational, or professional situations. As such, it is more generalizable and less biased. Decision-makers can more accurately assess their domain expertise, and greater domain expertise leads to confidence and a readiness to act in response to feedback. They may also be less threatened by performance below aspirations because of their domain expertise, and they also ensure they have a wide range of alternative employment options. Their increased confidence and greater alternative options allow decision-makers with greater domain expertise to act more readily on performance than those with less domain expertise. As a result, we expect a stronger increase in responses to performance below aspirations when domain expertise is considered and propose the following hypothesis:

> ***Hypothesis 2:*** *Studies that include decision-makers' domain expertise show a stronger increase in responses to*

performance below aspirations than those that do not include domain expertise.

3.2. Incentives as motivations for decision-makers

In their theorizing on organizational decision-making, Carnegie scholars have identified incentives as an important means to influence decision-making and align the interest of the individual decision-maker with the interest of the organization (March and Simon, 1958; Cyert and March, 1992). While initially March and Simon (1958) discuss how incentives can motivate employees, they later focus their discussion of incentives on key decision-makers, arguing that incentives are key to managers' learning since they motivate them to accept information and change their behavior (Cyert and March, 1992).

Detailed discussions about the effects of rewards on the responses of individuals to feedback can be found in the psychology literature (Kluger and DeNisi, 1996). Here, incentives or rewards are understood as motivating core behavioral principles for human responses to feedback. In this literature, the research on executive compensation (Gomez-Mejia and Wiseman, 1997; Devers et al., 2016) represents the most relevant literature to our argument because it specifically addresses how organizational decision-makers respond to rewards or incentives.

One stream within the larger literature on executive compensation presents a behavioral, bounded rationality perspective on executive compensation, the Behavioral Agency Model (BAM) (Wiseman and Gomez-Mejia, 1998). BAM takes the decision-makers' personal wealth and corresponding aspirations as reference points and therefore is very close to March's original models (March and Shapira, 1992). BAM centers on risk bearing (i.e., the extent to which executives are likely to perceive risk to their personal wealth) and predicts that executives will react conservatively to organizational performance above aspirations because they expect a gain in wealth (Wiseman and Gomez-Mejia, 1998) and any additional risk-taking on behalf of the organization might jeopardize this personal gain. When firm performance is below aspirations, decision-makers anticipate loss to personal wealth and, due to loss aversion, are willing to engage in greater organizational risk-taking. Therefore, the predictions of BAM match those of the Carnegie perspective (March and Shapira, 1992). However, the mechanism outlined by Wiseman and Gomez-Mejia is tied to anticipated personal rather than organizational gain or loss, as in the Carnegie perspective. This is in line with prospect theory, which assumes loss aversion of the individual. Accordingly, in the BAM model, the motivation for behavior originates in individual rather than organizational concerns. Integrating the insights from BAM into the theoretical framework of the Carnegie perspective allows us to explain how differences among key decision-makers' incentives impact organizational responses to performance feedback.

In this study, we differentiate decision-makers' performance-based incentives (e.g., bonus and options) from their compensation (e.g., salary). While we argue that both incentives and compensation affect responses to performance feedback, we propose that the influence of performance-based incentives is stronger than the influence of compensation.

3.2.1. Performance-based incentives

Performance-based incentives change frequently, often yearly, and decision-makers thus tend to be sensitive to organizational performance. When their firms perform below aspirations, decision-makers who receive greater performance-based incentives have more of their personal wealth at risk than those receiving fewer: They face a greater cost of failure. For instance, if they hold stock options, they face greater risk of losing those options. Since individuals who receive greater incentives anticipate greater losses, they become more loss averse and are willing to take more risks to avoid the anticipated loss (Wiseman and Gomez-Mejia, 1998). As such, we expect a stronger increase in responses to performance below aspirations when performance-based incentives are considered and propose the following hypothesis:

Hypothesis 3a: *Studies that include decision-makers' performance-based incentives show a stronger increase in responses to performance below aspirations than those that do not include performance-based incentives.*

Our prediction for responses to performance above aspirations is different. Here, those individuals who receive high incentives experience greater risk, potentially losing more. Therefore, these individuals will become risk averse. Our reasoning builds on Lim and McCann (2014), who showed that CEOs with higher variable pay, in the form of stock options, tend to be loss averse and are conservative when organizational feedback exceeds aspirations. Therefore, we expect a weaker increase in responses to performance above aspirations, as well as a weaker decrease in responses to performance above aspirations when performance-based incentives are considered. Thus, we propose the following hypotheses:

Hypothesis 3b: *Studies that include decision-makers' performance-based incentives show a weaker increase in responses to performance above aspirations than those that do not include performance-based incentives.*

Hypothesis 3c: *Studies that include decision-makers' performance-based incentives show a weaker decrease in responses to performance above aspirations than those that do not include performance-based incentives.*

3.2.2. Compensation

Decision-makers receive compensation, for instance, their salaries, regularly. Compensation differs from performance-based incentives because it is long-term and more stable. Decision-makers rely on their salary for recurring expenses and consider it an endowment (Larraza-Kintana et al., 2007). The higher their compensation is, the more loss averse decision-makers become with regard to this endowment. In an attempt to protect future compensation, decision-makers take fewer strategic risks and reduce their responses to performance feedback (Wiseman and Gomez-Mejia, 1998). As such, we expect a stronger increase in

responses to performance below aspirations when compensation is considered and propose the following hypothesis:

Hypothesis 4a: *Studies that include decision-makers' compensation show a stronger increase in responses to performance below aspirations than those that do not include compensation.*

When considering their future risk-taking in response to feedback above aspirations, decision-makers experience instant endowment of their anticipated compensation and tend to become loss averse (Wiseman and Gomez-Mejia, 1998). To protect the anticipated compensation, which in their mental accounting already belongs to them, they will be inclined to take risks to stay above aspirations. Therefore, we expect that decision-makers with higher compensation are less prone to complacency when their firms perform above aspirations than those who receive lower compensation. However, highly reliable compensation does not motivate excessive risk-taking above aspirations. Thus, we expect a weaker increase in responses to performance above aspirations, as well as a weaker decrease in responses to performance above aspirations when compensation is considered. Accordingly, the hypotheses are as follows:

Hypothesis 4b: *Studies that include decision-makers' compensation show a weaker increase in responses to performance above aspirations than those that do not include compensation.*

Hypothesis 4c: *Studies that include decision-makers' compensation show a weaker decrease in responses to performance above aspirations than those that do not include compensation.*

4. Methods

To test our hypotheses, we followed recent meta-analyses in the organizational performance feedback and strategic management literature (Crook et al., 2008; Vanneste et al., 2014; Bilgili et al., 2016; D'Oria et al., 2021; Kotiloglu et al., 2021, 2023; Blettner et al., 2023) to compare the effects of performance feedback models that included and excluded decision-makers' job experience, domain expertise, performance-based incentives, and compensation in their analyses.

4.1. Sample

To identify and select appropriate studies for inclusion in our analysis, we searched for studies that analyze the effects of organizational performance feedback. Our sample selection criteria and process are summarized in Table 1. Our final sampling resulted in 205 empirical studies with 516 effect sizes and a total of 3,386,451 firm-year observations. Following Aguinis et al. (2018) and Combs et al. (2018), we report sample size, sample characteristics (i.e., time and location of data collection), and coding information for each study[2].

2 Bibliographic details for all studies can be found in Appendix.

4.2. Coding

We hypothesized that the consideration of decision-makers' experience, domain expertise, compensation, and incentives influence the overall explanatory power of the performance feedback model. To test our hypotheses, we analyzed various studies in our sample based on performance feedback and decision-maker-level variables.

Regarding performance feedback mechanisms, we coded studies based on whether they analyzed the impact of performance below or above aspirations. For studies that analyzed responses to performance above aspirations, we also considered whether they show an increase in responses or a decrease in responses to performance above aspirations. This was determined by the correlation coefficient reported in each study: A positive coefficient for performance above aspirations indicates an increase in responses to performance above aspirations, and a negative coefficient for performance above aspirations indicates a decrease in responses to performance above aspirations.

Based on our hypotheses, we coded each research study based on the decision-maker-level variables that were analyzed, including job experience, domain expertise, incentives, and compensation. Table 2 provides an overview of our coding approach, including coding labels, examples of variables, and selected studies.

To code job experience, we followed Gaba et al. (2022), considering a study as analyzing experience if it incorporated CEO career experience or tenure in its analyses. Similarly, for domain expertise, we followed Gaba et al. (2022) and coded a study as analyzing domain expertise if it examined CEO specialization or education. For incentives, we followed Harris and Bromiley (2007) and Lim (2017), coding a study as analyzing incentives if it incorporated CEO ownership, stock options, or bonus in its analyses. To indicate the presence or absence of these variables in each study, we used binary variables. In terms of compensation, we followed Lim and McCann (2014) and coded a study as analyzing compensation if it included CEO salary or pay in its analyses.

4.3. Analyses

To assess the overall effect sizes of performance below and above aspirations, we employed the bivariate meta-analytic procedure (Hunter and Schmidt, 1990) since this procedure is the most accurate and widely used method in management studies (Crook et al., 2008; Bergh et al., 2016). Using this procedure, we first calculated the sample size weighted average effect sizes from the Pearson correlation coefficients. This calculation was done using the following formula:

$$\mathbf{r}=\frac{\sum_{\mathbf{i}} \mathbf{n_i r_i}}{\sum_{\mathbf{i}} \mathbf{n_i}} \quad (1)$$

where r is the average effect size, n_i is the sample size, and r_i is the Pearson correlation coefficient for each study i. We used correlation coefficients to estimate effect sizes since they allow easy interpretation and limit downward bias (Geyskens et al., 2008; Aguinis et al., 2011). In general, we used all reported correlations from all studies in our sample to assess the overall effect sizes.

TABLE 1 Sample selection and criteria.

Step	Procedure	Number of studies	Notes
1: Initial literature search	Using the following keywords for our searches of all journals included in the ABI/INFORMS and Web of Science databases: "aspiration level", "attainment discrepancy", behavioral theory of the firm", "organizational change", "organizational decision-making", "organizational search", "performance feedback", "problemistic search", "risk-taking", "slack search", and combinations of these terms.	263 new studies, added	- The resulting studies were published between 1987 and 2021. While we did not expect to find any studies on organizational performance feedback theory before the publication of A Behavioral Theory of the Firm (Cyert and March, 1963), the start for our analysis, 1987, emerged from our search. - All the studies in our sample reported at least one effect size for performance feedback and organizational responses.
2: Backward search	Through the references of the identified studies	Seven new studies, added	
3: Identify unpublished studies	Solicited our request for unpublished studies through Academy of Management (AoM) lusters. We published our request for unpublished studies in several divisions of AoM, including Strategic Management, Organization and Management Theory, and Technology and Innovation Management. We also searched for unpublished studies in EBSCO, SSRN, and Google Scholar databases.	10 new studies, added	- This step addresses the "file drawer problem" (Rosenthal, 1995).
4: Identify if studies included the required statistical information for meta-analysis	Removed studies that did not report all the required information (e.g., sample size and correlations).	72 studies, removed	
5: Avoid double counting	Avoided double counting studies that referred to the same sample. For duplicated studies, we included only the most recently published ones in the final sample.	Three studies, removed	

Sample size: 205 empirical studies.

TABLE 2 Explanation of coding.

Coding label	Examples of variables used	Sample papers
Experience	CEO tenure, CEO experience	Arora and Dharwadkar, 2011; Kavadis and Castañer, 2015; Gomez-Mejia et al., 2018; Say and Vasudeva, 2020; Schumacher et al., 2020
Expertise	CEO specialization, CEO education	Baum et al., 2005; Wennberg and Holmquist, 2008; Mount and Baer, 2021; Wang and Zhang, 2021; Gaba et al., 2022
Incentives	CEO ownership, CEO stock options, CEO bonus	Harris and Bromiley, 2007; Shimizu, 2007; Alessandri, 2008; Arrfelt et al., 2012; Lim, 2018; He et al., 2021; Shi et al., 2022
Compensation	CEO salary, CEO compensation	Alessandri and Pattit, 2014; Lim, 2015, 2017; Ahn et al., 2020; Kolev and McNamara, 2020

To test our hypotheses, we employed subgroup analyses, which is a suitable meta-analytic approach for categorical variables (Geyskens et al., 2008; Aguinis et al., 2011) [3]. In these analyses, we created subgroups of studies based on two factors: the type of performance feedback mechanism (responses to performance below aspirations, increases in responses to performance above aspirations, and decreases in responses to performance above aspirations) and whether the studies included or excluded decision-makers' variables (experience, domain expertise, compensation, and incentives) in their analyses. We compared the effect sizes of these subgroups to determine whether the specific variable being studied had an impact on the analyzed relationship. We calculated the mean effect sizes for each subgroup and conducted Z-tests to assess differences across the groups (Schmidt and Hunter, 2014).

5. Results

5.1. Main results

Table 3 provides an overview of the overall findings regarding the relationships between performance feedback and organizational responses. Our analysis reveals that as performance decreases further below aspirations, organizational responses increase ($r = -0.076$, $p = 0.000$). Furthermore, our results indicate that the relationship between performance above aspirations and organizational response is not significant ($p = 0.237$). These results are in line with the prior meta-analyses on organizational performance feedback (Verver et al., 2019; Kotiloglu et al., 2021; Blettner et al., 2023).

Our theorizing differentiates between increases and decreases in responses to performance above aspirations. Accordingly, we reported the results for increases and decreases in responses to

3 In addition to subgroup analyses, meta-regression analysis is another approach that allows testing for the interaction effects of the variables in question. However, subgroup analyses are more appropriate to test for the interaction effect of binary and categorical variables, while meta-regression analyses are more appropriate for continuous variables (Aguinis et al., 2011). Therefore, we opted for subgroup analyses to test our hypotheses.

TABLE 3 Meta-analysis results, baseline effects.

Model	k	r	p	SE	CI 95%	Cr. I. 95%
All responses to performance below aspirations	261	−0.076	0.000	0.006	−0.089; −0.067	−0.264; 0.111
All responses to performance above aspirations	225	0.011	0.237	0.009	−0.007; 0.029	−0.256; 0.278
Increase in responses to performance above aspirations	121	0.087	0.000	0.012	0.063; 0.111	−0.175; 0.349
Decrease in responses to performance above aspirations	104	−0.077	0.000	0.007	−0.091; −0.063	−0.206; 0.052

Number of data points (k), sample size weighted mean effect size (r), the standard deviation of sample size weighted correlation (SE), 95% confidence interval around the mean sample size weighted correlation (CI 95%), 95% credibility interval around the mean sample size weighted correlation (Cr. I. 95%), and Z-statistic (Z) for the critical ratio that indicates whether the subgroups are significantly different (significance of Z-test is determined using two-tailed tests).

performance above aspirations separately. Effect sizes of increases ($r = 0.087$, $p = 0.000$) and decreases ($r = -0.077$, $p = 0.000$) in responses to performance above aspirations are statistically significant and practically meaningful.

Table 4 presents the results of the subgroup analyses on the effects of the decision-maker job experience. The results suggest that decision-maker job experience is associated with a weaker increase in responses to performance below aspirations; the effect size of performance below aspirations for studies that included the job experience variables ($r = -0.059$, $p = 0.003$) is smaller than the effect size of performance below aspirations for studies that excluded the job experience variables ($r = -0.110$, $p = 0.000$), and the difference is statistically significant ($\Delta r = 0.051$, $Z = 2.319$, $p = 0.020$). This result supports Hypothesis 1, which suggested that studies that include decision-makers' job experience show a weaker effect for responses to performance below aspirations than those that do not include experience.

Although we did not develop hypotheses on the influence of decision-maker job experience on the responses to performance above aspirations, our results indicate that decision-maker experience does not influence increases and decreases in responses to performance above aspirations. Specifically, the differences in the overall effects of studies that included or excluded experience variables are not statistically significant for increasing ($p = 0.641$) or decreasing ($p = 0.984$) responses to performance above aspirations.

Table 5 presents the results of the subgroup analyses on the effects of the decision-maker domain expertise. The results suggest that domain expertise strengthens the increase in responses to performance below aspirations; the overall effect of studies that included the domain expertise variables ($r = -0.166$, $p = 0.000$) is greater than the effect size of studies that excluded these variables ($r = -0.078$, $p = 0.000$). This difference is statistically significant ($\Delta r = 0.088$, $Z = -4.272$, $p = 0.000$), supporting Hypothesis 2, which posited that studies that include decision-makers' domain expertise show a stronger increase in responses to performance below aspirations than those that do not include domain expertise.

Although we did not develop hypotheses on the influence of decision-makers' domain expertise on the responses to performance above aspirations, our results indicate that decision-makers' domain expertise does not have an impact on the increases and decreases in responses to performance above aspirations. The difference in the overall effects of studies that included or excluded experience variables is not statistically significant for increasing responses to performance above aspirations ($p = 0.082$). Moreover, we did not find enough empirical studies that reported decreases in responses to performance above aspirations and included the domain expertise variables ($n = 2$). As a result, we are unable to test the influence of decision-makers' domain expertise for decreases in responses to performance above aspirations.

Table 6 presents the results of the subgroup analyses on the effects of the decision-makers' performance-based incentives. These results indicate that decision-maker incentives do not have an impact on the increase in responses to performance below aspirations. The difference in the overall effects of studies that included or excluded inventive variables is not statistically significant for performance below aspirations ($p = 0.395$). Therefore, Hypothesis 3a, which proposed that studies that include decision-makers' performance-based incentives show a stronger increase in responses to performance below aspirations than those that do not include performance-based incentives, is not supported.

Our findings also reveal that decision-makers' performance-based compensation weakens both increasing and decreasing responses to performance above aspirations. For increasing responses to performance above aspirations, the effect is smaller in studies that included the incentive variables ($r = 0.028$, $p = 0.020$), compared to studies that excluded them ($r = 0.122$, $p = 0.001$). The difference between these two effects is statistically significant ($\Delta r = 0.098$, $Z = -2.431$, $p = 0.015$). Similarly, for decreasing responses to performance above aspirations, the effect is smaller in studies that included the incentive variables ($r = -0.049$, $p = 0.000$), compared to studies that excluded them ($r = -0.102$, $p = 0.000$). The difference between these two effects is statistically significant ($\Delta r = 0.053$, $Z = 3.648$, $p = 0.000$). These findings provide support for Hypothesis 3b, which posited that studies that include decision–makers' performance–based incentives show a weaker increase in responses to performance above aspirations than those that do not include performance-based incentives, and Hypothesis 3c, which suggested that studies that include decision-makers' performance-based incentives show a weaker decrease in

TABLE 4 Meta-analysis results with experience variables (CEO tenure, experience).

Criteria	Model	k	r	p	SE	CI 95%	Cr. I. 95%	Z	p_Z
All responses to performance below aspirations	Models with experience variables	41	−0.059	0.003	0.020	−0.098; −0.020	−0.307; 0.189		
	Models without experience variables	51	−0.110	0.000	0.009	−0.127; −0.092	−0.218; −0.001	2.319	0.020
Increase in responses to performance above aspirations	Models with experience variables	17	0.088	0.063	0.047	−0.005; 0.181	−0.303; 0.479		
	Models without experience variables	24	0.117	0.003	0.039	0.039; 0.194	−0.260; 0.494	−0.466	0.641
Decrease in responses to performance above aspirations	Models with experience variables	18	−0.091	0.000	0.015	−0.120; −0.062	−0.203; 0.021		
	Models without experience variables	20	−0.091	0.000	0.012	−0.115; −0.067	−0.190; 0.009	−0.020	0.984

Number of data points (k), sample size weighted mean effect size (r), the standard deviation of sample size weighted correlation (SE), 95% confidence interval around the mean sample size weighted correlation (CI 95%), 95% credibility interval around the mean sample size weighted correlation (Cr. I. 95%), and Z-statistic (Z) for the critical ratio that indicates whether the subgroups are significantly different (significance of Z-test is determined using two-tailed tests).

TABLE 5 Meta-analysis results with domain expertise variables (CEO specialization, education).

Criteria	Model	k	r	p	SE	CI 95%	Cr. I. 95%	Z	p_Z
All responses to performance below aspirations	Models with domain expertise variables	9	−0.166	0.000	0.017	−0.200; −0.132	−0.266; −0.067		
	Models without domain expertise variables	83	−0.078	0.000	0.011	−0.100; −0.056	−0.267; 0.111	−4.272	0.000
Increase in responses to performance above aspirations	Models with domain expertise variables	4	0.051	0.000	0.014	0.024; 0.078	0.007; 0.095		
	Models without domain expertise variables	35	0.116	0.001	0.035	0.048; 0.185	−0.287; 0.518	−1.726	0.084
Decrease in responses to performance above aspirations	Models with domain expertise variables	2	–	–	–	–	–		
	Models without domain expertise variables	38	−0.082	0.000	0.009	−0.100; −0.065	−0.180; 0.015	–	–

Number of data points (k), sample size weighted mean effect size (r), the standard deviation of sample size weighted correlation (SE), 95% confidence interval around the mean sample size weighted correlation (CI 95%), 95% credibility interval around the mean sample size weighted correlation (Cr. I. 95%), and Z-statistic (Z) for the critical ratio that indicates whether the subgroups are significantly different (significance of Z-test is determined using two-tailed tests).

responses to performance above aspirations than those that do not include performance-based incentives.

Table 7 presents the results of the subgroup analyses on the effects of the decision-makers' compensation. The findings suggest that decision-makers' compensation does not influence the increase in responses to performance below aspirations. Specifically, the difference in the overall effects of studies that included or excluded compensation variables is not statistically significant for performance below aspirations ($p = 0.786$). Therefore, Hypothesis 4a, which proposed that studies that include decision-makers' compensation show a stronger increase in responses to performance below aspirations than those that do not include compensation, is not supported.

Furthermore, we found that decision-makers' compensation attenuates increases in responses to performance above aspirations. The effect of performance above aspirations on increases in responses is smaller in studies that included compensation variables ($r = 0.043$, $p = 0.000$), compared to studies that excluded them ($r = 0.118$, $p = 0.001$). The difference between these two effects is statistically significant ($\Delta r = 0.075$, $Z = -2.050$, $p = 0.040$). These findings support Hypothesis 4b, which suggested that studies that include decision-makers' compensation show a weaker increase in responses to performance above aspirations than those that do not include compensation. However, for decreasing responses to performance above aspirations, the difference between the effects of studies that included and excluded decision-makers' compensation variables is not statistically significant ($p = 0.689$). Therefore, Hypothesis 4c, which suggested that studies that include decision-makers' compensation show a weaker decrease in responses to performance above aspirations than those that do not include compensation, is not supported. Table 8 presents a summary of our hypotheses and findings.

TABLE 6 Meta-analysis results with performance-based incentive variables (CEO ownership, options, bonus).

Criteria	Model	k	r	p	SE	CI 95%	Cr. I. 95%	Z	p_z
All responses to performance below aspirations	Models with performance-based incentive variables	16	−0.072	0.000	0.019	−0.108; −0.035	−0.214; 0.071		
	Models without performance-based incentive variables	76	−0.091	0.000	0.012	−0.114; −0.067	−0.289; 0.107	0.850	0.395
Increase in responses to performance above aspirations	Models with performance-based incentive variables	8	0.028	0.020	0.012	0.004; 0.052	−0.027; 0.083		
	Models without performance-based incentive variables	33	0.122	0.001	0.037	0.050; 0.194	−0.290; 0.534	−2.431	0.015
Decrease in responses to performance above aspirations	Models with performance-based incentive variables	7	−0.049	0.000	0.010	−0.068; −0.029	−0.095; −0.003		
	Models without performance-based incentive variables	31	−0.102	0.000	0.011	−0.123; −0.081	−0.205; 0.001	3.648	0.000

Number of data points (k), sample size weighted mean effect size (r), the standard deviation of sample size weighted correlation (SE), 95% confidence interval around the mean sample size weighted correlation (CI 95%), 95% credibility interval around the mean sample size weighted correlation (Cr. I. 95%), and Z-statistic (Z) for the critical ratio that indicates whether the subgroups are significantly different (significance of Z-test is determined using two-tailed tests).

TABLE 7 Meta-analysis results with compensation variables (CEO salary, compensation).

Criteria	Model	k	r	p	SE	CI 95%	Cr. I. 95%	Z	p_z
All responses to performance below aspirations	Models with compensation variables	15	−0.093	0.000	0.021	−0.134; −0.051	−0.251; 0.066		
	Models without compensation variables	77	−0.086	0.000	0.012	−0.110; −0.063	−0.282; 0.110	−0.272	0.786
Increase in responses to performance above aspirations	Models with compensation variables	7	0.043	0.000	0.010	0.025; 0.061	0.008; 0.078		
	Models without compensation variables	34	0.118	0.001	0.036	0.048; 0.188	−0.290; 0.526	−2.050	0.040
Decrease in responses to performance above aspirations	Models with compensation variables	8	−0.085	0.000	0.016	−0.116; −0.055	−0.160; −0.010		
	Models without compensation variables	30	−0.093	0.000	0.011	−0.115; −0.071	−0.204; 0.018	0.400	0.689

Number of data points (k), sample size weighted mean effect size (r), the standard deviation of sample size weighted correlation (SE), 95% confidence interval around the mean sample size weighted correlation (CI 95%), 95% credibility interval around the mean sample size weighted correlation (Cr. I. 95%), and Z-statistic (Z) for the critical ratio that indicates whether the subgroups are significantly different (significance of Z-test is determined using two-tailed tests).

5.2. Additional analyses

In addition to the variables hypothesized in our study, recent research by Blagoeva et al. (2020) and Gaba et al. (2022) has highlighted the significant role of decision-makers' overconfidence in shaping organizational responses to performance feedback. Specifically, Gaba et al. (2022) emphasize that decision-makers' experience plays a crucial role in their level of overconfidence. As a result, we also investigated the potential influence of decision-makers' overconfidence on the relationships between performance feedback and organizational responses. To conduct this analysis, we followed Blagoeva et al. (2020) and Schumacher et al. (2020), categorizing studies as examining overconfidence if they incorporated CEO tenure, gender, or bonus variables in their models.

Table 9 presents the results of the subgroup analyses on the effects of performance below and above aspirations on organizational responses, categorized by decision-maker overconfidence. Our findings indicate that decision-maker overconfidence weakens the increases in responses to performance below aspirations. In studies that included overconfidence variables, the effect of performance below aspirations ($r = -0.067$, $p = 0.000$) is smaller compared to studies that excluded these variables ($r = -0.107$, $p = 0.001$). The difference between these effects is statistically significant ($\Delta r = 0.040$, $Z = 1.968$, $p = 0.049$).

TABLE 8 Summary of hypotheses and results.

Hypothesis	Support	Results table
H1: Studies that include decision-makers' job experience show a weaker increase in responses to performance below aspirations than those that do not include job experience.	Supported	Table 4
H2: Studies that include decision-makers' domain expertise show a stronger increase responses to performance below aspirations than those that do not include domain expertise.	Supported	Table 5
H3a: Studies that include decision-makers' performance-based incentives show a stronger increase in responses to performance below aspirations than those that do not include performance-based incentives.	Not supported	Table 6
H3b: Studies that include decision-makers' performance-based incentives show a weaker increase in responses to performance above aspirations than those that do not include performance-based incentives.	Supported	
H3c: Studies that include decision-makers' performance-based incentives show a weaker decrease in responses to performance above aspirations than those that do not include performance-based incentives.	Supported	
H4a: Studies that include decision-makers' compensation show a stronger increase in responses to performance below aspirations than those that do not include compensation.	Not supported	Table 7
H4b: Studies that include decision-makers' compensation show a weaker increase in responses to performance above aspirations than those that do not include compensation.	Supported	
H4c: Studies that include decision-makers' compensation show a weaker decrease in responses to performance above aspirations than those that do not include compensation.	Not supported	

TABLE 9 Additional analysis, meta-analysis results with overconfidence variables (CEO tenure, gender, bonus).

Criteria	Model	k	r	p	SE	CI 95%	Cr. I. 95%	Z	p_z
All responses to performance below aspirations	Models with overconfidence variables	46	−0.067	0.000	0.018	−0.103; −0.031	−0.306; 0.172		
	Models without overconfidence variables	46	−0.107	0.000	0.009	−0.126; −0.089	−0.220; 0.006	1.968	0.049
Increase in responses to performance above aspirations	Models with overconfidence variables	19	0.087	0.039	0.042	0.005; 0.170	−0.279; 0.454		
	Models without overconfidence variables	22	0.120	0.005	0.043	0.036; 0.204	−0.275; 0.515	−0.544	0.587
Decrease in responses to performance above aspirations	Models with overconfidence variables	20	−0.086	0.000	0.014	−0.113; −0.060	−0.194; 0.021		
	Models without overconfidence variables	18	−0.096	0.000	0.013	−0.121; −0.071	−0.195; 0.003	0.518	0.604

Number of data points (k), sample size weighted mean effect size (r), the standard deviation of sample size weighted correlation (SE), 95% confidence interval around the mean sample size weighted correlation (CI 95%), 95% credibility interval around the mean sample size weighted correlation (Cr. I. 95%), and Z-statistic (Z) for the critical ratio that indicates whether the subgroups are significantly different (significance of Z-test is determined using two-tailed tests).

Our results suggest that overconfidence is not associated with increases or decreases in responses to performance above aspirations as the differences between studies included and excluded overconfidence variables are not statistically significant (increases in responses: $p = 0.587$, decreases in responses: $p = 0.604$).

5.3. *Post hoc* analyses

To analyze whether outliers might have biased our results (Aguinis et al., 2010a; Schmidt and Hunter, 2014), we calculated the effect sizes for performance above and below aspirations without the outliers. Following Junni et al. (2013), we excluded correlation coefficients that were more than six standard deviations above or below the mean correlations of the overall sample. The results from this analysis are similar to the original results. Specifically, we found that, when potential outliers are excluded, the effect size of organizational performance feedback decreases by 0.001 for performance below aspirations and 0.007 for performance above aspirations. The difference between the two effect sizes is not significant (below: $p = 0.949$, above: $p = 0.093$). Moreover, when increases and decreases in responses to performance above aspirations are considered separately, when potential outliers are excluded, the effect size of organizational performance feedback decreases by 0.022 for increases in responses and 0.008 for decreases in responses. The difference between the two effect sizes is not significant (increases in responses: $p = 0.144$, decreases in responses: $p = 0.446$). The outlier analyses for subgroups were also insignificant.

To assess how many unpublished studies with null results would be needed to invalidate our results, we carried out the Fail-Safe N test (Rosenthal, 1995). The Fail-Safe N for the mean correlation between performance feedback and organizational actions is 1,097,455 for performance below aspirations and 22,679 for performance above aspirations. Moreover, when increases

and decreases in responses to performance above aspirations are considered, the Fail-Safe N is 241,436 for increases in responses and 115,595 for decreases in responses to performance above aspirations. All Fail-Safe N values, including the ones for the subgroup analyses, exceeded the criterion suggested by Rosenthal (1979), i.e., five times the number of studies in the sample plus 10.

With a trim-and-fill analysis, we followed Aguinis et al. (2010b) to further assess the file drawer problem. The trim-and-fill method simulates studies that might be missing, and we included these simulated studies in our estimations of effect sizes (Duval and Tweedie, 2000). The estimated number of missing studies from our sample is zero, both for performance below and above aspirations. The estimated number of missing studies was also minimal for the subgroups (subgroups of studies that included and excluded individual-level variables), and the differences in our calculated effect sizes and the results of trim-and-fill methods were statistically insignificant.

To better assess whether publication bias exists, we followed Kromrey and Rendina-Gobioff (2006) and used Egger's regression method (Egger et al., 1997) and Begg's rank correlation method (Begg and Mazumdar, 1994), in addition to the trim-and-fill method to assess whether publication bias may have influenced our results. The results from these analyses were consistent for our main relationships and in line with the trim-and-fill analyses (performance below aspirations: Egger's test suggests that asymmetry in the funnel plot is not significant with p=0.573, and Begg's rank suggests that the funnel plot is not significantly asymmetric with p=0.866), increases in responses to performance above aspirations (Egger's test suggests that asymmetry in the funnel plot is not significant with $p = 0.215$, and Begg's rank suggests that the funnel plot is not significantly asymmetric with $p = 0.105$), decreases in responses to performance above aspirations (trim-and-fill analysis estimates 0 studies to be missing from the sample, Egger's test suggests that asymmetry in the funnel plot is not significant with p=0.295, and Begg's rank suggests that the funnel plot is not significantly asymmetric with p=0.368). Therefore, our analyses do not provide any evidence that publication bias exists in our sample.

As an additional analysis, we tested whether our subsamples that included and excluded the variables in question were significantly different in terms of their study characteristics, which could impact the extent of support for our hypotheses. We used meta-analytic regression models to examine the extent to which several methodological biases—i.e., publication year, publication quality, and research designs of studies—influenced the effect sizes of subgroup analyses. We ran these analyses between subgroups that included and excluded the experience, domain expertise, performance-based incentive, and compensation variables, and for increases in responses to performance below aspirations and increases and decreases in responses to performance above aspirations. We did not find significant differences between subsamples that included or excluded the variables in question in terms of methodological variables, except for publication year. This difference is likely because the studies that included the variables in question are more recently published, compared to the ones that excluded these variables. Overall, we did not observe any methodological biases between our subgroups.

6. Discussion

In this study, we meta-analytically examined the role of experience and incentives and how they relate to decision-making when decision-makers respond to organizational performance feedback. We find that both decision-makers' job experience and domain expertise influence their processing of feedback information below aspirations and incentives influence responses to performance feedback above aspirations.

6.1. Contributions

6.1.1. Job experience versus domain expertise in performance feedback

Our analysis shows that decision-makers' job experience and domain expertise differ in their effects on responses to performance feedback. We argue that decision-makers' job experience derives from experiential learning that is prone to many biases, such as sampling bias, status quo bias, or attribution bias. Decision-makers overestimate the quality of the knowledge gained in this process: They believe that they are more competent in their role as the decision-maker than they objectively are. They become overconfident and, as a result, less responsive to performance feedback (Schumacher et al., 2020). Gaba et al. (2022) proposed overconfidence as a mechanism for the effect of experience on organizational responses. Our additional analyses demonstrate that overconfidence decreases responses across many diverse responses. We propose that the sources of overconfidence are rooted in the biases that arise from experiential learning.

We argue that decision-makers who have high domain expertise, however, are less prone to these biases because the knowledge is not acquired through experiential learning but by adopting codified knowledge of a field. This knowledge is more explicit and the rules that the learner derives are dissociated from the learner. This process of knowledge acquisition reduces biases and fosters broader information processing. Decision-makers with higher domain knowledge will become confident thanks to their knowledge base and engage in problemistic search in response to performance below aspirations. While Eggers and Suh (2019) theorized on domain-specific experience at the organizational level, our finding on decision-makers' domain expertise is novel to the Carnegie perspective. Our findings resonate with psychological studies that show a relationship between domain expertise and reduced loss aversion (see Mrkva et al., 2020 for a discussion).

6.1.2. Explaining responses to performance below aspirations

Our diverging findings for job experience and domain expertise deepen our understanding of when decision-makers engage in problemistic search (Posen et al., 2018) and when they interpret performance feedback in a self-enhancing way (Audia and Brion, 2007; Jordan and Audia, 2012; Lim and Audia, 2020). We theorized that experiential learning is associated with many biases such as attribution bias (Alicke and Sedikides, 2009) that lead to self-enhancing interpretation of performance feedback and instill overconfidence in decision-makers. We conclude that problemistic

search may be reduced by individual decision-makers' information processing which is more biased for job experience than for domain expertise.

6.1.3. Incentives and compensation in performance feedback

We contribute to the theorizing of the effect of incentives and compensation in the performance feedback mechanism. We find that incentives/compensation influence responses above aspirations. They render the aspiration level more salient, increasing decision-makers' focus on the aspiration level. Incentives, in particular, make decision-makers less complacent but also less ambitious. This is in line with Lim and McCann (2014) who showed decreased risk-taking for performance above aspirations. Thanks to our differentiation between increases and decreases of responses to performance above aspirations that is not commonly made in the literature, we were able to detect more nuanced effects; specifically, we are able to attribute this effect to reduced ambition rather than complacency. While both incentives and compensation emphasize the aspiration level, incentives are related to continued, moderate risk-taking above aspirations while compensation is not.

BAM predicts incentives and compensation increase responses below aspirations, but we did not find such evidence. Our non-findings for incentives and compensation for performance aspirations are also contrary to Lim and McCann (2014) who showed that CEOs who receive high incentives (here: stock options) become risk averse. This could be because decision-makers are already intrinsically motivated to search for solutions to their organizations' performance problems (Greve, 2003). Another reason is that decision-makers who receive high incentives are powerful and able to embellish the outcomes of their decisions, for instance, by switching reference groups (Audia et al., 2022). Our non-findings also resonate with Hogarth et al. (1991) who find incentives to be ineffective in situations of negative feedback. Similarly, Etchart-Vincent and l'Haridon (2010) found that incentives were crucial in the gain domain but not in the loss domain. Therefore, our meta-analytic results are consistent with several relevant psychological studies. We show that these results—that are generally generated by individuals in the laboratory—apply to the context of organizations.

6.1.4. Explaining responses to performance above aspirations

We contribute to the discussion concerning controversy on responses to performance above aspirations (Kotiloglu et al., 2021). Scholars have proposed organizational factors such as organizational size and slack (e.g., Singh, 1986; Greve, 2003) as a potential explanation for why increases in responses to performance above aspirations are observed in some organizations and contexts, but decreases in responses are observed in others, but the underlying mechanism and conditions for when firms increase their responses to performance above aspirations are not yet well understood (Ref and Shapira, 2017). This study makes clear that incentives and compensation, inasmuch as they affect the decision-makers' motivation to take risk, influence their individual responses. We believe that the specific incentive mixes which decision-makers receive will determine whether they activate organizational slack in the first place. Ignoring the motivation of decision-makers or assuming that all decision-makers are equally motivated, independent of their specific situation (e.g., incentives), is not an adequate reflection of what we now know.

6.2. Practical implications of our results

Our results have important implications for practice. Since executives' experience affects responses to feedback, it is important to carefully screen executives' profiles during the selection and hiring processes. They are also relevant in executive development, in terms of raising awareness of the differences and levels of rigidity in individuals' cognitive frames through specialized training.

Our findings on incentives imply that organizational policy needs to create appropriate and adaptive incentives and compensation packages for executives. It is important to balance the advantages and drawbacks of increasing incentive: An increase in executives' incentives may decrease their intrinsic motivation (Wiersema, 1992; Deci et al., 1999); decision-makers may become overly focused on their high pay reference points (Pokorny, 2008) and, as a result, become less interested in learning from feedback (Hogarth et al., 1991). Incentives lead to less risk-taking when performance is above aspirations.

6.3. Limitations and future research

Our study is limited by the samples used in the underlying studies. Most empirical BTOF studies are based on larger, publicly traded companies. There are many constraints and specific regulations, for example, shareholder expectations and performance reporting standards for individuals, in large, public organizations. Therefore, some variables representing the individual level might not show sufficient heterogeneity. This could lead to lower effect sizes. We expect a stronger effect size for individual-level variables in samples consisting of smaller or private companies for which systematic data are not generally available. Given that the CEO effect (on performance) in general has increased over the past years (Quigley and Hambrick, 2015; Quigley and Graffin, 2017), we also expect that this effect will get stronger in BTOF studies as well.

There are several important differences among cultures, such as risk preferences and uncertainty avoidance, which are relevant for responses to performance feedback (Hofstede, 2001; Statman, 2008; Kotiloglu et al., 2023). However, most empirical BTOF studies are based on samples from the United States. This leads to more homogeneity than is representative.

While our analysis cumulatively accounted for context factors such as riskiness, factors related to the industry and economic environment and our findings are generalizable across context. While this allows us to make generalizable predictions, it does not allow us to dissect facets of contextual factors. For instance, the ambiguity and the riskiness of context are likely to affect this relationship (Audia and Brion, 2007; Gächter et al., 2022).

As more BTOF studies become available, a meta-analysis of the effect of those relevant context factors will be possible. Similarly, it will be interesting to differentiate different types of organizational responses (Kuusela et al., 2017) and diverse and diverging performance measures (Audia and Brion, 2007; Steinberg et al., 2022).

We also believe that job experience/domain expertise and incentives/compensation will affect which reference points decision-makers consider meaningful and against which they assess their own performance (Audia et al., 2015, 2022). Tarakci et al. (2018) showed that decision-makers use their individual performance feedback as a reference point in addition to organizational feedback. Individuals may have reference points within and outside of the organizations (Kacperczyk et al., 2015). March (1994, p. 31) already hinted at such individual-based reference points, writing that aspirations "... are affected by the past performances of the particular individual or organizations and by the past performance of those individuals and organizations perceived as comparable". Building on March's statement, future models of organizational feedback could consider two individual-level reference points (individual feedback relative to own prior performance and individual feedback relative to peers) in addition to the two organizational-level reference points (organizational performance relative to own prior performance and organizational performance relative to peer organizations) that are typically considered. Similarly, decision-makers with different cognitive frames will likely have idiosyncratic reference points that go beyond the standard performance feedback model (Audia et al., 2022). It will be important to study how decision-makers balance their attention among multiple reference points (Hu et al., 2017; Tarakci et al., 2018) and how their attention allocation to diverse reference points mediates the relationship between performance feedback and responses.

Since we identified overconfidence as a mechanism that influences whether firms increase their responses to performance below aspirations or not, we propose that future studies examine this construct more closely. Scholars may opt for experimental, survey-based, or text-based approaches. Building on Schumacher et al. (2020)'s work that illustrated the relevance of overconfidence using a media-based and an option-based measure of overconfidence, it will be important to further explore overconfidence in the performance feedback mechanism using direct measures of the construct. Scholars may measure overconfidence as miscalibration (Russo and Schoemaker, 1992), as decision behavior (Glaser and Weber, 2007), or perform psycholinguistic analyses of decision-makers' text or speech (Pennebaker et al., 2015; Zyung and Shi, 2022). Since these measures capture different facets of the construct, robustness tests of alternative measures are crucial. We also hope that researchers will examine overconfidence in diverse contexts as it can vary across task environments (Glaser et al., 2005).

7. Conclusion

Within the Carnegie perspective, BTOF explains organizational decision-making. While it proposes that decisions are made by individual managers, the theory has, as we allude to, unfinished business. BTOF scholars only recently started analyzing the role of individual decision-makers in organizational decision-making. There is more work to be done regarding the integration of the individual level to the organizational decision-making process. Our meta-analytic review showed that individual decision-makers' job experience and domain expertise influence organizational responses to performance below aspirations and performance-based incentives and compensation influence responses to performance above aspirations. In doing so, we open multiple pathways and opportunities for future studies that seek to extend the BTOF by further exploring specific individual-level factors. We believe that there is great promise for the insights and contributions of scholars in the field of psychology to enrich the theorizing of the role of individual decision-makers in the Carnegie perspective.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Funding

This work was supported by the Simon Fraser University Central Open Access Fund and the Beedie School of Business.

Acknowledgments

We thank the editor for their generous support and very helpful guidance in developing this paper. We thank our reviewers for their insightful comments. We thank Barbara Burkhardt, Turanay Caner, Beverly Tyler, and the participants of the 2021 AOM Annual Meeting for their inspiring and helpful suggestions.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of

their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1166185/full#supplementary-material

References

Aguinis, H., Dalton, D. R., Bosco, F. A., Pierce, C. A., and Dalton, C. M. (2010a). Meta-analytic choices and judgment calls: Implications for theory building and testing, obtained effect sizes, and scholarly impact. *J. Manage.* 37, 5–38. doi: 10.1177/0149206310377113

Aguinis, H., Gottfredson, R. K., and Wright, T. A. (2011). Best-practice recommendations for estimating interaction effects using meta-analysis. *J. Organ. Behav.* 32, 1033–1043. doi: 10.1002/job.719

Aguinis, H., Pierce, C. A., Bosco, F. A., Dalton, D. R., and Dalton, C. M. (2010b). Debunking myths and urban legends about meta-analysis. *Organ. Res. Methods* 14, 306–331. doi: 10.1177/1094428110375720

Aguinis, H., Ramani, R. S., and Alabduljader, N. (2018). What you see is what you get? Enhancing methodological transparency in management research. *Acad. Manag. Ann.* 12, 83–110. doi: 10.5465/annals.2016.0011

Ahn, S., Cho, C. K., and Cho, T. S. (2020). Performance feedback and organizational learning: the role of regulatory focus. *Manag. Decis.* 59, 616–637. doi: 10.1108/MD-09-2019-1319

Alessandri, T. M. (2008). Risk and procedural rationality: a behavioral theory perspective. *J. Strategy Manag.* 1, 198–217. doi: 10.1108/17554250810926375

Alessandri, T. M., and Pattit, J. M. (2014). Drivers of R&D investment: the interaction of behavioral theory and managerial incentives. *J. Bus. Res.* 67, 151–158. doi: 10.1016/j.jbusres.2012.11.001

Alicke, M. D., and Sedikides, C. (2009). Self-enhancement and self-protection: what they are and what they do. *Eur. Rev. Social Psychol.* 20, 1–48. doi: 10.1080/10463280802613866

Argote, L. (1999). *Organizational Learning: Creating, Retaining, and Transferring Knowledge*. Boston: Kluwer Academic.

Arora, P., and Dharwadkar, R. (2011). Corporate governance and corporate social responsibility (CSR): The moderating roles of attainment discrepancy and organization slack. *Corp. Govern.* 19, 136–152. doi: 10.1111/j.1467-8683.2010.00843.x

Arrfelt, M., Wiseman, R. M., and Hult, G. T. M. (2012). Looking backward instead of forward: Aspiration-driven influences on the efficiency of the capital allocation process. *Acad. Manage. J.* 56, 1081–1103. doi: 10.5465/amj.2010.0879

Audia, P. G., and Brion, S. (2007). Reluctant to change: self-enhancing responses to diverging performance measures. *Organ. Behav. Hum. Decis. Process.* 102, 255–269. doi: 10.1016/j.obhdp.2006.01.007

Audia, P. G., Brion, S., and Greve, H. R. (2015). Self-assessment, self-enhancement, and the choice of comparison organizations for evaluating organizational performance. *Cognit. Strat.* 32, 89–118. doi: 10.1108/S0742-332220150000032018

Audia, P. G., and Greve, H. R. (2006). Less likely to fail: low performance, firm size, and factory expansion in the shipbuilding industry. *Manage. Sci.* 52, 83–94. doi: 10.1287/mnsc.1050.0446

Audia, P. G., and Greve, H. R. (2021). "Organizational Learning from Performance Feedback: A Behavioral Perspective on Multiple Goals," in *Elements in Organization Theory Series*. (Cambridge, UK: Cambridge University Press). doi: 10.1017/9781108344289

Audia, P. G., Locke, E. A., and Smith, K. G. (2000). The paradox of success: an archival and a laboratory study of strategic persistence following radical environmental change. *Acad. Manage. J.* 43, 837–853. doi: 10.2307/1556413

Audia, P. G., Rousseau, H. E., and Brion, S. (2022). CEO power and nonconforming reference group selection. *Organiz. Sci.* doi: 10.1287/orsc.2020.1397

Baum, J. A., Rowley, T. J., Shipilov, A. V., and Chuang, Y.-T. (2005). Dancing with strangers: Aspiration performance and the search for underwriting syndicate partners. *Adm. Sci. Q.* 50, 536–575. doi: 10.2189/asqu.50.4.536

Begg, C. B., and Mazumdar, M. (1994). Operating characteristics of a rank correlation test for publication bias. *Biometrics.* 50, 1088–1101. doi: 10.2307/2533446

Bergh, D. D., Aguinis, H., Heavey, C., Ketchen, D. J., Boyd, B. K., Su, P., et al. (2016). Using meta-analytic structural equation modeling to advance strategic management research: Guidelines and an empirical illustration via the strategic leadership-performance relationship. *Strateg. Manag. J.* 37, 477–497. doi: 10.1002/smj.2338

Bilgili, T. V., Calderon, C. J., Allen, D. G., and Kedia, B. L. (2016). Gone with the wind: A meta-analytic review of executive turnover, its antecedents, and postacquisition performance. *J. Manage.* 43, 1966–1997. doi: 10.1177/0149206316635252

Blagoeva, R. R., Mom, T. J., Jansen, J. J., and George, G. (2020). Problem-solving or self-enhancement? A power perspective on how CEOs affect R&D search in the face of inconsistent feedback. *Acad. Manage. J.* 63, 332–355. doi: 10.5465/amj.2017.0999

Blettner, D., Kotiloglu, S., and Lechler, T. (2019). Variations in the effects of performance above aspirations: Empirical artifact or theoretical gap? *Acad. Manage. J.* 2019, 12248. doi: 10.5465/AMBPP.2019.12248abstract

Blettner, D., Kotiloglu, S., and Lechler, T. G. (2023). Self-assessment versus self-improvement motives: how does social reference group selection influence organizational responses to performance feedback? *Br. J. Management*. doi: 10.1111/1467-8551.12700

Chatterjee, A., and Hambrick, D. C. (2011). Executive personality, capability cues, and risk taking. *Adm. Sci. Q.* 56, 202–237. doi: 10.1177/0001839211427534

Chen, W.-R., and Miller, K. D. (2007). Situational and institutional determinants of firms' R&D search intensity. *Strateg. Manag. J.* 28, 369–381. doi: 10.1002/smj.594

Combs, J. G., Crook, T. R., and Rauch, A. (2018). Meta-analytic research in management: Contemporary approaches, unresolved controversies, and rising standards. *J. Manag. Stud.* 56, 1–18. doi: 10.1111/joms.12427

Crook, T. R., Ketchen, D. J., Combs, J. G., and Todd, S. Y. (2008). Strategic resources and performance: a meta-analysis. *Strateg. Manag. J.* 29, 1141–1154. doi: 10.1002/smj.703

Cyert, R. M., and March, J. G. (1963). *A Behavioral Theory of the Firm.* Englewood Cliffs, NJ: Prentice-Hall, Inc.

Cyert, R. M., and March, J. G. (1992). *A Behavioral Theory of the Firm.* Malden, MA: Blackwell Publishers.

Deci, E. L., Koestner, R., and Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychol. Bull.* 125, 627–658. doi: 10.1037/0033-2909.125.6.627

Devers, C. E., Cannella, A. A., Reilly, G. P., and Yoder, M. E. (2016). Executive compensation: a multidisciplinary review of recent developments. *J. Manage.* 33, 1016–1072. doi: 10.1177/0149206307308588

D'Oria, L., Crook, T. R., Ketchen, D. J., Sirmon, D. G., and Wright, M. (2021). The evolution of resource-based inquiry: a review and meta-analytic integration of the strategic resources–actions–performance pathway. *J. Manage.* 47, 1383–1429. doi: 10.1177/0149206321994182

Duval, S. J., and Tweedie, R. L. (2000). Trim and fill: a simple funnel plot-based method of testing and adjusting for publication bias in meta-analysis. *Biometrics.* 56, 455–463. doi: 10.1111/j.0006-341X.2000.00455.x

Egger, M., Smith, G. D., Schneider, M., and Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ.* 315, 629–634. doi: 10.1136/bmj.315.7109.629

Eggers, J. P., and Suh, J. H. (2019). Experience and behavior: how negative feedback in new versus experienced domains affects firm action and subsequent performance. *Acad. Manage. J.* 62, 309–334. doi: 10.5465/amj.2017.0046

Ert, E. (2012). On the value of experience-based decisions in studying constructs of risk taking. *Front. Psychol.* 3, 7. doi: 10.3389/fpsyg.2012.00007

Etchart-Vincent, N., and l'Haridon, O. (2010). Monetary incentives in the loss domain and behavior toward risk: an experimental comparison of three reward schemes including real losses. *J. Risk Uncertain.* 42, 61–83. doi: 10.1007/s11166-010-9110-0

Finkelstein, S., and Hambrick, D. C. (1990). Top-management-team tenure and organizational outcomes: The moderating role of managerial discretion. *Adm. Sci. Q.* 35, 484–503. doi: 10.2307/2393314

Fox, C. R., and Hadar, L. (2006). "Decisions from experience" = sampling error + prospect theory: Reconsidering Hertwig, Barron, Weber & Erev (2004). *Judgm. Decis. Mak.* 1, 159–161. doi: 10.1017/S1930297500002370

Gaba, V., Lee, S., Meyer-Doyle, P., and Zhao-Ding, A. (2022). Prior experience of managers and maladaptive responses to performance feedback: evidence from mutual funds. *Organiz. Sci.* 34, 509–986. doi: 10.1287/orsc.2022.1605

Gächter, S., Johnson, E. J., and Herrmann, A. (2022). Individual-level loss aversion in riskless and risky choices. *Theory Decis.* 92, 599–624. doi: 10.1007/s11238-021-09839-8

Gavetti, G., Levinthal, D., and Ocasio, W. (2007). Perspective—neo-carnegie: the carnegie school's past, present, and reconstructing for the future. *Organiz. Sci.* 18, 523–536. doi: 10.1287/orsc.1070.0277

Geyskens, I., Krishnan, R., Steenkamp, J.-B. E. M., and Cunha, P. V. (2008). A review and evaluation of meta-analysis practices in management research. *J. Manage.* 35, 393–419. doi: 10.1177/0149206308328501

Glaser, M., Langer, T., and Weber, M. (2005). *Overconfidence of Professionals and Lay Men : Individual Differences Within and Between Tasks?*. Mannheim: Universitat Mannheim. doi: 10.1037/e722842011-018

Glaser, M., and Weber, M. (2007). Why inexperienced investors do not learn: They do not know their past portfolio performance. *Finance Res. Lett.* 4, 203–216. doi: 10.1016/j.frl.2007.10.001

Glockner, A., and Pachur, T. (2012). Cognitive models of risky choice: parameter stability and predictive accuracy of prospect theory. *Cognition.* 123, 21–32. doi: 10.1016/j.cognition.2011.12.002

Gomez-Mejia, L. R., Patel, P. C., and Zellweger, T. M. (2018). In the horns of the dilemma: Socioemotional wealth, financial wealth, and acquisitions in family firms. *J. Manage.* 44, 1369–1397. doi: 10.1177/0149206315614375

Gomez-Mejia, L. R., and Wiseman, R. M. (1997). Reframing executive compensation. An assessment and outlook. *J. Manage.* 23, 291–374. doi: 10.1016/S0149-2063(97)90035-0

Greve, H. R. (1998). Performance, aspirations, and risky organizational change. *Adm. Sci. Q.* 43, 58–86. doi: 10.2307/2393591

Greve, H. R. (2003). *Organizational Learning from Performance Feedback: A Behavioral Perspective on Innovation and Change*. Cambridge, UK: Cambridge University Press. doi: 10.1017/CBO9780511615139

Harris, J., and Bromiley, P. (2007). Incentives to cheat: the influence of executive compensation and firm performance on financial misrepresentation. *Organiz. Sci.* 18, 350–367. doi: 10.1287/orsc.1060.0241

He, L., Huang, L., and Yang, G. (2021). Invest in innovation or not? How managerial cognition and attention allocation shape corporate responses to performance shortfalls. *Manage. Organizat. Rev.* 17, 815–850. doi: 10.1017/mor.2021.58

Hofstede, G. (2001). *Culture's Consequences, Comparing Values, Behaviors, Institutions, and Organizations Across Nations*. Thousand Oaks, CA: Sage.

Hogarth, R. M., Gibbs, B. J., McKenzie, C. R., and Marquis, M. A. (1991). Learning from feedback: exactingness and incentives. *J. Experim. Psychol.* 17, 734–752. doi: 10.1037/0278-7393.17.4.734

Hönl, A., Meissner, P., and Wulf, T. (2017). Risk attribution theory: an exploratory conceptualization of individual choice under uncertainty. *J. Behav. Experim. Econ.* 67, 20–27. doi: 10.1016/j.socec.2017.02.001

Hu, S., He, Z. -L., Blettner, D. P., and Bettis, R. A. (2017). Conflict inside and outside: Social comparisons and attention shifts in multidivisional firms. *Strateg. Manag. J.* 38, 1435–1454. doi: 10.1002/smj.2556

Hunter, J. E., and Schmidt, F. L. (1990). *Methods of Meta-Analysis*. Newbury Park, CA.: Sage.

Jordan, A. H., and Audia, P. G. (2012). Self-enhancement and learning from performance feedback. *Acad. Manage. Rev.* 37, 211–231. doi: 10.5465/amr.2010.0108

Junni, P., Sarala, R. M., Taras, V., and Tarba, S. Y. (2013). Organizational ambidexterity and performance: a meta-analysis. *Acad. Manage. Perspectives* 27, 299–312. doi: 10.5465/amp.2012.0015

Kacperczyk, A., Beckman, C. M., and Moliterno, T. P. (2015). Disentangling risk and change: Internal and external social comparison in the mutual fund industry. *Adm. Sci. Q.* 60, 228–262. doi: 10.1177/0001839214566297

Kahneman, D. (2011). *Thinking, Fast and Slow*. Chicago, IL: Macmillan.

Kahneman, D., and Tversky, A. (1979). Prospect theory: an analysis of decision under risk. *Econometrica.* 263–291. doi: 10.2307/1914185

Kavadis, N., and Castañer, X. (2015). Who drives corporate restructuring? Co-Existing owners in French firms. *Corporate Govern.* 23, 417–433. doi: 10.1111/corg.12108

Kluger, A. N., and DeNisi, A. (1996). The effects of feedback interventions on performance: a historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychol. Bull.* 119, 254–284. doi: 10.1037/0033-2909.119.2.254

Kolev, K. D., and McNamara, G. (2020). The role of top management teams in firm responses to performance shortfalls. *Strategic Organiz.* 20, 3. doi: 10.1177/1476127020962683

Kotiloglu, S., Blettner, D., and Lechler, T. G. (2023). Integrating national culture into the organizational performance feedback theory. *Eur. Manag. J.* doi: 10.1016/j.emj.2023.01.003

Kotiloglu, S., Chen, Y., and Lechler, T. (2021). Organizational responses to performance feedback: A meta-analytic review. *Strategic Organiz.* 19, 285–311. doi: 10.1177/1476127019883361

Kraatz, M. S., and Zajac, E. J. (2001). How organizational resources affect strategic change and performance in turbulent environments: theory and evidence. *Organiz. Sci.* 12, 632–657. doi: 10.1287/orsc.12.5.632.10088

Kromrey, J. D., and Rendina-Gobioff, G. (2006). On knowing what we do not know: An empirical comparison of methods to detect publication bias in meta-analysis. *Educ. Psychol. Meas.* 66, 357–373. doi: 10.1177/0013164405278585

Kuusela, P., Keil, T., and Maula, M. (2017). Driven by aspirations, but in what direction? Performance shortfalls, slack resources, and resource-consuming vs. resource-freeing organizational change. *Strateg. Manag. J.* 38, 1101–1120. doi: 10.1002/smj.2544

Larraza-Kintana, M., Wiseman, R. M., Gomez-Mejia, L. R., and Welbourne, T. M. (2007). Disentangling compensation and employment risks using the behavioral agency model. *Strateg. Manag. J.* 28, 1001–1019. doi: 10.1002/smj.624

Levinthal, D. A., and March, J. G. (1993). The myopia of learning. *Strateg. Manag. J.* 9, 95–112. doi: 10.1002/smj.4250141009

Levitt, B., and March, J. G. (1988). Organizational learning. *Annu. Rev. Sociol.* 14, 319–340. doi: 10.1146/annurev.so.14.080188.001535

Lim, E. (2015). The role of reference point in CEO restricted stock and its impact on R&D intensity in high-technology firms. *Strateg. Manag. J.* 36, 872–889. doi: 10.1002/smj.2252

Lim, E. (2017). CEO option wealth and firm risk-taking: an analysis of multiple reference points. *Long Range Plann.* 50, 809–825. doi: 10.1016/j.lrp.2016.12.013

Lim, E. (2018). Social pay reference point, external environment, and risk taking: an integrated behavioral and social psychological view. *J. Bus. Res.* 82, 68–78. doi: 10.1016/j.jbusres.2017.08.001

Lim, E., and Audia, P. G. (2020). Problem-solving or self-enhancing? Influences of diversification and bright spot on corporate resource allocation responses to performance shortfalls. *Strategy Sci.* 5, 348–368. doi: 10.1287/stsc.2020.0117

Lim, E., and McCann, B. T. (2014). Performance feedback and firm risk taking: the moderating effects of CEO and outside director stock options. *Organiz. Sci.* 25, 262–282. doi: 10.1287/orsc.2013.0830

March, J. G. (1991). Exploration and exploitation in organizational learning. *Organiz. Sci.* 2, 71–87. doi: 10.1287/orsc.2.1.71

March, J. G. (1994). *Primer on Decision Making: How Decisions Happen*. New York, NY: Simon and Schuster.

March, J. G. (2008). *Explorations in Organizations*. Stanford, CA: Stanford University Press. doi: 10.1515/9781503627147

March, J. G. (2010). *The Ambiguities of Experience*. Ithaca, NY: Cornell University Press. doi: 10.7591/9780801459016

March, J. G., and Shapira, Z. (1992). Variable risk preferences and the focus of attention. *Psychol. Rev.* 99, 172–183. doi: 10.1037/0033-295X.99.1.172

March, J. G., and Simon, H. A. (1958). *Organizations*. New York: John Wiley & Sons.

Miller, D. (1991). Stale in the saddle: CEO tenure and the match between organization and environment. *Manage. Sci.* 37, 34–52. doi: 10.1287/mnsc.37.1.34

Mount, M. P., and Baer, M. (2021). CEOs' regulatory focus and risk-taking when firms perform below and above the bar. *J. Manage.* doi: 10.1177/01492063211016029

Mrkva, K., Johnson, E. J., Gächter, S., and Herrmann, A. (2020). Moderating loss aversion: loss aversion has moderators, but reports of its death are greatly exaggerated. *J. Cons. Psychol.* 30, 407–428. doi: 10.1002/jcpy.1156

Nohria, N., and Gulati, R. (1996). Is slack good or bad for innovation? *Acad. Manage. J.* 39, 1245–1264. doi: 10.5465/256998

Pachur, T., Bröder, A., and Marewski, J. N. (2008). The recognition heuristic in memory-based inference: is recognition a non-compensatory cue? *J. Behav. Decis. Mak.* 21, 183–210. doi: 10.1002/bdm.581

Pachur, T., Mata, R., and Hertwig, R. (2017). Who dares, who errs? Disentangling cognitive and motivational roots of age differences in decisions under risk. *Psychol. Sci.* 28, 504–518. doi: 10.1177/0956797616687729

Pennebaker, J. W., Boyd, R. L., Jordan, K., and Blackburn, K. (2015). *The Development and Psychometric Properties of LIWC2015*. Austin, TX: University of Texas at Austin.

Pokorny, K. (2008). Pay—but do not pay too much. *J. Econ. Behav. Organ.* 66, 251–264. doi: 10.1016/j.jebo.2006.03.007

Posen, H. E., Keil, T., Kim, S., and Meissner, F. (2018). Renewing research on problemistic search - a review and research agenda. *Acad. Manag. Ann.* 12, 208–251. doi: 10.5465/annals.2016.0018

Quigley, T. J., and Graffin, S. D. (2017). Reaffirming the CEO effect is significant and much larger than chance: a comment on Fitza (2014). *Strateg. Manag. J.* 38, 793–801. doi: 10.1002/smj.2503

Quigley, T. J., and Hambrick, D. C. (2015). Has the "CEO effect" increased in recent decades? A new explanation for the great rise in America's attention to corporate leaders. *Strateg. Manag. J.* 36, 821–830. doi: 10.1002/smj.2258

Ref, O., and Shapira, Z. (2017). Entering new markets: the effect of performance feedback near aspiration and well below and above it. *Strateg. Manag. J.* 38, 1416–1434. doi: 10.1002/smj.2561

Rosenthal, R. (1979). The "file drawer problem" and tolerance for null results. *Psychol. Bull.* 86, 638–641. doi: 10.1037/0033-2909.86.3.638

Rosenthal, R. (1995). Writing meta-analytic reviews. *Psychol. Bull.* 118, 183–192. doi: 10.1037/0033-2909.118.2.183

Russo, J. E., and Schoemaker, P. J. (1992). Managing overconfidence. *Sloan Manage. Rev.* 33, 7–17.

Say, G., and Vasudeva, G. (2020). Learning from digital failures? The effectiveness of firms' divestiture and management turnover responses to data breaches. *Strat. Sci.* 5, 117–142. doi: 10.1287/stsc.2020.0106

Schmidt, F. L., and Hunter, J. E. (2014). *Methods of Meta-Analysis: Correcting Error and Bias in Research Findings*. Newbury Park, CA.: Sage. doi: 10.4135/9781483398105

Schumacher, C., Keck, S., and Tang, W. (2020). Biased interpretation of performance feedback: the role of CEO overconfidence. *Strateg. Manag. J.* 41, 1139–1165. doi: 10.1002/smj.3138

Sedikides, C., and Strube, M. J. (1997). "Self evaluation: To thine own self be good, to thine own self be sure, to thine own self be true, and to thine own self be better," in *Advances in Experimental Social Psychology,* Zanna, M. P. Cambridge, MA: Academic Press. p. 209–269. doi: 10.1016/S0065-2601(08)60018-0

Shi, W., Chen, G., and Li, B. (2022). Problem solving or responsibility avoidance? The role of CEO internal attribution tendency in shaping corporate downsizing in response to performance shortfalls. *J. Manag. Stud.* doi: 10.1111/joms.12896

Shimizu, K. (2007). Prospect theory, behavioral theory, and the threat-rigidity thesis: combinative effects on organizational decisions to divest formerly acquired units. *Acad. Manage. J.* 50, 1495–1514. doi: 10.5465/amj.2007.28226158

Shinkle, G. A. (2012). Organizational aspirations, reference points, and goals: Building on the past and aiming for the future. *J. Manage.* 38, 415–455. doi: 10.1177/0149206311419856

Simon, H. A. (1947). *Administrative Behavior: A Study of Decision-Making Processes in Administrative Organization*. New York: The Macmillan Company.

Singh, J. V. (1986). Performance, slack, and risk taking in organizational decision making. *Acad. Manage. J.* 29, 562–585. doi: 10.2307/256224

Statman, M. (2008). Countries and culture in behavioral finance. *CFA Inst. Conf. Proc. Quart.* 5, 38–44. doi: 10.2469/cp.v25.n3.6

Steinberg, P. J., Asad, S., and Lijzenga, G. (2022). Narcissistic CEOs' dilemma: the trade-off between exploration and exploitation and the moderating role of performance feedback. *J. Prod. Innovat. Manage.* 39, 773–796. doi: 10.1111/jpim.12644

Tarakci, M., Ate,ş, N. Y., Floyd, S. W., Ahn, Y., and Wooldridge, B. (2018). Performance feedback and middle managers' divergent strategic behavior: the roles of social comparisons and organizational identification. *Strateg. Manag. J.* 39, 1139–1162. doi: 10.1002/smj.2745

Trepel, C., Fox, C. R., and Poldrack, R. A. (2005). Prospect theory on the brain? Toward a cognitive neuroscience of decision under risk. *Brain Res Cogn Brain Res* 23, 34–50. doi: 10.1016/j.cogbrainres.2005.01.016

Vanneste, B. S., Puranam, P., and Kretschmer, T. (2014). Trust over time in exchange relationships: meta-analysis and theory. *Strateg. Manag. J.* 35, 1891–1902. doi: 10.1002/smj.2198

Verver, H., van Zelst, M., Lucas, G. J. M., and Meeus, M. T. H. (2019). *Understanding Heterogeneity in the Performance Feedback –Organizational Responsiveness Relationship: A Meta-Analysis*. Available online at: https://osf.io/hq4uw. doi: 10.31219/osf.io/hq4uw

Wang, K., and Zhang, X. (2021). The effect of media coverage on disciplining firms' pollution behaviors: evidence from Chinese heavy polluting listed companies. *J. Clean. Prod.* 280, 123035. doi: 10.1016/j.jclepro.2020.123035

Wangrow, D. B., Kolev, K., and Hughes-Morgan, M. (2019). Not all responses are the same: how CEO cognitions impact strategy when performance falls below aspirations. *J. General Manage.* 44, 73–86. doi: 10.1177/0306307018798143

Wennberg, K., and Holmquist, C. (2008). Problemistic search and international entrepreneurship. *Eur. Manag. J.* 26, 441–454. doi: 10.1016/j.emj.2008.09.007

Wiersema, M. F. (1992). Strategic consequences of executive succession within diversified firms. *J. Manag. Stud.* 29, 73–94. doi: 10.1111/j.1467-6486.1992.tb00653.x

Wiseman, R. M., and Gomez-Mejia, L. R. (1998). A behavioral agency model of managerial risk taking. *Acad. Manage. Rev.* 23, 133–153. doi: 10.2307/259103

Zyung, J. D., and Shi, W. (2022). In retrospect: the influence of chief executive officers' historical relative pay on overconfidence. *Strat. Organiz.* 20, 627–651. doi: 10.1177/14761270211004891

frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 27 December 2023
DOI 10.3389/fpsyg.2023.1167243

OPEN ACCESS

EDITED BY
Pino Audia,
Dartmouth College, United States

REVIEWED BY
Oliver Baumann,
University of Southern Denmark, Denmark
Stephan Billinger,
University of Southern Denmark, Denmark

*CORRESPONDENCE
Naryoung Yu
✉ nyu.phd@ivey.ca

RECEIVED 16 February 2023
ACCEPTED 10 November 2023
PUBLISHED 27 December 2023

CITATION
Kim J-H, Terlaak A and Yu N (2023) A Carnegie perspective on intermittent risk taking in entrepreneurship.
Front. Psychol. 14:1167243.
doi: 10.3389/fpsyg.2023.1167243

A Carnegie perspective on intermittent risk taking in entrepreneurship

Ji-hyun Kim[1], Ann Terlaak[2] and Naryoung Yu[3]*

[1]Yonsei School of Business, Yonsei University, Seoul, Republic of Korea, [2]Wisconsin School of Business, University of Wisconsin, Madison, WI, United States, [3]Ivey Business School, Western University, London, ON, Canada

Varying risk-taking tendency is an important area of inquiry for the Carnegie perspective. Drawing on organizational learning literature, we develop a model to illuminate the mechanisms that can underlie time-varying risk taking tendency in entrepreneurship. In particular, we delineate conditions under which abrupt risk taking punctuates periods of risk-avoiding behaviors, a pattern that we call "intermittent risk taking." We use serial entrepreneurs whose bouts with risk taking are often depicted as driven by an entrepreneurial itch to illustrate our model. In our conceptualization, decision makers engage in an interplay of experiential and vicarious learning as they move into and out of higher-risk self-employment (i.e., venture creation) with in-between stints in lower-risk wage-employment. Using a computational model to simulate the dynamics of this conceptualization, we find that vicarious learning from satisfied risk-avoiding peers can exert a pull that draws disappointed entrepreneurs into periods of risk avoidance (i.e., wage-employment). However, the moment that the satisfaction of these peers fails to convince, this pull wanes. In effect, the entrepreneur vicariously learns that the grass may not be greener on the other side which then leads them to return into self-employment. The itch for risk taking then recurs not necessarily because risky venture creation offers higher payoffs than risk-avoiding options but because decision makers come to see that risk avoidance may not be a satisfactory alternative either — a conceptualization that adds nuance to prior notions of varying risk tendencies and serial entrepreneurship.

KEYWORDS

risk taking, entrepreneurial decision-making, serial entrepreneurship, experiential learning, vicarious learning, computational modeling

1 Introduction

Risk taking is a central area of inquiry for several schools of economic and managerial thought, including the Carnegie perspective (Cyert and March, 1963). In part, it owes this centrality to its role in shaping economic growth and fueling innovation. From a macroeconomic perspective, economic entities' risk perceptions and attitudes matter for the effects of monetary policy on the overall economy (Bauer et al., 2023). From an innovation point of view, risk taking is essential for new venture creation. This is because for aspiring entrepreneurs, new venture creation is a risky endeavor, especially when compared to engaging in alternate wage-employment. Venture creation, while often generating the same *average* payoffs than wage-employment, tends to be riskier because it is associated with payoffs that exhibit much greater variations (Hamilton, 2000; Carroll et al., 2001; Miller, 2007; Åstebro et al., 2011). All too often, it can produce not only astounding successes that push technological frontiers and disrupt established processes to generate better ones but also devastating failures.

In line with the importance of risk taking for innovation and growth, scholars working in the Carnegie perspective have long sought to illuminate the mechanisms that drive decision makers to engage in or, conversely, avoid risky endeavors and practices [e.g., the "hot stove model" proposed by Denrell and March (2001) and conceptualizations of variable risk preferences by March and Shapira (1992)]. We here continue in this line of inquiry, paying special attention to one particular pattern of risk taking: that of intermittent risk taking, i.e., a pattern whereby decision makers vacillate between risk taking and avoidance. Serial entrepreneurs—entrepreneurs that repeatedly and sequentially engage in new venture-creations (Westhead and Wright, 2017)—are a case in point. To be sure, some serial entrepreneurs engage in continuous risk seeking as they go from one venture creation straight to the next.[1] But others engage in intermittent risk taking whereby they enter into lower-risk wage-employment in between bouts with higher-risk self-employment (Hamilton, 2000; Amaral et al., 2011; Åstebro et al., 2011). Mariam Naficy, founder and CEO of *Minted*, exemplifies this. Before founding *Minted*, she founded *Eve.com*, an online makeup company. Subsequent to selling *Eve.com* for $110 million, Ms. Naficy worked as a manager at *The Body Shop* for the next 8 years, then returning into entrepreneurship to found *Minted*, an online stationery store that as of 2021 had 2,000+ employees and 1.22 billion USD in revenue (Dun and Bradstreet, 2022). As recent studies highlight, Ms. Naficy's shifting employment pattern is not a unique phenomenon. Analyzing the career paths of 205 entrepreneurs, Koch et al. (2021, p. 8) find that 33% of the sample exhibited mixed self-employment career patterns, with entrepreneurs frequently shifting between self-employment and wage employment along with periods of unemployment and training. Feng et al. (2022, p. 205) similarly observe that "the back-and-forth movement of an entrepreneurial career across paid jobs and new ventures is indeed common." *What, then, are the processes that underlie such intermittent risk taking?*

Illuminating the processes that result in entrepreneurs vacillating between high- and low-risk behaviors is of both empirical and theoretical importance. Empirically, 48% of entrepreneurial activity in the U.S. is attributable to serial entrepreneurs (Kelly et al., 2020). In Europe, this share is 18–30% (Plehn-Dujowich, 2010). Intermittent risk taking also exhibits itself beyond the entrepreneurship realm, with scholars typically pointing to specific events as triggers for changes in risk taking. For example, Guiso et al. (2018) found that individual investors varied their risk taking subsequent to experiencing the 2008 financial crisis. As another example, Shum and Xin (2022) found that individual drivers' risk taking increased following near-miss accidents, with this effect lasting for a few weeks before reverting back to its original level. Together, these studies suggest that individuals do engage in intermittent risk taking, often as triggered by the conditions they experience.

From a theoretical perspective, two lines of inquiry within the Carnegie perspective address varying risk taking behaviors. The first of these lines focuses on variable risk preferences as the result of changing fortunes and shifting attention. Specifically, March and Shapira (1992, p. 172) suggest that "the level of individual or organizational risk taking is responsive to a risk taker's changing fortune." Similarly, in the second edition of the Behavioral Theory of the Firm, Cyert and March (1992, p. 227) note that "preferences for high variance alternatives are not constant but are responsive to changing fortune." But even when accumulated resources are the same, risk taking may still vary as decision makers shift their attention between aspiration levels and survival points. Using a random variable to govern how attention may shift between these points, March and Shapira (1992) show that a certain combination of attention shifts can result in varying risk taking patterns over time. From this perspective, the intermittent risk taking inherent in serial entrepreneurship could then come about because of resource levels or shifting attention between survival and aspirations points.

Theories of learning and adaptive sampling offer a second, alternative view on varying risk taking (Denrell and March, 2001). This view does not make assumptions about risk preferences. Instead, risk seeking or avoidance is the result of (possibly risk-neutral) decision makers learning from, and adapting to, their own experiences and those of others (Denrell and March, 2001; Denrell, 2003). As for the risk taking consequences of decision makers learning from their own experience, Denrell and March (2001) have coined the term "hot stove effect" to describe the tendency of experiential learning to lead decision makers to become risk averse. The term references Mark Twain's cat: Twain's cat sat on a hot stove lid once, never to sit on it again, not even a cold one. The idea is that as decision makers choose their actions based on prior experiences, they will avoid alternatives that had poor payoffs in the past — such as a hot lid in the case of Mark Twain's cat, or a devastating financial loss in the case of new venture creation (Cyert and March, 1963). Because a high-risk alternative, compared to a low-risk one of equal average value, more frequently has very poor payoffs, and because one very poor experience leads the decision maker to abandon that alternative, the decision maker cannot collect any further experiences that would reveal the alternative's true value. As a result, they become risk averse, selecting into lower-risk alternatives such as wage-employment over higher-risk ones such as venture creation (March, 1996; Denrell and March, 2001; Fazio et al., 2004; Denrell, 2008).[2] As for the risk taking consequences of decision makers learning vicariously, effects are opposite, with vicarious learning generating upwardly biased risk taking. This is driven by sampling: because decision makers tend to sample the experiences of successful others, and because the successes or payoffs of risky alternatives tend to be larger than those of equal value but lower-risk alternatives, vicarious learning inherently involves an undersampling of failure. This leads decision makers to engage in more risk taking than they would otherwise (e.g., Greve, 1995; Baum et al., 2000; Denrell, 2003).

Our theoretical approach to intermittent risk taking is aligned with this second line of inquiry—the idea that both risk seeking and risk avoidance can result from adaptive learning. By virtue of being able to account for both low- and high-risk behaviors, adaptive learning carries clear potential for explaining intermittent risk taking. What is more, this approach does not necessitate assumptions about risk preferences and their stability. This is especially attractive for explaining phenomena in the entrepreneurship realm where the debate regarding entrepreneurs' risk preferences and whether these preferences systematically and stably differ from those of wage-employees is of yet unresolved (Brockhaus,

1 Some entrepreneurs called "portfolio entrepreneurs" are involved in multiple startups at the same time.

2 Throughout the manuscript, we use "they" and "their" as a gender-neutral pronoun for decision makers and entrepreneurs.

1980; Stewart and Roth, 2001; Miner and Raju, 2004). Yet despite this potential, we so far lack an understanding of what, exactly, the learning processes that can result in decision makers, particularly entrepreneurs, vacillating between risk seeking and avoidance may look like. In part, this gap in understanding comes about because most studies in this space analyze the risk taking consequences of decision makers engaging in each learning mode in isolation. With each learning mode engendering either risk taking *or* risk avoidance, these studies convincingly explain how a decision maker may engage in one type of risk taking over the other, but they fall short in accounting for potential switches between the two. For instance, Denrell and March's (2001) hot stove model solely focuses on experiential learning and the risk avoidance that ensues whereas Denrell (2003) illuminates how sole vicarious learning can result in risk seeking. To be sure, some studies do begin to explore how the two learning modes and resulting risk-taking tendencies may combine, suggesting that vicarious learning and interdependent sampling (where one decision maker's choice of action depends on both their own attitude and that of others) can attenuate the bias against risk that emerges from experiential learning (Yechiam and Busemeyer, 2006; Denrell and Le Mens, 2007). But these studies still assume that information from one mode (vicarious learning) passively adds information to the other (experiential learning) and that it is sampling, not learning, that is interdependent. This leaves unexplored how the two learning modes may interplay and what the effects of such interplay on intermittent risk taking may be—the question that we address here.

We use serial entrepreneurship to illustrate our study on the interplay between experiential and vicarious learning and resultant risk taking. As such, we address the underlying processes of the repeated transition from one employment state, self-employment, into the other state, wage-employment, and back again. Practitioners describe these transitions as triggered by an itch that comes and goes. Scott Baxter, founder and chief executive of SA Baxter, remarks that "I'm 2 years into my next project, Doolli, a next-generation internet technology company, although it is not operating yet. SA Baxter is 7 years old. I've got the itch again" (Baxter, 2013). Another entrepreneur, Ben Erez, recounts that "when I shut down my first startup last year, some close friends and mentors told me "Do not worry, the itch will come back" (Erez, 2015). We here develop a theoretical underpinning for when and why that itch strikes again.

Our study's contribution to the Carnegie perspective is two-fold. First, we illuminate how intermittent risk taking can be the result of learning and adaptive sampling rather than variable risk preferences (Cyert and March, 1963; March and Shapira, 1992). In fact, our conceptualization accommodates for decision makers to be risk neutral, thereby allowing us to sidestep assumptions whether the risk preferences of decision makers that engage in higher-risk activities like entrepreneurship are systematically different from those that engage in lower-risk activities like wage-employment (Hall and Woodward, 2010; Brown et al., 2011; see section 5.4 of Parker, 2018 for a detailed review). Second, we investigate risk taking as the result of decision makers engaging in an interplay between experiential and vicarious learning. This moves the field beyond prior conceptualizations of risk taking as stemming from just one of these modes, with risk aversion having been understood as an outcome of experiential learning and risk seeking as an outcome of vicarious learning (Denrell and March, 2001; Denrell, 2003).

Our paper also makes a third contribution, this one to the field of serial entrepreneurship. In that field, research has paid particular attention to the origins of serial entrepreneurs. It suggests, for instance, that prior self-employment allows entrepreneurs to improve their capabilities, leading them to repeatedly try their hand at venture creation (Ucbasaran et al., 2009; Westhead and Wright, 2017) and that biases like comparative optimism and overconfidence drive entrepreneurs to become serial entrepreneurs (Hayward et al., 2010; Spivack et al., 2014). Yet an integral component of serial entrepreneurship, the actual transitions between self- and wage-employment, has received comparably less attention. We contribute by developing a model that explicitly addresses these transitions. This allows us to move the focus away from analyzing self-employment as status—an emphasis that also aligns with recent developments to view entrepreneurship as a transient state rather than an absorbing one (Burton et al., 2016).

We set up the remainder of the paper as follows: We next provide some conceptual background on our learning model and its application to entrepreneurship. We then develop a formal model. Subsequently, we employ a computational simulation that allows us to examine the learning dynamics and risk-taking patterns that result from experiential and vicarious learning interplaying. After that, we discuss results and offer concluding thoughts.

2 Conceptual background

2.1 Performance feedback and the interplay of experiential and vicarious learning

Performance feedback theory—a cornerstone in theories of behavioral decision making in the Carnegie perspective—suggests that as decision makers chart their course of action, they are influenced by how the performance outcomes of their prior choices compare to their aspiration levels, i.e., the reference points that separate satisfactory outcomes from unsatisfactory ones (e.g., Cyert and March, 1963; Bromiley, 1991; March and Shapira, 1992; Greve, 1995; Miller and Chen, 2004). Outcomes near aspiration levels stimulate exploitative behaviors, i.e., local search within known alternatives, whereas outcomes that fall below aspiration levels foster nonlocal exploration (e.g., Greve, 2003).

Organizational learning scholars in the Carnegie perspective have applied these insights to shed light on how experiential and vicarious learning may interplay. Baum and Dahlin (2007), for instance, employ a performance feedback logic when explaining patterns of learning in the context of railroads' learning from train accidents. Interpreting vicarious learning as nonlocal explorative search and experiential learning as local exploitative search, they theorize and find that decision makers emphasize experiential learning when performing near aspirations levels and that these decision makers switch to vicarious learning subsequent to unsatisfactory performance outcomes. Schwab (2007) finds similar patterns when examining how experiential and vicarious learning shape baseball teams' incremental adjustments to previously adopted farm-team systems. He shows that satisfactory performance outcomes lead teams to rely on experiential learning for adjusting farm-team sizes while unsatisfactory outcomes lead to adjustments based upon vicariously learned sizes of others' farm-team systems. Schwab argues that this learning-mode interplay comes about as "negative performance feedback may lead an organization to question both its ability to master the innovative practice and its ability to learn from its own performance. Such

uncertainty may lead organizations to rely more on simple vicarious information" (Schwab, 2007, p. 247). Clough and Piezunka (2020) find corresponding learning patterns in the context of Formula One car builders making decisions regarding buyer–supplier relationships. Finally, Aranda et al. (2017) document a similar mechanism in the context of organizational goal setting. These authors find that when setting targets, unfavorable performance weakens the organizational unit's reliance on its past performance; in effect, the unit relies less on experiential learning. Similar to the other studies, Aranda et al. (2017, p. 1194) argue that this comes about because "failures question existing assumptions about cause–effect relationships, which forces organizations into non-local searches… Learning from failure leads to a focus on outside organizations' performance."

As the above studies suggest, underlying the notion of decision makers engaging in vicarious learning in response to disappointing experiences is the idea that unexpectedly poor outcomes can lead to reflection and further information search. Generally, decision makers pursue a certain course of action because they believe it to be valuable. As a result, a disappointing outcome may be met with doubt — "maybe this is due to improper implementation or a random influence?" — causing decision makers to turn to others to see how their course of action has fared for them, and using this vicariously learned information to determine their next step. This is consistent with decision makers being skeptical of information that diverges from initial expectations (Levine, 1971) and also with research that performance failures represent one source of uncertainty that stimulates reliance on vicarious learning (Baum and Berta, 1999).

2.2 Experiential and vicarious learning in entrepreneurship

Research in entrepreneurship has highlighted that both experiential learning (Rerup, 2005; Politis, 2008; Fan et al., 2021) and vicarious learning play critical roles in shaping entrepreneurial activity (Sorenson and Audia, 2000; Nanda and Sørensen, 2010; Qin and Estrin, 2015). Experiential learning takes center stage when scholars model entrepreneurial abilities as a capability that develops with accumulating entrepreneurship experiences (Politis, 2005; Holcomb et al., 2009). Experiential learning also is central in studies examining the specific decision point to enter into or exit from self-employment (Plehn-Dujowich, 2010; Carbonara et al., 2020). Experience with their occupational choice allows entrepreneurs to learn about the payoffs associated with that choice. Armed with this knowledge, they compare these payoffs with what they aspire to earn or with what they could earn in a different choice (Gimeno et al., 1997). Subsequent choices—whether it is continuation in the current venture, exit to create a different venture, or exit to enter wage-employment—are based on this comparison, with transitions occurring when decision makers' payoffs fall below desired thresholds (Gimeno et al., 1997; Plehn-Dujowich, 2009; Åstebro et al., 2011).

Vicarious learning similarly matters in driving entrepreneurial activity. Nikolaev and Wood (2018) argue that vicarious learning is a particularly useful strategy in the context of entrepreneurship because outcomes in this realm are uncertain, and trial-and-error processes are costly. Exiting wage-employment to give entrepreneurship a try can be a risky and involved proposition—it implies forgoing a stable income in favor of a new, risky venture that may face a failure rate of up to 90% (Patel, 2015). Looking to the experiences of others can provide at least some information for comparing alternatives without engaging in this costly trial-and-error process. In line with this, scholars find that exposure to peers that engage in entrepreneurship, or even mere observation of regionally proximate entrepreneurs, affect an observer's entry into self-employment by shaping that observer's confidence and career aspirations, and by providing information on road-maps, needed capabilities, and likely outcomes (Sorenson and Audia, 2000; Giannetti and Simonov, 2009; Lerner and Malmendier, 2013; Qin and Estrin, 2015; Nikolaev and Wood, 2018). Vicarious learning can also shape the reverse transitions from entrepreneurship into wage-employment. In their study on serial entrepreneurship, Nielsen and Sarasvathy (2016, p. 263) point out that entrepreneurs may not know how payoffs would change if they transitioned into wage-employment. Faced with this payoff uncertainty, it is plausible that entrepreneurs look to the experiences of their wage-employed peers and consider this vicariously learned information when making their next move. The notion that vicarious learning matters for both the transition into *and* out of self-employment is echoed in studies on how pay comparisons affect moves across a variety of occupational choices (Hartog et al., 2010; Carnahan et al., 2012).

2.3 Performance feedback, learning modes, and entrepreneurship

An intriguing possibility arises when we combine the evidence of entrepreneurs relying on both experiential and vicarious learning with insights from the Carnegie perspective on how performance feedback may govern the interplay between these two learning modes. Combining these lines of thought suggests that a failed venture experience—in effect, a disappointing outcome of a risky alternative—does not necessarily trigger a transition from self-employment into low-risk wage-employment. As prior research implies, if the decision maker solely relied on experiential learning, such a transition would be inevitable because adaptive learning would result in the entrepreneur choosing low-risk wage-employment in an effort to avoid future failure experiences. Yet if a disappointing payoff leads the entrepreneur to reflect and question—*I wonder if this was simply bad luck rather than an indication that entrepreneurship is an inherently poor choice? How have others fared with their ventures? And what are other options?*—exit is no longer a foregone conclusion. This is because as the entrepreneur's doubts lead them to learn from the experiences of others, similar to how disappointing outcomes in the above railroad and baseball team examples led to vicarious learning, their next steps will be shaped by what they observe. A transition into low-risk wage-employment can still be a possible result but so is continuation in high-risk self-employment.

This similarly applies to the transition from wage-employment to self-employment. In their study on serial entrepreneurship, Spivack et al. (2014, p. 657) provide a quote from a study object who, reflecting on his repeated transition from wage- into self-employment, states that his infatuation with entrepreneurship returns as he engages with wage-employment and as "I get discontent (…) and look for something." This comment echoes the notion that a poor payoff or dissatisfaction with a current choice motivates outward looking for figuring out next steps. Once such vicarious learning occurs, discontent with wage-employment no longer inevitably leads into

self-employment. Instead, depending on what the entrepreneur observes, they may choose to continue in wage-employment for a while longer.

In what follows, we develop a formal model and employ a computational simulation to examine these learning dynamics and their outcomes more systematically.

3 Model

3.1 Background

We build on existing models of adaptive learning to formalize the choice between a risky and non-risky alternative as the result of decision makers learning experientially and vicariously (Denrell and March, 2001; Burgos, 2002; Oyarzun and Sarin, 2013). Hereafter, in accordance with us using serial entrepreneurship to illustrate our conceptualization, we use self- and wage-employment to denote risky and non-risky options, respectively. The basic model on which we build is Denrell and March (2001)'s experiential learning model. It assumes a single decision maker who chooses between a risky alternative and a non-risky one. In every period, the decision maker receives performance feedback. This feedback shapes their choice for the next period. We modify this structure to include multiple decision makers that engage in both experiential learning and vicarious learning as they select into the risky alternative (self-employment) versus the non-risky alternative (wage-employment). Our model consists of four main components: the choice between a risky- and non-risky option, payoff outcome, aspiration level, and the experiential and vicarious learning processes.

3.2 Self- and wage-employment as risk taking behaviors

In each period, each decision maker chooses between self- and wage-employment. For instance, a decision maker selects into self-employment with probability p and into wage-employment with probability 1-p. We use r to denote the case of choosing self-employment; r follows the Bernoulli distribution with probability p, i.e., $\Pr(r=1)=p$. To introduce vicarious learning, we assume that there are multiple decision makers and multiple periods; p_{it} denotes decision maker i's probability of choosing self-employment at time t. We set the initial probability of choosing self-employment at 0.5 such that at the outset of the simulation, a decision maker selects into self-employment with the same likelihood as they select into wage-employment.

3.3 Payoff outcome

Decision maker i's payoff outcome in time t is denoted by O_{it}. Our payoff captures not only monetary outcomes earned by an entrepreneur (Wright et al., 1997; Westhead and Wright, 1998) but also non-monetary utility in general. Payoff outcome is a random draw from a normal distribution. For wage-employment, the draw is from a normal distribution with a mean of Y and a standard deviation of zero. For self-employment, it is from a normal distribution with a mean of X and a standard deviation of S. Following Denrell and March's (2001), and in line with Åstebro et al. (2011, p. 2015) that "the empirical literature has repeatedly revealed that self-employment earnings exhibit greater variation than wage earnings, but do not offer higher average earnings in compensation," we set $X=Y=10$, and $S=10$. In later robustness checks, we vary these parameters and also experiment with drawing outcomes from a Beta distribution to model an alternative representation of the occasional extremely high or low payoffs associated with self-employment.

3.4 Aspiration level

The probability of decision maker i choosing self-employment versus wage-employment at time $t+1$ is influenced by the decision maker comparing the payoff outcomes from their choice at time t with their aspiration levels. Following prior performance feedback studies and research on organizational turnover, decision makers determine their aspiration levels based on their prior payoffs (historical aspiration) or a mix of these own payoffs and those received by others (mixed aspiration) (Cyert and March, 1963; Levinthal and March, 1981; Greve, 2003; Trevor and Wazeter, 2006; Carnahan et al., 2012). Decision maker i's historical aspiration at time t, LH_{it}, is determined by a weighted average of their previous historical aspiration level $LH_{i,t-1}$ and their most recent payoff outcome:

$$LH_{it} = LH_{i,t-1}(1-b) + O_{i,t-1}b \tag{1}$$

where b represents a non-negative fraction denoting the weight given to the most recent outcome $O_{i,t-1}$.

Decision maker i's mixed aspiration level at time t, LM_{it}, is composed of LH_{it} and their social aspiration level at time t, LS_{it}. LS_{it} is computed as the mean of all decision makers' payoffs excluding that of the focal decision maker.

$$LS_{it} = \frac{1}{N-1}\sum_{j\neq i} O_{j,t-1} \tag{2}$$

where j denotes other decision makers, $O_{j,t-1}$ the outcomes of all others at time $t-1$, and N the total number of decision makers. We then compute LM_{it}, as a weighted average, with c denoting the weight given to the social aspiration:

$$LM_{it} = (1-c)LH_{it} + cLS_{it} \tag{3}$$

We initially set aspiration levels at 10 and $b=c=0.5$ (Denrell and March, 2001).

3.5 Experiential and vicarious learning

In each period, the payoffs of decision maker i's choice can exceed, be sufficiently close,[3] or fall short of their aspiration level. When payoffs exceed aspirations, the probability that decision maker i selects

3 We say payoff and aspiration level are sufficiently close when the absolute difference is less than 1×10^{-4}.

that same choice again in $t+1$ increases (and the probability for the alternative choice decreases). For example, the choice of self-employment followed by above-aspiration payoffs at time t increases the probability of choosing self-employment in $t+1$ and decreases the probability for wage-employment. This upward updating p is formalized as:

$$p_{i,t+1} = p_{it} + a\left(1 - p_{it}\right) \tag{4}$$

where a is a positive fraction that captures the speed of learning. The larger the value of a, the stronger the effect of a single experience on the subsequent probability of choosing self-employment. We initially set $a = 0.4$ (Denrell and March, 2001). When the choice of wage-employment is followed by an above-aspiration outcome in t, the probability of decision maker i choosing wage-employment in $t+1$ increases, and the probability for self-employment decreases. This downward updating of p is formalized as:

$$p_{i,t+1} = \left(1 - a\right) p_{it} \tag{5}$$

For the case when realized payoffs in t are sufficiently close to the aspiration level in t, p_{it} remains unchanged for $t+1$ (Denrell and March, 2001).

The last case is one where realized payoffs fall short of decision maker i's aspirations. This triggers vicarious learning such that decision maker i makes their choice in $t+1$ based on decision maker j's experience in t. Put differently, when decision maker i learns vicariously, it is no longer the comparison of decision maker i's payoffs with their aspirations that determines whether $p_{i,t+1}$ is governed by equation (4) or (5). Instead, it is decision maker j's experience that determines which of the two equations governs $p_{i,t+1}$. In Figure 1, we provide a schematic illustration of this process.

Starting at the top of Figure 1, consider the case where decision maker i selects into self-employment at time t and receives above-aspiration payoffs. This increases the probability for decision maker i to re-select into self-employment in $t+1$. Now consider the case where decision maker i's venture generates below-aspiration payoffs. If decision maker i were to exclusively engage in experiential learning, this failure experience reduces the probability for them to re-select into self-employment and increase that of selecting into wage-employment. But in our model, below-aspiration payoffs lead decision maker i to look to the experience of decision maker j. How does this play out? If decision maker j also selected into self-employment and receives above-aspiration payoffs, the observation of decision maker j's success experience will lead decision maker i to interpret their own failure experience as an unlucky fluke. Accordingly, $p_{i,t+1}$ is updated following equation (4), as if decision maker i's own experience had been a success, and the probability of them re-selecting into self-employment in $t+1$ increases. The situation differs if decision maker j's payoffs from self-employment are below aspirations. This observation leads decision maker i to conclude that entrepreneurship is not a satisfactory option after all. Decision maker i's probability of re-selecting into self-employment decreases and that of entering wage-employment increases. Instead of fully relying on j's experience, as we model here, it may be possible that i uses j's information partially or probabilistically. In a set of results not reported here, we found that our baseline results are consistent as long as the probability of using j's experience is above 0.5.

To illustrate further, consider the case where decision maker i receives unsatisfactory payoffs in self-employment and observes decision maker j to engage in wage-employment where they receive below-aspiration level payoffs as well. Decision maker j's unsatisfactory experience with wage-employment leads decision maker i to conclude that wage-employment is not a desirable choice either and, following equation (4), decision maker i's probability of giving self-employment another try increases. If, instead, decision maker j receives satisfactory payoffs, decision maker i sees wage-employment as an attractive option, leading their probability of choosing wage-employment to increase as spelled out in equation (5).

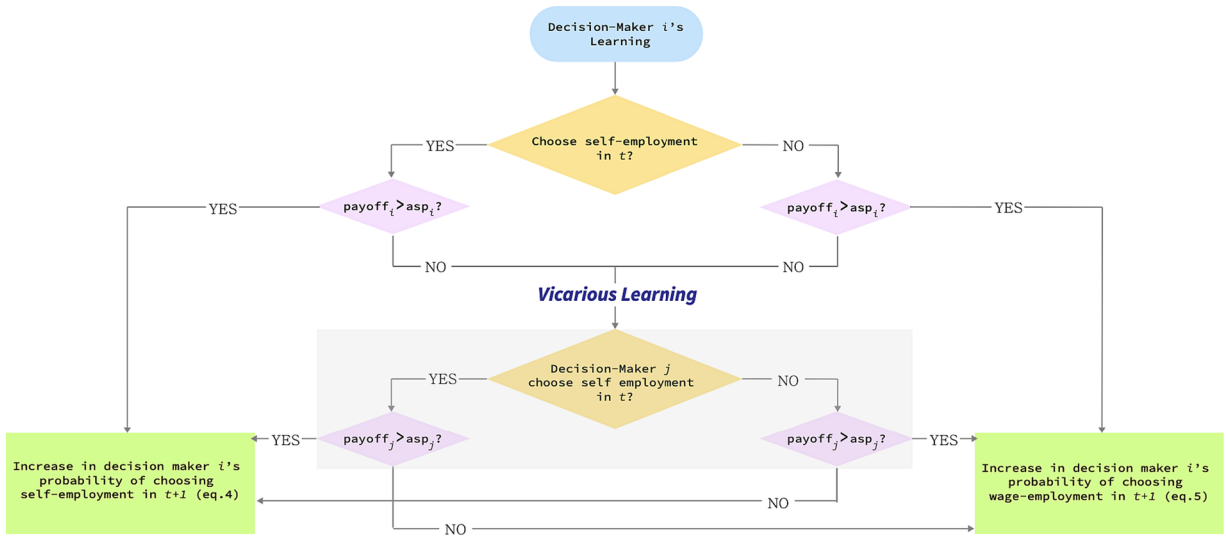


FIGURE 1
A visual representation of the learning process.

Lastly, what happens if decision maker *j*'s outcome is sufficiently close to their aspiration rather than exceeding or failing it? In that case, decision maker *j* reveals ambiguous information, leaving decision maker *i* unclear whether to interpret this outcome as success or failure. Alternatively, decision maker *i* may interpret this outcome as an unconvincing success since decision maker *j*'s choice appears to be merely a satisficing alternative with payoffs that meet, but do not exceed, aspiration levels. Following prior findings that decision makers reduce reliance vicarious learning when learning targets offer ambiguous or unconvincing information (Gaba and Terlaak, 2013), we model decision maker *i* to respond to this scenario by dismissing vicariously learned information and relying, instead, on their own outcome-experience in *t* to determine the course of action for $t+1$.

4 Simulation results

Results suggest that the interplay between experiential and vicarious learning centrally drives repeated transitions into and out of self- and wage-employment. For our least restrictive models—models that consider mixed aspiration levels and more than two decision makers—we find that out of 500 instances in which a transition back into self-employment could occur, the itch strikes in 138 of those, a rate of 27.6%. In our baseline models—models with historical aspiration levels in a two-actor setting—the entrepreneurial itch strikes less frequently. Nonetheless, we begin by presenting these baseline models because they most readily reveal the exact processes that underlie the recurrence of the entrepreneurial itch.

4.1 Intermittent risk taking

In our baseline models, the interplay between experiential and vicarious learning leads some entrepreneurs, though not all, to return into risk taking subsequent to engaging in the non-risky option. Figure 2A shows a single simulation run for this pattern. The decision maker for whom the itch strikes is denoted as decision maker *i* and the other as decision maker *j*. Shaded areas in Figure 2 indicate when a decision maker engages in self-employment, i.e., where $r=1$. Starting with a 50% probability of selecting into self-employment at the outset of the simulation, Figure 2A shows that decision maker *i* initially gives entrepreneurship a try, only to settle, seemingly for good, into wage-employment subsequent to period 25. A selection into the low-risk option aligns with adaptive learning where experiential learning from an occasional extreme failure experience with the risky option guides the decision maker to settle with the lower-risk option (Denrell and March, 2001; Burgos, 2002; Oyarzun and Sarin, 2013). Yet it plays out differently in our model: in Figure 2A, *p* sharply increases to nearly one around period 69, indicating that the decision maker is likely to return into self-employment for a while—the entrepreneurial itch has struck. The pattern in Figure 2A—i.e., the return into self-employment after a period in wage-employment—is representative of 12% of all baseline-model runs that start out with an initial selection into entrepreneurship.

In our baseline models, intermittent risk taking occurs one time only. Put differently, if risk taking recurs once, there are no other sharp increases in *p* for that decision maker within the next 2,000 periods. (We end the horizontal axis in Figure 2 at $t=150$ only to facilitate illustration). What is more, for any given run in which risk taking recurs, it only recurs for one of the two decision makers and never for both. Figure 2C depicts decision maker *j*'s pattern for the simulation run shown for decision maker *i* in Figure 2A. After the first wave of risk taking, decision maker *j* settles into wage-employment and remains there for the next 2,000 periods. This pattern—risk taking recurring for decision maker *i or j*, but not both—is representative of 100% of all baseline-model cases.

Figures 2B,D show averaged result of 500 independent simulation runs for decision maker *i* and *j*, respectively. Intermittent risk taking is less pronounced in this averaged presentation but notable as a small uptick in *p* after $t=50$. Of course, these averaged results understate the importance of recurring risk taking. Consider that only 50% of decision makers initially engage in the risky alternative, thereby setting the necessary stage for the itch to strike again at a later point. Also consider that not every initial entrepreneur re-engages in self-employment after settling into wage-employment, and that for those for whom the itch strikes, it strikes at different times. Ultimately, out of 500 independent simulation runs, risk taking recurs in 60 and 62 runs for decision maker *i* and *j*, respectively.

To clarify the role of the interplay of vicarious and experiential learning in the recurrence of risk taking, we compare our results with those from a model where decision makers solely learn experientially (Denrell and March, 2001). In such a model, a failure experience in self-employment reduces the probability of re-selecting into self-employment according to equation (5), and unsatisfactory payoffs in wage-employment reduce the probability for re-selecting into wage-employment according to equation (4).

Figure 2E shows a single simulation run for this experiential learning-only model. Mirroring the run shown in Figure 2A, a decision maker initially selects into self-employment. However, self-employment's confluence of the occasional high payoff that drives up aspirations and an eventual failure experience that does not meet these aspirations soon guides the decision maker into wage-employment, consistent with Denrell and March (2001). Unlike in our baseline model, the decision maker, once settled in wage-employment, does not re-select into self-employment at a later point. The pattern shown in Figure 2E is representative of 100% of runs. Averaged results for the experiential learning-only model, shown in Figure 2F, reflect this, with no noticeable uptick in *p* in later periods.

We use *t*-tests to examine whether the difference in the occurrence of intermittent risk taking between our model and the experiential learning-only model is statistically significant. We consider both the likelihood of recurring risk taking as well as each incident's duration. We capture re-engagement in self-employment to take place when *p* bounces back up to near one subsequent to having reached a point below 0.001. Duration is captured by the number of periods between the point of initial departure of *p* from below 0.001 and the time of return of *p* to below 0.001. Results, presented in Table 1 [Line (B)], show that our model of experiential and vicarious learning produces a statistically significant higher number of the entrepreneurial itch recurring than the experiential learning-only model (mean = 0.122 [61 cases], s.d. = 0.330 versus mean = 0.000 [0 cases], s.d. = 0.000, respectively).

Taken together, these results indicate that the interplay between experiential and vicarious learning is key for repeated transitions into and out of self-employment. Without vicarious learning, risk taking does not recur. Yet results also suggest that while this learning-mode interplay is central for the entrepreneurial itch to strike, it does not lead all entrepreneurs to reselect into self-employment. What, then,

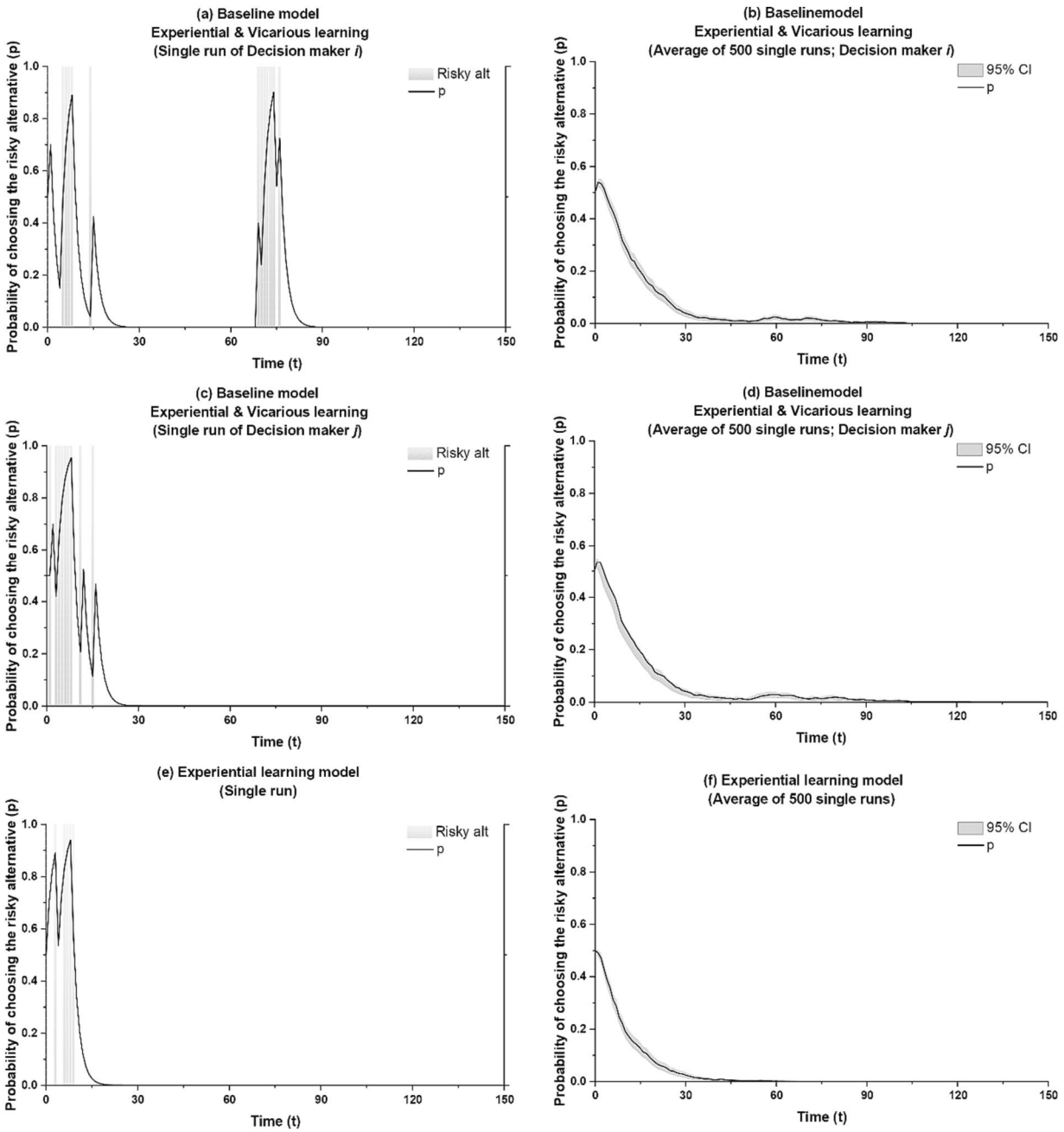


FIGURE 2
Emergence of recurring itches with vicarious learning. The shaded areas in **(a**,**c)** and **(e)** indicate actual risk-taking.

are the exact circumstances in which this learning interplay triggers the transition back into self-employment?

4.2 Dynamics of intermittent risk taking

Intermittent risk taking comes about as two circumstances converge: The first creates a situation where the focal decision maker, upon experiencing a failure in self-employment, has a learning target that contentedly engages in wage-employment. Through learning vicariously, this leads the focal decision maker to engage in wage-employment as well. The second circumstance makes for a situation where the learning target eventually becomes unconvincing, causing the focal decision maker to revert back to learning experientially and giving self-employment another try. We shed light on each circumstance below.

The first circumstance is a result of one decision maker, here decision maker *i,* experiencing an early success in self-employment whereas decision maker *j* experiences an early failure. For decision maker *i,* this success increases their aspirations. Of course, heightened aspirations increase the likelihood for a subsequent unsatisfactory outcome. This outcome leads decision maker *i* to question whether entrepreneurship is the right choice after all, and to look to decision maker *j* to inform their next step. As for decision maker *j*, their early failure in entrepreneurship lowered their aspirations. This increased the chances of satisfactory payoffs even if engaging in

TABLE 1 Differences in recurring itches between models (*t*-test).

	Likelihood of recurrence			Likelihood of recurrence (Both decision makers)			Duration		
	Mean	SD	*t*-statistics	Mean	SD	*t*-statistics	Mean	SD	*t*-statistics
(A) Experiential learning only	0.000	0.000							
(B) Baseline (Historical aspiration)	0.122	0.330	11.673*** (B) – (A)	0.000	0.000		20.033	8.632	
(C) Mixed aspiration	0.115	0.340	−0.467 (C) – (B)	0.648	0.482	30.294*** (C) – (B)	28.361	15.049	5.204*** (C) – (B)
(D) Four-actor historical aspiration	0.128	0.338	0.461 (D) – (B)				20.822	9.454	0.776 (D) – (B)
(E) Four-actor mixed aspiration	0.276	0.533	8.707*** (E) – (C)				49.065	37.979	5.564*** (E) – (C)

Likelihood of recurrence = number of recurring incidences/total number of independence simulation run. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

wage-employment, and their selection into wage-employment solidifies.[4] As decision maker *i* observes decision maker's *j* satisfaction in wage-employment, they transition into wage-employment as well.

What happens next? Absent the second circumstance, both decision makers tend to stay in wage-employment from here on out. But consider what happens if decision maker *j* becomes an unconvincing learning target. After following decision maker *j* into wage-employment, decision maker *i* continues to learn vicariously. This is because decision maker *i*'s initial entrepreneurial success increased their aspirations. These lingering aspirations outpace the payoffs from wage-employment, leading decision maker *i* to be continually uncertain about the right course of action and to learn from decision maker's *j* experiences. This keeps decision maker *i* in wage-employment as long as decision maker *j*'s experiences make wage-employment appear attractive. But this changes when decision maker *j*'s signal becomes ambiguous. As decision maker *i* observes that decision maker *j*'s payoffs are merely near aspirations, decision maker *j* becomes an unconvincing learning target: perhaps decision maker *j* has been pursuing wage-employment simply because this is what they have been doing in the past rather than because it is a truly satisfying option. With no other suitable target to learn from, decision maker *i* reverts back to learning experientially and relying on their own aspiration-outcome comparison to guide next steps. Since these aspirations are still higher than what wage-employment can deliver, decision maker *i* tries their hand at self-employment again—the entrepreneurial itch that drives the decision maker into intermittent risk taking is back.

For the above process to unfold, the timing at which wage-employment becomes but a satisficing option is important: in the above case, it needs to happen sooner for decision maker *j* than for decision maker *i*. This occurs quite frequently; all it requires is that decision maker *j*'s failure experience with entrepreneurship is less severe and earlier than decision maker *i*'s initial success experience. To elaborate more, we use Figure 3 which shows variations in aspiration levels of the two decision makers across time. Figures 3a,b are tied to the run shown in Figures 2a,b, with Figure 3a showing how decision maker *i*'s aspirations move along as the run from Figure 2a unfolds, and Figure 3b showing corresponding changes in decision maker *j*'s aspirations.

In Figures 3a,b, both decision makers' aspiration levels converge toward 10, but total convergence happens sooner for decision maker *j* (at $t = 68$) than decision maker *i* (at $t = 95$). To understand why this is, note that in the run shown in Figures 3a,b, decision maker *i* had a success event that occurred a bit later and was more extreme than the initial failure event experienced by decision maker *j*. With aspirations adapting at the same rate for both decision makers, this results in a situation where total convergence between aspirations and expected outcomes occurs sooner for decision maker *j* than for decision maker *i*. Specifically, in period 68, decision maker *i* observes that for decision maker *j*, wage-employment has become a satisficing option with payoffs merely meeting aspirations. At that time, decision maker *i*'s aspirations still outpace the payoffs from wage-employment. It is this precise combination of decision maker *j* revealing ambiguous information about the attractiveness of wage-employment and decision maker *i* finding that its payoffs still fail to meet their own aspirations that prompt them to give entrepreneurship another try.

4.3 Extended model with mixed aspirations

Results so far suggest that intermittent risk taking occurs when decision makers engage in an interplay between experiential and vicarious learning, and, further, when initial failure and success experiences align such that the appeal of wage-employment, as signaled by decision maker *j*, becomes unconvincing prior to decision maker *i* fully resigning themselves to wage-employment as a satisficing choice. We next explore how the frequency of this confluence of events changes when decision makers form their aspirations not only based on their own experiences but also the experiences of others, as spelled out in equation (3).

When we account for mixed aspirations, intermittent risk taking can occur for both decision maker *i and j* in a given run, rather than just one of them. This comes about because decision maker *j*, subsequent to their initial entrepreneurial failure and selection into wage-employment, now incorporates decision maker *i*'s early entrepreneurial success when forming their own aspirations. Since this will upward-adjust decision maker *j*'s aspirations, these aspirations begin to outpace wage-employment's payoffs. This prompts decision maker *j* to learn vicariously from decision maker *i*, who, at that point, is happily engaged in self-employment. As a result, decision maker *j* re-selects into entrepreneurship as well.

Figure 4 illustrates these results. Similar to Figures 2a–c, it shows individual simulation runs. Yet different to Figures 2a–c, it shows the

4 Our models are probabilistic. Thus, while decision maker *j*, in response to their early entrepreneurial failure, learns vicariously from decision maker's *i* entrepreneurial success, and while this increases p_{jt+1}, there still is a chance that decision maker *j* engages in wage-employment in $t+1$. When this happens, their lowered aspirations make the payoffs of wage-employment satisfactory, causing decision maker *j* to settle into this selection.

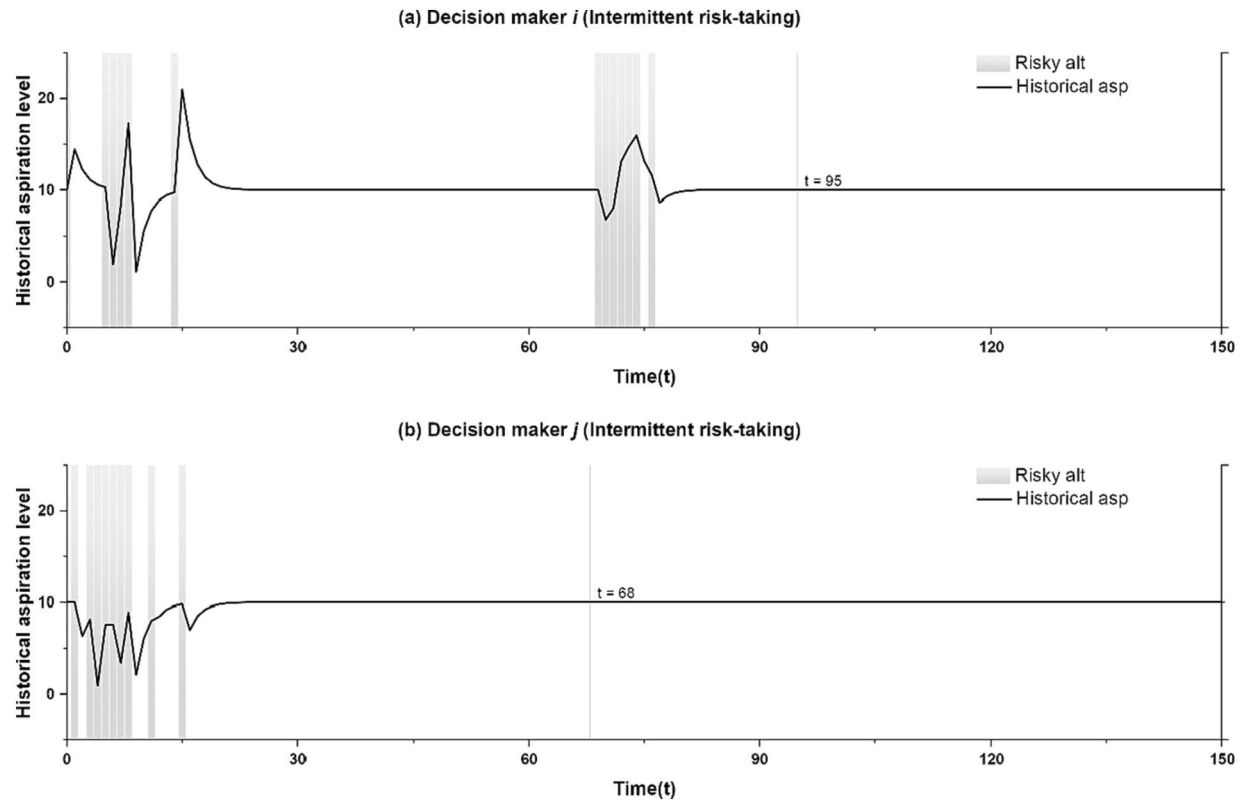


FIGURE 3
The role of aspiration in generating recurring itches. The shaded areas in **(a,b)** indicate actual risk-taking.

probability of the two decision makers selecting into self-employment across time. Figure 4a shows a run from our baseline model with historical aspiration levels, with risk taking recurring to only one of the decision makers (in this case, decision maker *i*). Figure 4b shows a run from a model with mixed aspiration levels. Here, the pattern of the itch striking both decision makers in the same run is representative of 44% of all runs in which the itch strikes.

We conduct *t*-tests to analyze statistically how the recurrence of risk taking differs between the baseline model and mixed aspirations model. Results, presented in Table 1 [Line (C)], show that the total number of times with which risk taking recurs is not significantly different between the two models. However, the likelihood of *both* decision makers re-selecting into self-employment is significantly higher in the mixed aspirations model than the baseline model (mean = 0.648 [35 cases], s.d. = 0.482 versus mean = 0.000 [0 cases], s.d. = 0.000, respectively). What is more, in the mixed-aspirations model, decision makers re-engage in self-employment for significantly longer than in the baseline case (mean = 28.361 per risk taking, s.d. = 15.049 versus mean = 20.033 per risk taking, s.d. = 8.632, respectively).

4.4 Extended model with multiple decision makers

As a final model iteration, we increase the number of decision makers beyond two. We assume that when decision makers learn vicariously subsequent to an unsatisfactory outcome, they select their learning target through a tournament selection mechanism whereby a subset of *m* decision makers is randomly chosen from the population of *N* (Posen et al., 2013). The learner compares the payoffs of these randomly chosen decision makers and selects the decision maker with the highest payoff as learning target. After this selection process, the learner follows the vicarious learning rule specified earlier. To capture the net effect of increasing the number of decision makers, we initially set $m = 1$ and $N = 4$. With $m = 1$, the selection process is random, allowing us to attribute differences in this case to the increase in population from two to four. We vary the value of *N* in later robustness checks. In Figure 5, we report typical runs from the four decision maker-model as compared to the two decision maker-model with historical aspirations (Figure 5a) and mixed aspirations (Figure 5b).

We find that in the four decision maker-model with mixed aspiration levels, intermittent risk taking becomes very pronounced, both in terms of the number of times decision makers return into self-employment as well as how long they stay with this selection. Of all cases in which intermittent risk taking occurred at least once (in our analysis, this is in 138 out of 500 instances), risk taking recurs at least once in 73.96% of these cases, and more than once in 26.04% of cases.

How does this difference come about? Recall that in the baseline model, the entrepreneurial itch struck and risk taking recurred to decision maker *i* as decision maker *j*'s signal about the attractiveness of wage-employment became ambiguous. This prompted decision maker *i* to reckon with their own aspirations still outpacing the payoffs of wage-employment, leading them to give self-employment another try. Yet in the baseline model, the entrepreneurial itch was a one-time occurrence: because decision maker *j* had become an unviable learning target, decision maker *i* learned only experientially from that point onwards. This exclusive reliance on experiential learning eventually led the decision maker to select into wage-employment for

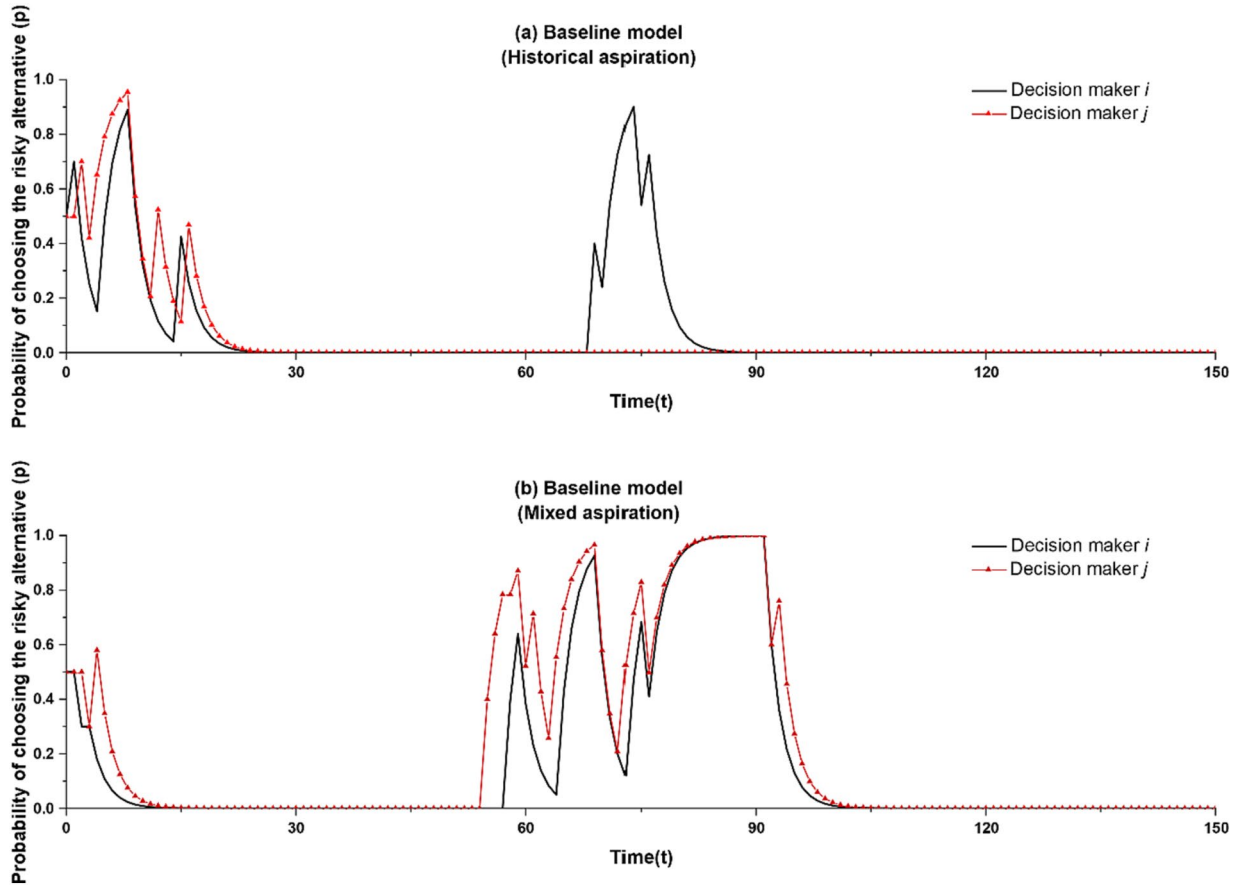


FIGURE 4
(a) and **(b)** illustrate intermittent risk-taking with historical and mixed aspiration, respectively.

good. This is where the multiple decision maker-model differs: decision maker *i*, subsequent to their second bout with entrepreneurship, can choose alternative learning targets, thereby restarting the process that led to the initial recurrence of the itch.

We conduct *t*-tests to examine statistical differences in the results of the two models. Table 1 [Line (E)] shows that the model with four actors and mixed aspirations produces significantly more returns into self-employment (mean = 0.115 [57.5 cases], s.d. = 0.340 for the two-actor model versus mean = 0.276 [138 cases], s.d. = 0.533 for the four-actor model). The self-employment bouts are also of greater duration (mean = 28.361 per risk taking, s.d. = 15.049 for the two-actor model versus mean = 49.065 per risk taking, s.d. = 37.979 for the four-actor model). However, when we consider historical aspirations in the four-actor model [Line (D)], the four- versus two-actor models generate a similar number of recurrences (with mean = 0.122 [61 cases], s.d. = 0.330 for the two-actor model versus mean = 0.128 [64 cases], s.d. = 0.338 for the four-actor model). There also is no significant difference in the duration of the risk taking (with mean = 20.033, s.d. = 8.632 for the two-actor model versus mean = 20.822, s.d. = 9.454 for the multi-actor model).

4.5 Sensitivity analysis

We examine the sensitivity of our results to changes in parameter values and the rules governing vicarious learning. As for altering parameters, we vary the speed of learning (parameter *a*), the rate with which aspirations adapt to outcomes (parameter *b*), and the weight given to others' aspirations when decision makers use mixed aspirations (parameter *c*). As one might expect, when learning is very slow ($a = 0.1$), p adapts very slowly, and the switch between self-employment and wage-employment becomes rare. In effect, very slow learning results in decision makers sticking with their initial choice, thereby limiting the opportunity for the itch to strike. Yet beyond this, results are robust across a considerable range of values for *b* and *c*, with any differences in timing or degree of the entrepreneurial itch being too minor to qualitatively affect results.

We also vary *m*, the size of the sub-sample for tournament selection. We find that as the sub-sample for the tournament selection increases, the general tendency to select into self-employment increases, thereby limiting the recurrences of risk taking. In other words, intermittent risk taking occurs less frequently because decision makers display a more general and prevailing tendency to engage in self-employment—the itch cannot recur as much because it does not go away as often in the first place. A primary driver for this is the tournament selection mechanism whereby decision makers vicariously learn from the best performing learning target in the chosen sub-sample. In our model, these high performers are successful entrepreneurs. As their success with self-employment promotes entrepreneurship to those that learn vicariously, a population-level propensity to select

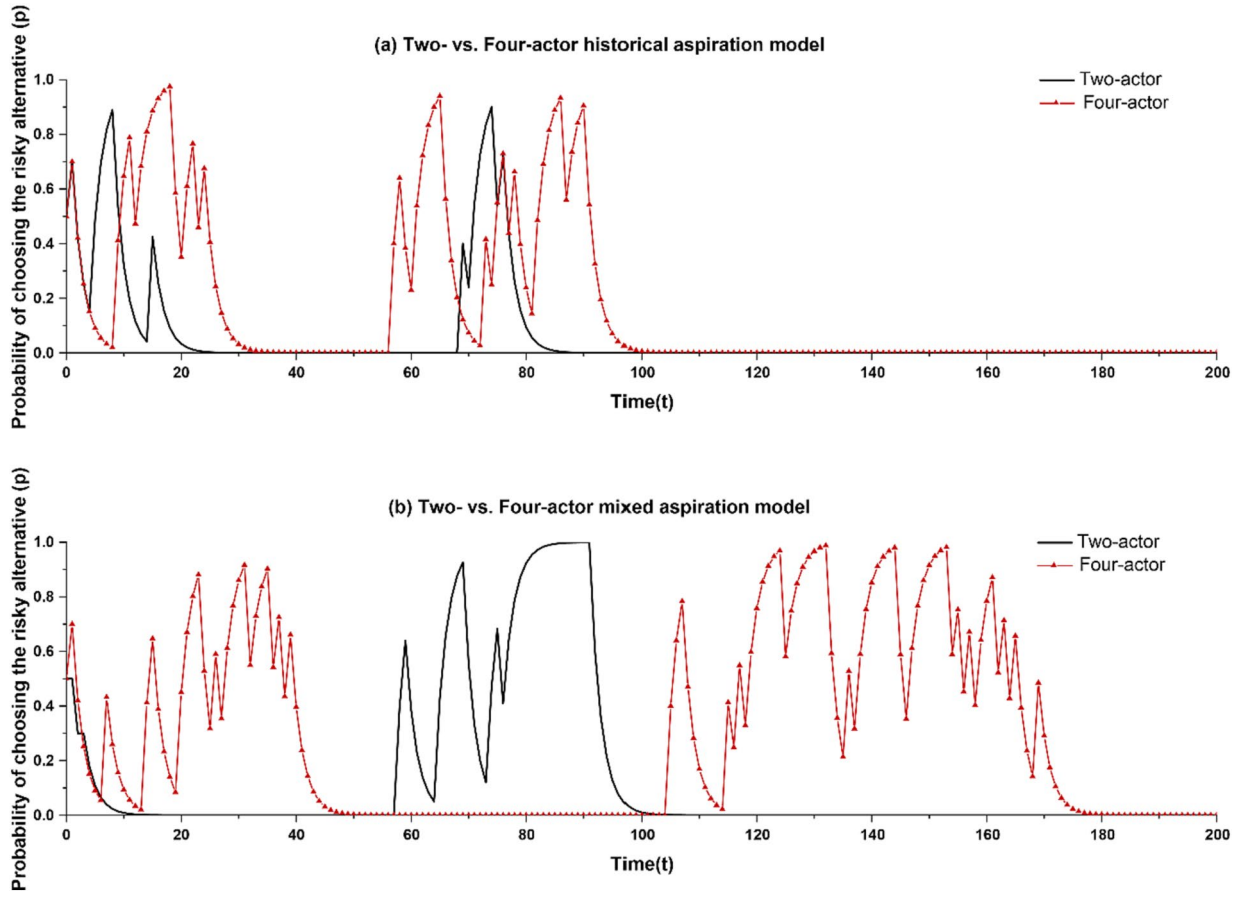


FIGURE 5
Comparison between two-actor and four-actor models. The two-actor models in **(a,b)** correspond to the baseline model and the mixed aspiration model, respectively.

into self-employment emerges. As this selection prevails, a prerequisite for intermittent risk taking—near-convergence of p to 0—occurs less often. We also vary N, the number of decision-makers in the population, to 5, 7, and 9. In all cases, we found significantly higher likelihoods of recurring risk taking with longer duration than in models that consider only experiential learning.

A final modification in parameter values relates to assigning each decision maker a randomly drawn value for p, with all values coming from within the range of 0.1 to 0.9 (i.e., $p_{t=0} = 0.1 \sim 0.9$). No major difference in results emerges as a result of this modification.

We also experiment with payoff distributions other than the normal distribution. There is a high rate of failed startups and extremely few ventures that become "unicorns," implying that payoff distributions may be skewed with a significant probability mass on the left side. To account for this, we adopt a beta distribution that follows this tendency. We keep the mean and the standard deviation at 10. Under this alternative characterization of self-employment payoffs, in both historical- and mixed-aspiration cases, the entrepreneurial itch recurs similarly to how it does in the results from models using the normal distribution.

Lastly, we test the robustness of our results to changes in the vicarious learning process. In our model, decision makers cease to learn vicariously when the learning target's payoffs equal their aspirations. When observed payoffs neither exceed nor fall below aspiration levels, revealed information becomes ambiguous, making it difficult for the observer to conclude whether the focal alternative is attractive. Research suggests that when learning targets reveal such ambiguous information, decision makers reduce their reliance on vicarious learning (Gaba and Terlaak, 2013). It also is plausible that the observer stops learning vicariously because while payoffs may still be satisficing, they insufficiently endorse the focal alternative and hence are unconvincing. This pathway is different from the first: it is not about ambiguity but about the observer deciding that an alternative that generates but satisficing payoffs is not worth pursuing. Testing the sensitivity of our results to changes in this learning rule shows that our results require that decision makers assess an alternative as attractive only when its payoffs exceed aspirations and not when its payoffs meet aspirations.

We also explore if results are sensitive to the assumption that when learning vicariously, decision makers rely entirely on their learning target's experience for informing their own course of action. As an alternative, we model the focal decision maker's reliance on the learning target's information to be governed by a randomly assigned probability between 0 and 1. Results for this case are qualitatively similar to the ones we report here.

5 Discussion

The antecedents and consequences of risk taking in organizational life is a central area of inquiry in the Carnegie perspective (Cyert and March, 1963). In this study, we draw on organizational learning literature and use the context of entrepreneurship to develop a computational model that illuminates the mechanisms that can underlie time-varying risk taking tendency. In particular, we delineate conditions under which abrupt risk taking punctuates periods of risk-avoiding behaviors, a pattern that we call "intermittent risk taking." We use serial entrepreneurs whose bouts with risk taking are often depicted as driven by an "entrepreneurial itch" to illustrate our model. Reflecting on their repeated move between self- and wage-employment, one entrepreneur in Spivack et al.'s (2014, p. 657) study explains that "when I close down a venture for whatever reason, if it fails or just misses the mark and I go back to the corporate world, […] it does not last long. After 2 years, I'm just itching to do something else and it shows on my resume." We have shed light on learning mechanisms that can explain this pattern of entrepreneurs repeatedly moving back and forth between risky and non-risky alternatives, and, further, have examined the exact circumstances under which the itch for risk taking recurs.

Using a computational model that conceptualizes decision makers to chart their course by learning from their own experiences as well as those of others, and using our serial entrepreneurship illustration, the following storyline emerges. The repeated switch between self-employment and wage-employment, i.e., intermittent risk taking, comes about as an entrepreneur, primed by early success in venture creation, develops too high expectations about the payoffs that entrepreneurship can consistently deliver. Once disillusioned, this entrepreneur looks to their peers who, after initial failures in venture creation, found success in wage-employment. Encouraged by this observation, the entrepreneur engages in wage-employment as well. Yet over time, these peers become less convincing as they begin to pursue wage-employment as a satisficing option, rather than one that is truly fulfilling. Absent any observations that make wage-employment unambiguously attractive, and with their early venture success having left a lingering expectation that payoffs should be higher than what wage-employment can deliver, the entrepreneur gives venture creation another try. The entrepreneurial itch is back.

This mechanism for intermittent risk taking has a number of implications for research on varying risk taking preferences, serial entrepreneurship, and theories of organizational learning generally.

5.1 Risk taking and organizational learning

Our model of adaptive learning driving the selection into high-risk self-employment versus low-risk wage-employment builds on prior conceptualization of organizational learning and risk taking in the Carnegie perspective (Cyert and March, 1963; Denrell and March, 2001; Denrell, 2008; Oyarzun and Sarin, 2013). Prior work in this perspective elucidates that experiential learning fosters a bias against risk. This bias comes about because risky alternatives have extreme outcomes, both good and bad, with the eventual bad outcome prompting decision makers to shy away from subsequent risks (March, 1996; Denrell and March, 2001). Vicarious learning is associated with an opposite, risk-seeking bias. When learning vicariously, decision makers often learn from samples that are biased toward observations that are enjoying success with risky alternatives, thereby prompting observers to become risk seeking as well (Denrell, 2003). Vicarious learning can also attenuate, though typically not overturn, the bias against risk that emerges from experiential learning since it can enable decision makers to access information about foregone outcomes from the risky alternative (Denrell and Le Mens, 2007; Smith and Collins, 2009).

When contemplating how risk taking may then unfold when the two learning modes interplay, a reasonable ex-ante expectation would be that experiential learning will drive decision makers into the low-risk alternative, only for vicarious learning to subsequently pull them back into the high-risk choice. But this is not what our results suggest, at least not in the context of serial entrepreneurship. To be sure, results do show that vicarious learning is instrumental for the repeated selection into the high-risk choice, i.e., venture creation—there was no evidence of such intermittent risk taking when decision makers engaged in experiential learning only. Yet rather than prompting a return into the risky choice by having entrepreneurs observe a lopsided sample of successful risk takers, it prompted this return as the focal entrepreneur observed that for others, the low-risk option (wage-employment) was merely a satisficing option, rather than a fulfilling one. This suggests some interesting avenues for future research: it hints that once we allow for different learning modes to interplay, each individual mode may drive risk taking in ways that are more nuanced than what studies that examine each learning mode in isolation have shown.

5.2 Interplay of experiential and vicarious learning

Prior entrepreneurship research has heavily drawn on theories of organizational learning to explain both occurrence and success of entrepreneurial activity (e.g., Corbett, 2005; Lumpkin and Lichtenstein, 2005; Rerup, 2005). Yet for the most part, this research has emphasized one learning mode over the other (see Lévesque et al., 2009 for an exception) and has left underexplored how these learning modes can interplay to affect entrepreneurship. We have drawn on organizational learning studies from the Carnegie perspective (and from outside the entrepreneurship realm) to address this gap. Building on conceptualizations by Baum and Dahlin (2007) and Schwab (2007), we model decision makers to engage in experiential learning when performance outcomes exceed aspirations and in vicarious learning when they fall below aspirations. Two implications emerge: First, accounting for decision makers to engage in a combination of learning modes can explicate patterns of entrepreneurship and risk taking that are difficult to explain by either learning mode alone. With experiential learning leading to risk aversion (and hence the eventual abandonment of high-risk choices) and vicarious learning encouraging risk seeking, it is unclear that either learning mode can fully explicate phenomena that involve repeated switches between high- and low-risk options. While we have focused on how a learning mode combination can drive the repeated switch between self- and wage-employment, future research could explore how such a combination can account for other entrepreneurial behaviors with varying risk taking tendencies.

A second implication relates to the importance of the mechanism that governs the interplay between learning modes. In our study, this

mechanism centrally influences results, thereby highlighting the importance of analyzing what the effects of other governing rules might be. The mechanism in our model rests on the notion that disappointing experiences seed doubt about the appropriate path to pursue, thus prompting a reliance on learning from others (Baum and Dahlin, 2007; Schwab, 2007; Aranda et al., 2017; Clough and Piezunka, 2020). Yet there may be alternative ways in which the learning modes interplay. We hope that future studies will explore these ways and their effects on behaviors.

5.3 Implications for entrepreneurship

Entrepreneurship is often not a lifelong commitment. Instead, it frequently involves transitions between self-employment and wage-employment (Koch et al., 2021; Feng et al., 2022). Our research both complements and extends existing insights into shifting patterns in entrepreneurial careers by suggesting a mechanism that elucidates when and why these transitions occur. Our computational results are similar to empirical patterns that capture "mixed self-employment career patterns" (Koch et al., 2021, p. 8). In our simulated scenario with multiple decision makers, we found 28% of decision makers to transition between self- and wage-employment; in their empirical analysis, Koch et al. (2021) show such a pattern for 33% of their sample. This alignment between empirical and computational findings lends confidence in applying our mechanism to understanding the recurrent risk taking inherent in serial entrepreneurship.

Our findings hint that the pursuit of entrepreneurship can come about simply because it is the next-best option. In other words, decision makers may (re)engage in self-employment not because they discover an opportunity or an opportunity presents itself, as stressed by studies exploring opportunity-led entrepreneurship (Baron and Ensley, 2006; Aparicio et al., 2016), and also not because they perceive self-employment as the occupation that offers higher expected payoffs, as other studies emphasize (e.g., Holmes and Schmitz, 1990; De Wit, 1993). Instead, (re)engagement in entrepreneurship comes about as decision makers fail to discover wage-employment to be a satisfactory alternative.[5] This speaks to the literature on necessity entrepreneurship, and, specifically, to recent conceptualizations of necessity entrepreneurship as lying along a continuum of needs. On one end of this continuum, decision makers engage in entrepreneurship because they lack other options to meet basic needs whereas on the other end, they pursue entrepreneurship as a means of fulfilling higher-level needs (Coffman and Sunny, 2021; Dencker et al., 2021). Our study addresses the middle ground between these two ends: we propose that decision makers engage in self-employment as a next-best option simply because it is expected to better meet their aspirations than wage-employment. As future studies further investigate the drivers of this type of entrepreneurship, it will be interesting to examine how a learning-based explanation like ours combines with other drivers to provide a more complete understanding of the settings and mechanisms underlying these nuances in entrepreneurship.

Implications also emerge from our analysis of the timing of the entrepreneurial itch. Assuming that venture creation opportunities exist at any point in time, what are the mechanisms that determine when an entrepreneur jumps on them? In extant necessity-based entrepreneurship research, this timing tends to be determined by broader economic conditions and individual attributes that foreclose other employment options (Poschke, 2013; Brush et al., 2017; Fairlie and Fossen, 2018). In contrast, in our framework, the timing of the entrepreneurial itch is determined by the point at which vicarious learning leads the decision maker to become unconvinced about the attractiveness of wage-employment. The notion that the timing is shaped by a threshold consideration (i.e., by some comparison between payoffs and expectations) aligns, in principle, with Gimeno et al.'s (1997) study on entrepreneurial exit. In that study, the switch from venture creation into something else also is based on a threshold consideration—it occurs when the payoffs of entrepreneurship fall below a certain level. For Gimeno et al. (1997), the location of this threshold is determined by the payoffs that the decision maker could receive from foregone alternatives, which, in turn, depend on their human capital attributes. This is where our study differs. In our framework, the threshold is determined by a vicarious learning process, with vicarious learning prompting a switch back into venture creation when it leads the focal entrepreneur to realize that the payoffs from wage-employment are only just good enough to keep others in this alternative, but not good enough for their own aspirations. This hints that factors other than human capital and economic conditions may shape the disappointment threshold that triggers a switch into (or out of) self-employment. We draw attention to the role that social processes like vicarious learning may play; it is worthwhile exploring how other socially constructed thresholds may drive patterns of (serial) entrepreneurship.

Lastly, while our study focuses on transitions between self-employment and wage-employment, it is important to acknowledge that entrepreneurs might also pursue various other states, such as vocational training and unemployment, as highlighted by Koch et al. (2021). Each of these categories may be associated with unique risk taking propensities, offering a promising avenue for additional investigation. Specifically, future research can use a risk taking framework to analyze further how decision makers transition between these different employment states, thereby providing a more comprehensive understanding of the mechanisms underlying the multifaceted aspects of entrepreneurial career choices.

6 Conclusion

Departing from traditional utility-curve-based explanations for risk taking, the Carnegie perspective proposed a set of behavioral approaches for understanding risk taking (Cyert and March, 1963; March and Shapira, 1992). To this day, these behavioral approaches continue to shape an important body of research in the field. In this study, we have continued in this line of inquiry to develop a learning based model that illuminates the processes that can underlie recurrent risk taking. Illustrating our model with serial entrepreneurs repeatedly transitioning between high-risk self-employment and low-risk wage-employment, we show that an interplay of experiential and vicarious learning can drive the type of intermittent risk taking inherent in repeated venture creation. Our study points to a promising line of inquiry

5 It is important to reiterate that in our model, self-and wage-employment are equally lucrative; the expected payoffs for self-employment and wage-employment are both set to 10.

examining mechanisms for varying risk taking tendencies and serial entrepreneurship from an organizational learning perspective.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Amaral, A. M., Baptista, R., and Lima, F. (2011). Serial entrepreneurship: impact of human capital on time to re-entry. *Small Bus. Econ.* 37, 1–21. doi: 10.1007/s11187-009-9232-4

Aparicio, S., Urbano, D., and Audretsch, D. (2016). Institutional factors, opportunity entrepreneurship and economic growth: panel data evidence. *Technol. Forecast. Soc. Chang.* 102, 45–61. doi: 10.1016/j.techfore.2015.04.006

Aranda, C., Arellano, J., and Davila, A. (2017). Organizational learning in target setting. *Acad. Manag. J.* 60, 1189–1211. doi: 10.5465/amj.2014.0897

Åstebro, T., Chen, J., and Thompson, P. (2011). Stars and misfits: self-employment and labor market frictions. *Manage. Sci.* 57, 1999–2017. doi: 10.1287/mnsc.1110.1400

Baron, R. A., and Ensley, M. D. (2006). Opportunity recognition as the detection of meaningful patterns: evidence from comparison of novice and experienced entrepreneurs. *Manage. Sci.* 52, 1331–1344. doi: 10.1287/mnsc.1060.0538

Bauer, M. D., Bernanke, B. S., and Milstein, E. (2023). Risk appetite and the risk-taking channel of monetary policy. *J. Econ. Perspect.* 37, 77–100. doi: 10.1257/jep.37.1.77

Baum, J. A. C., and Berta, W. B. (1999). Sources, timing, and speed: Population-level learning by organizations in a longitudinal behavioral simulation, in *Population-level learning and industry change, Advances in Strategic Management*. Eds. A. S. Miner and P. Anderson (Stamford, CT: JAI Press). 16: 155–184.

Baum, J. A. C., and Dahlin, K. B. (2007). Aspiration performance and railroads' patterns of learning from train wrecks and crashes. *Organ. Sci.* 18, 368–385. doi: 10.1287/orsc.1060.0239

Baum, J. A. C., Li, S. X., and Usher, J. M. (2000). Making the next move: how experiential and vicarious learning shape the locations of chains' acquisitions. *Admin. Sci. Quart.* 45, 766–801. doi: 10.2307/2667019

Baxter, S (2013) That entrepreneurial itch The New York Times. Available at: https://www.nytimes.com/2013/06/09/jobs/that-entrepreneurial-itch.html

Brockhaus, R. H. (1980). Risk taking propensity of entrepreneurs. *Acad. Manage. J.* 23, 509–520. doi: 10.2307/255515

Bromiley, P. (1991). Testing a causal model of corporate risk taking and performance. *Academy of Management Journal*, 34: 37–59. doi: 10.5465/256301

Brown, S., Dietrich, M., Ortiz-Nunez, A., and Taylor, K. (2011). Self-employment and attitudes towards risk: timing and unobserved heterogeneity, *Journal of Economic Psychology*, 32: 425–33. doi: 10.1016/j.joep.2011.02.01

Brush, C., Ali, A., Kelley, D., and Greene, P. (2017). The influence of human capital factors and context on women's entrepreneurship: which matters more? *J. Bus. Ventur. Insights* 8, 105–113. doi: 10.1016/j.jbvi.2017.08.001

Burgos, A. (2002). Learning to deal with risk: what does reinforcement learning tell us about risk attitudes? *Econ. Bull.* 4, 1–13.

Burton, M. D., Sørensen, J. B., and Dobrev, S. D. (2016). A careers perspective on entrepreneurship. *Entrep. Theory Pract.* 40, 237–247. doi: 10.1111/etap.12230

Carbonara, E., Tran, H. T., and Santarelli, E. (2020). Determinants of novice, portfolio, and serial entrepreneurship: an occupational choice approach. *Small Bus. Econ.* 55, 123–151. doi: 10.1007/s11187-019-00138-9

Carnahan, S., Agarwal, R., and Campbell, B. A. (2012). Heterogeneity in turnover: the effect of relative compensation dispersion of firms on the mobility and entrepreneurship of extreme performers. *Strategic Manage. J.* 33, 1411–1430. doi: 10.1002/smj.1991

Carroll, R., Holtz-Eakin, D., Rider, M., and Rosen, H. S. (2001). Personal income taxes and the growth of small firms. *Tax Policy Econ.* 15, 121–147. doi: 10.1086/654734

Clough, D. R., and Piezunka, H. (2020). Tie dissolution in market networks: a theory of vicarious performance feedback. *Admin. Sci. Quart.* 65, 972–1017. doi: 10.1177/0001839219899606

Coffman, C. D., and Sunny, S. A. (2021). Reconceptualizing necessity and opportunity entrepreneurship: a needs-based view of entrepreneurial motivation. *Acad. Manage. Rev.* 46, 823–825. doi: 10.5465/amr.2019.0361

Corbett, A. C. (2005). Experiential learning within the process of opportunity identification and exploitation. *Entrep. Theory Pract.* 29, 473–491. doi: 10.1111/j.1540-6520.2005.00094.x

Cyert, R., and March, J. (1992). *A Behavioral Theory of the Firm*. 2nd ed. Blackwell, Cambridge, MA.

Cyert, RM, and March, JG (1963) *A behavioral theory of the firm*. (Prentice-Hall: Englewood Cliffs, NJ).

Dencker, J. C., Bacq, S., Gruber, M., and Haas, M. (2021). Reconceptualizing necessity entrepreneurship: a contextualized framework of entrepreneurial processes under the condition of basic needs. *Acad. Manage. Rev.* 46, 60–79. doi: 10.5465/amr.2017.0471

Denrell, J. (2003). Vicarious learning, undersampling of failure, and the myths of management. *Organ. Sci.* 14, 227–243. doi: 10.1287/orsc.14.2.227.15164

Denrell, J. (2008). Organizational risk taking: adaptation versus variable risk preferences. *Ind. Corp. Chang.* 17, 427–466. doi: 10.1093/icc/dtn007

Denrell, J., and Le Mens, G. (2007). Interdependent sampling and social influence. *Psychol. Rev.* 114, 398–422. doi: 10.1037/0033-295X.114.2.398

Denrell, J., and March, J. G. (2001). Adaptation as information restriction: the hot stove effect. *Organ. Sci.* 12, 523–538. doi: 10.1287/orsc.12.5.523.10092

De Wit, G. (1993). Models of self-employment in a competitive market. *J. Econ. Surv.* 7, 367–397. doi: 10.1111/j.1467-6419.1993.tb00171.x

Dun and Bradstreet (2022). Minted, LLC. Available at: https://www.dnb.com/business-directory/company-profiles.minted_llc.da6f186c3292f0aebc55a1aed39c7008.html (Accessed November 2, 2022)

Erez, B. (2015). 5 reasons the entrepreneurial itch is a bitch. LinkedIn. Available at: https://www.linkedin.com/pulse/5-reasons-entrepreneurial-itch-bitch-ben-erez/

Fairlie, RW, and Fossen, FM (2018) *Opportunity versus necessity entrepreneurship: Two components of business creation. Stanford Institute for Economic Policy Research Discussion Paper 17–014*, Stanford Institute for Economic Policy Research: Palo Alto, CA.

Fan, T., Schwab, A., and Geng, X. (2021). Habitual entrepreneurship in digital platform ecosystems: a time-contingent model of learning from prior software project experiences. *J. Bus. Venturing* 36:106140. doi: 10.1016/j.jbusvent.2021.106140

Fazio, R. H., Eiser, J. R., and Shook, N. J. (2004). Attitude formation through exploration: Valence asymmetries. *Journal of Personality and Social Psychology*, 87, 293–311. 10. 1037/0022-3514.87.3.293.

Feng, J., Allen, D. G., and Seibert, S. E. (2022). Once an entrepreneur, always an entrepreneur? Entrepreneurial identity, job characteristics, and voluntary turnover of former entrepreneurs in paid employment. *Pers. Psychol.* 75, 179–213. doi: 10.1111/peps.12455

Gaba, V., and Terlaak, A. (2013). Decomposing uncertainty and its effects on imitation in firm exit decisions. *Organ. Sci.* 24, 1847–1869. doi: 10.1287/orsc.2013.0823

Giannetti, M., and Simonov, A. (2009). Social interactions and entrepreneurial activity. *J. Econ. Manag. Strategy* 18, 665–709. doi: 10.1111/j.1530-9134.2009.00226.x

Gimeno, J., Folta, T. B., Cooper, A. C., and Woo, C. Y. (1997). Survival of the fittest? Entrepreneurial human capital and the persistence of underperforming firms. *Admin. Sci. Quart.* 42, 750–783. doi: 10.2307/2393656

Greve, H. R. (1995). Jumping ship: the diffusion of strategy abandonment. *Admin. Sci. Quart.* 40, 444–473. doi: 10.2307/2393793

Greve, HR (2003) *Organizational learning from performance feedback: A behavioral perspective on innovation and change*. Cambridge University Press: Cambridge, UK

Guiso, L, Sapienza, P, and Zingales, L. (2018). Time varying risk aversion. *J. Financ. Econ.* 128:403–21. doi: 10.1016/j.jfineco.2018.02.007

Hall, R. E., and Woodward, S. E. (2010). The Burden of the Nondiversifiable Risk of Entrepreneurship, *American Economic Review*, 100: 1163–94. doi: 10.1257/aer.100.3.1163

Hamilton, B. H. (2000). Does entrepreneurship pay? An empirical analysis of the returns to self- employment. *J. Political Econ.* 108, 604–631. doi: 10.1086/262131

Hartog, J., Van Praag, M., and Van Der Sluis, J. (2010). If you are so smart, why aren't you an entrepreneur? Returns to cognitive and social ability: entrepreneurs versus employees. *J. Econ. Manag. Strategy* 19, 947–989. doi: 10.1111/j.1530-9134.2010.00274.x

Hayward, M. L., Forster, W. R., Sarasvathy, S. D., and Fredrickson, B. L. (2010). Beyond hubris: how highly confident entrepreneurs rebound to venture again. *J. Bus. Venturing* 25, 569–578. doi: 10.1016/j.jbusvent.2009.03.002

Holcomb, T. R., Ireland, R. D., Holmes, R. M., and Hitt, M. A. (2009). Architecture of entrepreneurial learning: exploring the line between heuristics, cognition, and action. *Entrep. Theory Pract.* 33, 167–192. doi: 10.1111/j.1540-6520.2008.00285.x

Holmes, T. J., and Schmitz, J. A. Jr. (1990). A theory of entrepreneurship and its application to the study of business transfers. *J. Political Econ.* 98, 265–294. doi: 10.1086/261678

Kelly, DJ, Brush, CG, Corbett, AC, and Majbouri, M (2020) *2019/2020 United States report, global entrepreneurship monitor: National Entrepreneurial Assessment for the United States of America*. Babson College: Babson Park, MA.

Koch, M., Park, S., and Zahra, S. A. (2021). Career patterns in self-employment and career success. *J. Bus. Ventur.* 36:105998. doi: 10.1016/j.jbusvent.2019.105998

Lerner, J, and Malmendier, U. (2013). With a little help from my (random) friends: success and failure in post-business school entrepreneurship. *The Review of Financial Studies* 26:2411–52. doi: 10.1093/rfs/hht024

Levine, M. (1971). Hypothesis theory and non-learning despite ideal S-R reinforcement Contingencies. *Psych. Rev.* 78, 130–140.

Lévesque, M., Minniti, M., and Shepherd, D. (2009). Entrepreneurs' decisions on timing of entry: learning from participation and from the experiences of others. *Entrep. Theory Pract.* 33, 547–570. doi: 10.1111/j.1540-6520.2009.00303.x

Levinthal, D. A., and March, J. G. (1981). A model of adaptive organizational search. *J. Econ. Behav. Organ.* 2, 307–333. doi: 10.1016/0167-2681(81)90012-3

Lumpkin, G. T., and Lichtenstein, B. B. (2005). The role of organizational learning in the opportunity–recognition process. *Entrep. Theory Pract.* 29, 451–472. doi: 10.1111/j.1540-6520.2005.00093.x

March, J. G. (1996). Learning to be risk averse. *Psychol. Rev.* 103, 309–319. doi: 10.1037/0033-295X.103.2.309

March, J. G., and Shapira, Z. (1992). Variable risk preferences and the focus of attention. *Psychol. Rev.* 99, 172–183. doi: 10.1037/0033-295X.99.1.172

Miller, K. D. (2007). Risk and rationality in entrepreneurial processes. *Strateg. Entrepreneurship J.* 1, 57–74. doi: 10.1002/sej.2

Miller, K. D., and Chen, W. R. (2004). Variable organizational risk preferences: tests of the March – Shapira model. *Academy of Management Journal* 47: 105–116. doi: 10.5465/20159563

Miner, J. B., and Raju, N. S. (2004). Risk propensity differences between managers and entrepreneurs and between low and high growth entrepreneurs: a reply in a more conservative vein. *J. Appl. Psychol.* 89, 3–13. doi: 10.1037/0021-9010.89.1.3

Nanda, R., and Sørensen, J. B. (2010). Workplace peers and entrepreneurship. *Management Sci.* 56, 1116–1126. doi: 10.1287/mnsc.1100.1179

Nielsen, K., and Sarasvathy, S. D. (2016). A market for lemons in serial entrepreneurship? Exploring type I and type II errors in the restart decision. *Acad. Manag. Discov.* 2, 247–271. doi: 10.5465/amd.2014.0108

Nikolaev, B. N., and Wood, M. S. (2018). Cascading ripples: contagion effects of entrepreneurial activity on self-employment attitudes and choices in regional cohorts. *Strateg. Entrepreneurship J.* 12, 455–481. doi: 10.1002/sej.1286

Oyarzun, C., and Sarin, R. (2013). Learning and risk aversion. *J. Econ. Theory* 148, 196–225. doi: 10.1016/j.jet.2012.09.011

Parker, S. C. (2018). *The Economics of Entrepreneurship*. 2nd ed. Cambridge: Cambridge University Press.

Patel, N (2015) 90% of startups fail: Here's what you need to know about the 10%. Available at: https://www.forbes.com/sites/neilpatel/2015/01/16/90-of-startups-will-fail-heres-what-you-need-to-know-about-the-10/?sh=5dcc5ffd6679 (Accessed November 2, 2022).

Plehn-Dujowich, J. (2009). Firm size and types of innovation. *Econ. Innov. New Technol.* 18, 205–223. doi: 10.1080/10438590701785850

Plehn-Dujowich, J. (2010). A theory of serial entrepreneurship. *Small Bus. Econ.* 35, 377–398. doi: 10.1007/s11187-008-9171-5

Politis, D. (2005). The process of entrepreneurial learning: a conceptual framework. *Entrep. Theory Pract.* 29, 399–424. doi: 10.1111/j.1540-6520.2005.00091.x

Politis, D. (2008). Does prior start-up experience matter for entrepreneurs' learning? *J. Small Bus. Enterp. Dev.* 15, 472–489. doi: 10.1108/14626000810892292

Poschke, M. (2013). 'Entrepreneurs out of necessity': a snapshot. *Appl. Econ. Lett.* 20, 658–663. doi: 10.1080/13504851.2012.727968

Posen, H. E., Lee, J., and Yi, S. (2013). The power of imperfect imitation. *Strategic Management J.* 34, 149–164. doi: 10.1002/smj.2007

Qin, F., and Estrin, S. (2015). Does social influence span time and space? Evidence from Indian returnee entrepreneurs. *Strateg. Entrepreneurship J.* 9, 226–242. doi: 10.1002/sej.1202

Rerup, C. (2005). Learning from past experience: footnotes on mindfulness and habitual entrepreneurship. *Scand. J. Manag.* 21, 451–472. doi: 10.1016/j.scaman.2005.09.010

Schwab, A. (2007). Incremental organizational learning from multilevel information sources: evidence for cross-level interactions. *Organ. Sci.* 18, 233–251. doi: 10.1287/orsc.1060.0238

Shum, M., and Xin, Y. (2022). Time-varying risk aversion? Evidence from near-miss accidents. *Rev. Econ. Stat.* 104, 1317–1328. doi: 10.1162/rest_a_01009

Smith, E. R., and Collins, E. C. (2009). Contextualizing person perception: distributed social cognition. *Psychol. Rev.* 116, 343–364. doi: 10.1037/a0015072

Sorenson, O., and Audia, P. G. (2000). The social structure of entrepreneurial activity: geographic concentration of footwear production in the United States, 1940–1989. *Am. Sociol. Rev.* 106, 424–462. doi: 10.1086/316962

Spivack, A. J., McKelvie, A., and Haynie, J. M. (2014). Habitual entrepreneurs: possible cases of entrepreneurship addiction? *J. Bus. Venturing* 29, 651–667. doi: 10.1016/j.jbusvent.2013.11.002

Stewart, W. H., and Roth, P. L. (2001). Risk propensity differences between entrepreneurs and managers: a meta-analytic review. *J. Appl. Psychol.* 86, 145–153. doi: 10.1037/0021-9010.86.1.145

Trevor, C. O., and Wazeter, D. L. (2006). A contingent view of reactions to objective pay conditions: interdependence among pay structure characteristics and pay relative to internal and external referents. *J. Appl. Psychol.* 91, 1260–1275. doi: 10.1037/0021-9010.91.6.1260

Ucbasaran, D., Westhead, P., and Wright, M. (2009). The extent and nature of opportunity identification by experienced entrepreneurs. *J. Business Venturing* 24, 99–115. doi: 10.1016/j.jbusvent.2008.01.008

Westhead, P., and Wright, M. (1998). Novice, portfolio, and serial founders: are they different? *J. Bus. Ventur.* 13, 173–204. doi: 10.1016/S0883-9026(97)90002-1

Westhead, P., and Wright, M. (2017) *The habitual entrepreneur*. Routledge: London, UK

Wright, M., Robbie, K., and Ennew, C. (1997). Venture capitalists and serial entrepreneurs. *J. Bus. Ventur.* 12, 227–249. doi: 10.1016/S0883-9026(96)06115-0

Yechiam, E., and Busemeyer, J. R. (2006). The effect of foregone payoffs on underweighting small probability events. *Journal of Behavioral Decision Making*, 19, 1–16. doi: 10.1002/bdm.509

frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 10 November 2023
DOI 10.3389/fpsyg.2023.1157527

OPEN ACCESS

EDITED BY
Daniella Laureiro Martinez,
ETH Zürich, Switzerland

REVIEWED BY
Christian Busch,
University of Southern California, United States
Burcu Kucukkeles,
University of Amsterdam, Netherlands

*CORRESPONDENCE
Chengwei Liu
✉ Chengwei.Liu@esmt.org

†These authors have contributed equally to this work

RECEIVED 02 February 2023
ACCEPTED 25 October 2023
PUBLISHED 10 November 2023

CITATION
Liu C and Tsay C-J (2023) A normative theory of luck.
Front. Psychol. 14:1157527.
doi: 10.3389/fpsyg.2023.1157527

A normative theory of luck

Chengwei Liu[1*†] and Chia-Jung Tsay[2,3†]

[1]European School of Management and Technology, Berlin, Germany, [2]Department of Management and Human Resources, University of Wisconsin-Madison, Madison, WI, United States, [3]Organisations and Innovation, University College London, London, United Kingdom

Psychologists have identified heuristics and biases that can cause people to make assumptions about factors that contribute to the success of individuals and firms, whose outcomes may have actually resulted primarily from randomness. Yet the interpretation of these biases becomes ambiguous when they represent reasonable cognitive shortcuts that offer certain advantages. This paper addresses this ambiguity by presenting four versions (weak, semi-weak, semi-strong, strong) of a normative theory of luck that integrates insights from psychology with the chance model approach to predict the circumstances under which performance non-monotonicity occurs: higher performance may not only indicate greater luck, but also lower expected merit or quality. The semi-strong version is illustrated by examining the decoupling of citations of academic publications and their impact, illuminating when higher citations indicate lower quality. We conclude by discussing the broader implications of a normative theory of luck, emphasizing strategies to address situations where people mistake luck for skill.

KEYWORDS

luck, chance models, attribution biases, behavioral strategy, the Carnegie school, Matthew effect, simulation

Introduction

Success attracts our attention. Yet research from psychology has demonstrated many attribution biases that arise when we evaluate success (Ross and Nisbett, 1991). For example, the outcome bias suggests that people tend to judge the quality of a decision based on its outcome instead of its process (Baron and Hershey, 1988), even when good decisions can lead to poor outcomes, and vice versa, due to unforeseeable circumstances (Barney, 1997). This tendency may be exacerbated by the hindsight bias (Fischhoff, 1975). Even when success can largely be attributed to luck, there is often something unique in a person or organization's history that can be cited to construct a plausible, yet untrue, narrative to support why the successful deserve the glory and reward associated with their successes—and accordingly, the stigmatization associated with their subsequent downfalls (Rosenzweig, 2007; March, 2012; Frank, 2016; Pluchino et al., 2018). A shared insight of these findings is that people tend to mistake luck for skill when evaluating achievement (Taleb, 2001; Makridakis et al., 2009; Kahneman, 2011).

However, the interpretation of these biases can become ambiguous when biases represent reasonable shortcuts that offer competitive or evolutionary advantages (Gigerenzer and Goldstein, 1996; March, 2006). For example, one of the most primitive heuristics among humans is to imitate the most successful (Richerson and Boyd, 2005; Rendell et al., 2010). Although this heuristic is subject to a strong outcome bias, the learning outcome may be adaptive in the sense that the most successful may be luckier than, but also superior to, the less successful. The motivational effect of holding the successful up as role models also generates beneficial exploration (due to imprecise copying) for the community (Dosi and Lovallo, 1997; Posen et al., 2013; Liu, 2020). The net effect of learning from the successful can be positive, implying that biases, such as misattributions of luck, can persist because they produce outcomes that are "better than rational" (Cosmides and Tooby, 1994).

Yet adaptive heuristics can become maladaptive due to mismatches: applications of heuristics to novel contexts where the underlying mechanisms appear similar but are qualitatively different. For example, learning from the most successful may no longer make sense in modern contexts where social or competitive mechanisms (such as rich-get-richer or winner-takes-it-all dynamics) can augment the impact of luck to such an extent that the more successful can even be inferior to their lower-performing counterpart (Levy, 2003; Denrell and Liu, 2012; Frank, 2016). Imitating the successful can be misleading and detrimental. To illustrate, a recent study shows that earnings can be negatively correlated with cognitive abilities beyond a certain threshold (Keuschnigg et al., 2023). That is, the highest earners have lower average cognitive abilities than their lower-earning counterparts. Their exceptional success—earnings several orders of magnitude higher than the rest—reflects more how factors beyond their control (e.g., inherited socio-economic status) were favorably reinforced rather than being a reliable indicator of their exceptional merit. Imitating such "successes" would thus lead to disappointment: Even if one could strive to replicate everything they did, one would not be able to replicate their luck.

To identify when learning from the "successful" is misleading, we present a normative theory of luck that predicts which performance range may be a less reliable indicator of merit and, in turn, entails fewer opportunities for learning. This theory draws insights from both chance models and psychology. Chance models aim to develop a theoretical mechanism that explains empirical regularities through the interaction of randomness and structured environments (Denrell et al., 2015; Liu and Tsay, 2021). In the context of learning and evaluation, chance models help predict when performance non-monotonicity occurs—that is, when higher performance actually predicts lower expected merit. Non-monotonicity violates the conditions for more typical evaluation heuristics, such that higher performers are, on average, superior (Milgrom, 1981), and instead predicts detrimental learning or imitation. Research from psychology further develop the implications: How attribution tendencies, such as the outcome bias, halo effect, and fundamental attribution error, predict how people may be rewarded or punished for performance that actually stems from luck. Normative implications can then be developed to help remedy biases in evaluating employees or to arbitrage the resources mispriced by rivals due to their biases (Liu et al., 2017; Denrell et al., 2019; Liu, 2020, 2021a,b).

The application of a normative theory of luck is illustrated by exploring a question that is relevant to many academics: When do high citations of academic papers reflect superior merit or impact? We first use an exploratory survey to illustrate that more highly cited papers are not necessarily more impactful: The number of citations articles received and the votes they received for impact in the survey can be negatively correlated for moderately highly cited papers, particularly for papers published in the field of management. Integrating theory across literatures with the patterns suggested by our exploratory survey, we develop a chance model to explore the mechanism for this non-monotonicity—a middle dip in the association between outcome and merit—and offer additional analyses. Our results suggest that moderately high outcomes entail greater uncertainty when a strong reinforcement mechanism is present; this level of "success" is most likely to be achieved by agents with mediocre merit, combined with a strong reinforcement of early luck (e.g., the fame of one of the authors or the popularity or timeliness of the topic). Agents with outcomes just below the middle dip are likely to have superior merit but early bad luck, bounding the eventual outcome they can achieve. The negative correlation between citation and impact point to important implications for how citation measures should be used in the evaluation of academics.

The paper is structured as follows: We first offer a primer of chance models that provide the foundation of a normative theory of luck. We then report when highly cited papers predict greater impact, as measured by our exploratory survey results from management and psychology academics. Prompted by survey patterns, we develop a chance model to reproduce the empirical patterns we found, thus providing a possible explanation for them. While prior chance models predict that top performers are likely the luckiest and associated with lower expected merit, our results produce a novel version of the normative theory of luck: The performance non-monotonicity occurs not at the extremes, but instead in the middle range. We conclude by discussing the implications of a normative theory of luck, including how to remedy the bias (e.g., through random allocation) and how to arbitrage the resources mispriced by rivals (e.g., searching for "hidden gem" papers with citations below certain thresholds).

Theoretical foundation

A primer on chance models

Luck—the impacts brought by chance events—is often cited as a factor relevant to important phenomena in the social sciences (Liu, 2020). Some see luck as a solution; for example, political scientists posit that random selection does not discriminate and can thus help resolve political deadlock by offering fairer results to competing parties (Carson et al., 1999; Stone, 2011). On the other hand, economists view luck as "noise"; for example, even when unexpected shocks create mispriced assets, market inefficiencies are fleeting, as they tend to be arbitraged away quickly by rational traders (Fama, 1970).

Other aspects of luck have also intrigued social scientists. For example, behavioral economics and finance researchers have shown that market inefficiencies can persist if decision makers are unable to self-correct, such as when investors make misguided conclusions about randomness (Shleifer and Vishny, 1997; Taleb, 2001; Thaler, 2015). Similarly, sociologists have explored the role of luck on status in society, such as how reinforcing mechanisms (e.g., the "Matthew effect"[1]) could

1 The Matthew Effect was coined by Robert Merton in his 1968 *Science* paper. The term is inspired by a paragraph in the *Gospel of Matthew*: "For to every one who has will more be given, and he will have abundance; but from him who has not, even what he has will be taken away." Merton used these sentiments to describe the unequal fame gained in incidents of simultaneous discoveries, with one taking all the credit while the other becomes obsolete. One example surrounds the development of calculus: The divergence between the contributions of Sir Isaac Newton and Gottfried Wilhelm Leibniz. While both mathematicians made substantial advancements in the field, Newton is commonly attributed with the discovery of calculus, primarily owing to his influential position within the scientific community and his association with the English-speaking world. Leibniz, on the other hand, presented a distinct formulation of calculus that bears closer resemblance to its contemporary usage. Despite the inherent intricacies of the attribution process, Newton's prominent stature and the dissemination of his work in the English language have contributed to the prevailing perception of him as the primary progenitor of calculus, thus shaping the historical narrative surrounding this fundamental mathematical discipline.

contribute to the accumulation of socioeconomic inequalities (Merton, 1968; Lynn et al., 2009; Sauder, 2020). Finally, psychologists have studied luck as an attribution factor for decades (Kelley, 1971; Baron and Hershey, 1988; Hewstone, 1989), and later research highlights how luck attributions impact self-reflection, identity construction, and ethical judgment (Kahneman and Tversky, 1982; Kahneman and Miller, 1986; Roese and Olson, 1995; Teigen, 2005).

However, few of these perspectives study luck as *the* explanation for behavioral or complex phenomena. To illustrate this unique perspective that places luck in a more central role, consider a chance model application in psychology: The subadditivity in probability judgments, which states that the probabilities of mutually exclusive events cannot exceed one. Yet, past research in psychology shows that when individuals are asked to evaluate the probabilities of such events, their answers often sum to more than one (Dougherty and Hunter, 2003). This phenomenon of subadditivity has been extensively studied by experimental researchers, who typically attribute it to systematic cognitive biases (Fox et al., 1996). For instance, one argument suggests that detailed descriptions of events evoke multiple associations, leading to overestimation (Tversky and Koehler, 1994). Here, a chance model proposes a more parsimonious explanation by assuming unbiased but noisy probability judgments (Bearden et al., 2007). In this model, probability judgments are unbiased on average, but subject to random noise. When an individual evaluates the probabilities of several mutually exclusive events, the average probability of each event must be relatively small, since they sum to one. Consequently, even unbiased but noisy estimates, due to random variability, will tend to result in overestimation. This is because when the true probability is close to zero, there is a "floor effect." For example, if the correct probability is 0.1, the event can only be underestimated by at most 0.1, but can be overestimated by a larger magnitude. The behavioral regularity of subadditivity may be explained by a chance model without assuming cognitive biases.

Another example of an application of the chance model comes from organization science. Consider the empirical regularity of age dependence in failure rates: The failure rates first increase with firm age and then decrease (Freeman et al., 1983). The assumed explanation is a liability of newness, combined with learning: Young firms with little experience are more likely to fail, and survivors who learn from past blunders become more viable over time. However, a random walk process with an absorbing lower bound can reproduce this empirical regularity without assuming a learning effect or differences in capabilities among firms (Levinthal, 1991). The initial increase may be attributed primarily to early bad luck rather than to the liability of newness; firms that happen to receive negative shocks early on are forced to exit. The later decrease in failure rates may be attributed primarily to early good luck rather than to learning or improvement. Firms that did not fail early on are likely to accumulate sizable resources that will keep them further away from the lower bound, making them less likely to fail over time. Thus, a chance model can provide an alternative explanation for the age dependence in failure rates (Denrell et al., 2015).

The chance model approach—the perspective of seeing randomness operating in a structured environment as the explanation for behavioral or complex phenomena—is built on the insights of James March, one of the founders of the Carnegie Perspective of Organizational Learning and Decision-making. The Carnegie Perspective was established from three classic books in organization science (Simon, 1947; March and Simon, 1958; Cyert and March, 1963). The founders' shared premise was to study organizations by understanding how boundedly rational actors make decisions with behaviorally plausible mechanisms under constraints in communication, coordination, and structure (Gavetti et al., 2007). Notably, luck was not a central construct in the Carnegie Perspective until March developed various "chance models" with his coauthors (for a review, see Liu and Tsay, 2021).

A classic example of a "chance model" is the garbage can model of organizational choice (Cohen et al., 1972), which highlights how disconnected problems, solutions, participations, and choice opportunities can be lumped together coincidentally in decision making and behavior instead of through rational design or the logic of consequence. "Luck" was added to the list of "behaviorally plausible mechanisms" in the sense that the aggregation of intentional actions could nevertheless appear non-systematic, and vice versa. A key takeaway is that luck should be considered as a default explanation for complex behavioral or organizational phenomena until strong counterevidence emerges (Denrell et al., 2015). Believing otherwise increases the risk of being misled by randomness and suffering from the illusion of control (Langer, 1975; Taleb, 2001; Liu and de Rond, 2016).

Toward a normative theory of luck

Lay theories of luck tend to be normative but unreliable (e.g., choosing lucky numbers increases the chances of winning), whereas academic theories of luck tend to descriptive (e.g., events beyond our control changes the course of history) and highlight their subjective nature (e.g., luck is in the eye of the beholder; an unlucky event can be a blessing in disguise with additional knowledge). We argue that, from a learning point of view per the Carnegie Perspective, a normative theory of luck is possible. That is, one could formalize the conditions under which a particular performance range may be more subject to random processes and a less reliable target for learning and aspirational imitation.

In particular, a normative theory of luck focuses on circumstances under which success can be a misleading indicator of merit—that is, when higher performance fails to indicate superior merit or set a good benchmark for learning and imitation. It requires the application of chance models to demonstrate when performance non-monotonicity occurs: Higher performances may indicate not only greater luck, as prior studies suggest (Kahneman, 2011; Mauboussin, 2012; Frank, 2016), but also lower expected merit. This is important because of the long tradition of learning from the successful across cultures in human history (Richerson and Boyd, 2005). "Successes" are usually compressed to a single dimension for the ease of learning and performance appraisals, such as returns on assets when comparing firm performance, wealth or income when comparing people, and number of publications and their citations when comparing academics. The heuristic of learning from the most successful is predicated on the assumption that the more successful are superior, on average, and thus are better role models. Chance models provide a critical lens to evaluate when learning from the successful can be misleading. Here, we briefly review three chance models before building on them to specify a normative theory of luck.

The March 1977 model: the almost random careers of senior executives

Past research in psychology has demonstrated that there is a tendency to give credit to the individual instead of the circumstances (Ross and Nisbett, 1991). March developed a series of "chance models" to challenge this assumption by showing how randomness and situational factors play more important roles in outcomes (March and March, 1977, 1978). The mechanism builds on a natural consequence of selection: variation reduction. The average skill of each round of surviving candidates increases over time because the least skilled employees are sorted out. However, an important side effect of selection is often neglected: the reduction of diversity (specific to the variance in skill) among survivors. This reduction effect, also known as the "paradox of skill," holds whenever the same selection criteria (e.g., having a college degree or not; publishing a certain number of academic papers; reaching a sales target) are applied to all candidates (Mauboussin, 2012; Page, 2017). The implication is that the eventual survivors—those who passed multiple rounds of selections in an organization or system—are very skilled, but the differences among them are very small, making the survivors increasingly indistinguishable from those selected out (Denrell et al., 2017). The results, based on analyses of a set of Wisconsin superintendents' data, largely supported the predictions: Transition probabilities (e.g., being promoted or fired in this school system) did not vary by individuals but instead were fixed. This suggests that career trajectories may have been approximated by chance fluctuations rather than by any individual-level characteristics of the superintendents, a phenomenon summarized aptly by the title of the paper, "Almost Random Careers" (March and March, 1977). The implication is that successful career outcomes among these superintendents may not have been a reliable indicator of superior merit but may instead have reflected the superintendents being at the right place and right time.

The March 1991 model: winners are overrated

One of the most prominent articles in organization science highlights a tension that arises when organizations try to balance exploration and exploitation (March, 1991), and offers a chance model that explores this dilemma in the context of competition (Model 2). As illustration, consider numerous firms competing to obtain the highest performance in an industry. Their performance draws from normal distributions with varying means and variances. This work showed that exploitation (defined as a pursuit of higher mean performance) becomes increasingly irrelevant when the number of competitors increases. In fact, only exploration (defined as a pursuit of variance in performance) matters when the number of competitors approaches infinity: The top performer is likely the firm that has the highest variance, regardless of its mean performance. The problem is that introducing competition becomes counterproductive: The winning firm is not necessarily better than others, and this mechanism introduces adverse selection. That is, firms with a low mean performance are motivated to take excessive risk in order to enhance the chance of finishing first, which they could not have otherwise achieved, as illustrated by forecasts made by Wall Street analysts (Denrell and Fang, 2010). The implication is that success under intense competition may not be a reliable indicator of merit but may instead reflect high variance and excessive risk-taking.

The Denrell and Liu 2012 model: the most successful may be worse

The most successful performer may be luckier than others, but learning from them may still be sensible if they are, on average, superior to the rest. Denrell and Liu (2012) developed a chance model to demonstrate when being a top performer indicates not only a high degree of luck, but inferior expected merit. Their model builds on the two earlier March models and generates novel predictions. March's 1977 model implies that the differences among agents who survive multiple rounds of competitive selections are small. March's 1991 model implies that when competition is intense, variance is important in determining the outcome. Denrell and Liu's 2012 model assumes agents' performance depend on both their merit and the strength of the reinforcing mechanism. Drawing insights from March's chance models, the distribution of merit is more compressed than that of reinforcing mechanisms. The implication is that trivial initial differences due to randomness can be augmented by a strong reinforcing mechanism, overwhelming the importance of merit and decoupling the typical association between merit and outcomes. The decoupling can be so strong that top performers can be associated with the strongest reinforcing mechanism (and benefit from "boosted" luck), without necessarily achieving the highest merit. The less exceptional performers, or "the second best," thus tend to have both the highest expected merit and highest expected future performance. Denrell and Liu's 2012 chance model prediction is also illustrated by the income-cognitive ability association mentioned earlier: Individuals with high but not top earnings have the highest level of cognitive abilities.

Consider an example in the music industry using the association of consecutive performances. If a musician has a Top 20 hit, should we infer exceptional talent from their success? Liu's (2021c) analysis of 8,297 acts in the US Billboard100 from 1980 to 2008 would suggest not. Music-label executives should instead try to sign those who reach positions between 22 and 30, the "second best" in the charts.

One example is the Korean performing artist PSY, whose "Gangnam Style" music video went viral beyond anyone's foresight. Since such an outcome involved exceptional luck—early luck combined with a strong word-of-mouth effect—PSY's success was unsustainable. In fact, artists charting in the Top 20 will likely see their next single achieve no higher than between 40 and 45 on average; they regress disproportionally more to the mean than their lower-performing counterparts. The exceptionally successful cannot replicate their exceptional luck. Those charting between 22 and 30, meanwhile, have the highest predicted future rank for their next single. Their less exceptional performance suggests that their successes depended less on luck, making their performance a more reliable predictor of their merit and future performance. The implication is that success can be a misleading indicator of merit, reflecting exceptional luck and circumstances that are not replicable or sustainable.

Three existing and one emerging versions of the normative theory of luck

A normative theory of luck builds on the three chance models reviewed in the last section. Table 1 provides a summary. The 1977 March model can be considered a weak version: Success is an unreliable indicator of merit because agents are all highly skilled due to competitive selection. The more successful are more likely to reflect

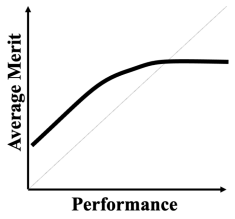
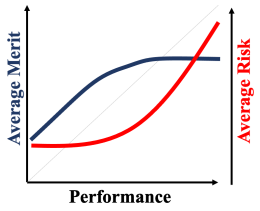
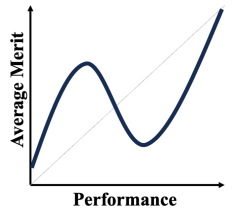
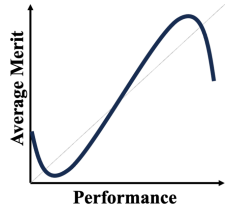
their luck instead of superior merit. The expected merit likely plateaus beyond a certain level of performance. The 1991 March model can be considered a semi-weak version of luck: Success is an unreliable indicator of merit because winning under intense competition requires not merit, but excessive risk taking. The more successful are more likely to reflect their risk-taking, producing favorable outcomes by chance, instead of superior strategy or foresight in competition. The 1991 March setup still predicts that the expected merit likely plateaus beyond a certain threshold, but an additional inference about the level of risk-taking can be made. In contrast, the Denrell and Liu 2012 model can be considered a strong version: Success can be a negative indicator of merit in the absence of competition because exceptional success tends to occur in exceptional circumstances. The most successful are likely to obtain their outcomes in contexts with a strong reinforcement mechanism. However, in such contexts, early luck can overwhelm merit, generating a negative correlation between success and merit at the highest performance range.

Another common characteristic among the three chance models is that they all connect to empirical regularities: the almost random career of Wisconsin superintendents; wild-card forecasts by Wall Street analysts who predicted the next big thing; the income-cognitive abilities association; top-ranked musicians whose performance subsequently regressed to below average. These events all challenge the usual assumption that higher performers are superior. The relationship between success and merit above a certain level of performance can flatten (as the 1977 and 1991 March models predict) or become negatively associated (as the Denrell and Liu model predicts). The fifth column in Table 1 illustrates their different implications for inferring merit from different performance levels. The strong version of the normative theory of luck presents performance non-monotonicity and hence rank reversal: Higher performers can be worse than their lower-performing counterparts, implying a systematic failure when applying the usual heuristic of learning from the most successful.

The existing versions of the normal theory of luck also inspire the recombination and exploration of new possibilities. One underexplored assumption is the situation in which the reinforcing mechanism is strong but does not vary across individuals. The 1991 March model and the Denrell and Liu 2012 model assume that the reinforcement mechanism is not only strong, but also varies across individuals. Yet in many contexts, individuals share the same level of reinforcing mechanism. For example, in academia, the Matthew Effect may be both strong and different across fields. But within the same field, academics are subject to the same level of the Matthew Effect. The existing chance models do not provide a clear prediction of what the association between performance and merit may look like.

In the next section, our empirical exploration examines this possibility. To preview our finding, performance non-monotonicity

TABLE 1 A summary table of the different versions of the normative theory of luck.

Normative theory of luck	Key reference	Key mechanisms	Empirical illustrations	Stylized predictions
Weak version	March and March (1977)	Individuals who passed through multiple rounds of selections in a system are similarly competent, meaning their performance differences are uninformative about their merit or competence.	Wisconsin superintendents' career movement (March and March, 1977)	
Semi-weak version	March (1991)	When outcomes are winner-takes-it-all and driven by both merit and risk taking, top performers are likely the ones that take extreme risk, regardless of their merit.	Forecasts made by Wall Street analysts (Denrell and Fang, 2010)	
Semi-strong version	Current paper; Denrell and Liu (2021)	When performance depends on both merit and past performance and the reinforcing mechanism is strong but fixed for all, an N-shaped performance non-monotonicity occurs.	The citation-impact association (current paper); The movie sales-rating association (Denrell and Liu, 2021)	
Strong version	Denrell and Liu (2012)	When performance depends on both merit and past performance, yet the distribution of merit is less variable than that of the reinforcing mechanisms, a S-shaped performance non-monotonicity occurs.	The income-cognitive ability association (Keuschnigg et al., 2023); The Billboard Hot 100 analysis (Liu, 2021c)	

occurs—not at the top level of success, as the three models reviewed in this section suggest, but at moderately high level of success. That is, the results show a N-shaped pattern: For a given academic field (such as management) where the reinforcement mechanism is strong but does not vary, expected impact first increases with citations, then decreases in the middle range, and then increases again for the most highly cited papers. This pattern is stronger for papers published in management than in psychology. A chance model is then developed to unpack the underlying mechanism, particularly how it differs from the Denrell and Liu 2012 model. This illustration of a novel performance non-monotonicity enriches the normative theory of luck by providing a "semi-strong version"—strong because it generates performance non-monotonicity and rank reversal—and offering important implications for performance evaluations in academia and beyond.

When highly cited papers are "worse"

To illustrate a normative theory of luck, we build on the latest developments of chance models (Denrell and Liu, 2021; Liu and Tsay, 2021) and apply their implications to a question relevant to many academics: When would a high level of citations of academic papers reflect superior merit or research impact? Many practices and policies in academia, such as recruitment, promotion, and grant allocation, assume that highly cited papers tend to be associated with higher-impact research (Kaplan, 1965; Small, 2004; Cronin, 2005). However, work on the Matthew Effect suggests that increasing recognition, including citations of papers, does not necessarily imply higher-impact research, but rather good fortune combined with strong reinforcing processes (Merton, 1968; Baum, 2011). For example, papers that are published by prominent authors or on timely topics may attract more attention and, in turn, elicit more initial citations than other papers of similar or superior merit or potential impact (Liu et al., 2017). The initial difference in citations can be augmented to such an extent that the eventual citation count decouples from expected merit or impact, and generates a non-monotonicity (Lynn et al., 2009; Denrell and Liu, 2012, 2021); more highly cited papers may even be associated with lower expected impact. Using exploratory survey results from academics, we empirically examine this theoretical prediction in the context of academia by measuring the association between citations and impact.

Notably, we are not arguing that highly cited papers always indicate lower expected impact or merit. Instead, we investigate when citations may be a less reliable indicator of impact or merit. Measuring the merit of a paper is very challenging, and many people simply use citations as a proxy for a paper's expected impact. However, as discussed in the previous section, reinforcing mechanisms can sometimes decouple outcomes (such as citation count) from merit (such as papers' counterfactual impact without the influence of the Matthew Effect) to such an extent that outcomes and expected merit may even become negatively correlated (Denrell and Liu, 2012). One needs an alternative measure for merit to avoid the confounds that may emerge from a reliance on citations alone. To address this challenge, we conducted two exploratory surveys in which we asked academics in both management and psychology to vote for papers that they considered to offer higher impact. Motivated by the results suggested by the surveys, we then developed a chance model to account for the empirical patterns found, including differences between the two fields.

Survey method and result

For the survey of management academics, we selected the 15 most prestigious management journals and the three all-time most-cited papers in each journal, which generated 45 seed articles. The journals were selected to provide an overlap between the 50-journal list developed by the *Financial Times* to calculate business school rankings and the list developed in Podsakoff et al.'s (2008) bibliometric analysis of management articles, including all management journals in the ISI Web of Knowledge database, which publishes the impact factors of journals. Only these 15 journals are considered top journals by both academics and practitioners. We then selected the top three most-cited papers in each of the 15 journals. For the survey of psychology academics, we selected 20 top psychology journals using a similar approach. More journals were included in psychology because it is a larger field than management and because more journals in psychology satisfy our selection criteria. The three most-cited papers in each of the 20 psychology journals were used as our seed articles for the survey, providing 60 seed articles.

We conducted our survey using All Our Ideas, a crowdsourcing platform developed by Matthew Salganik, which offered three unique features that aligned with our intended design. First, the platform implemented the survey as a pair-wise comparison. Participants saw two articles randomly drawn from the pool of all articles in each vote and were asked, "In your view, which article is the best?"[2] Participants selected one of the two or chose "I cannot decide." They voted as many times as they wished. Figure 1 provides an illustration of how the survey was run.

The second unique feature was that the platform allowed participants to add their input for seed articles. Thus, participants nominate preferred management/psychology articles to the pool, in addition to the seed articles, as long as the suggested articles were published in one of the selected journals. A pool of 64 ideas (i.e., papers) was generated for the management survey, which implies that 19 articles were added by participants. For the psychology survey, four articles were added by the participants, suggesting a final pool of 64 papers.[3]

The third feature of the platform was the algorithm developed to calculate a score measuring which of the ideas on the platform were most likely to win. A score of 80 for an idea (or paper, in this case) suggests that it has an 80% chance of being considered a better idea than a randomly chosen idea from the pool. Since we had two types of papers, seed papers and participant-added papers, we calculated the ranking of all ideas based on the scores representing the merit or impact of each paper.

2 We intentionally use "which article is the best" to avoid a demand effect from the participants—selecting the answers (articles) based on their inference of what the researchers want to find or consider appropriate. We acknowledge that this choice is imperfect because "best" does not necessarily mean "greater impact." Yet the dictionary definition of "best" is "of the most excellent or desirable type or quality," (Oxford English Dictionary) which is generic enough to serves our purpose.

3 A limitation is that participants only saw the seed papers plus any participant-added papers that were added before their participation.

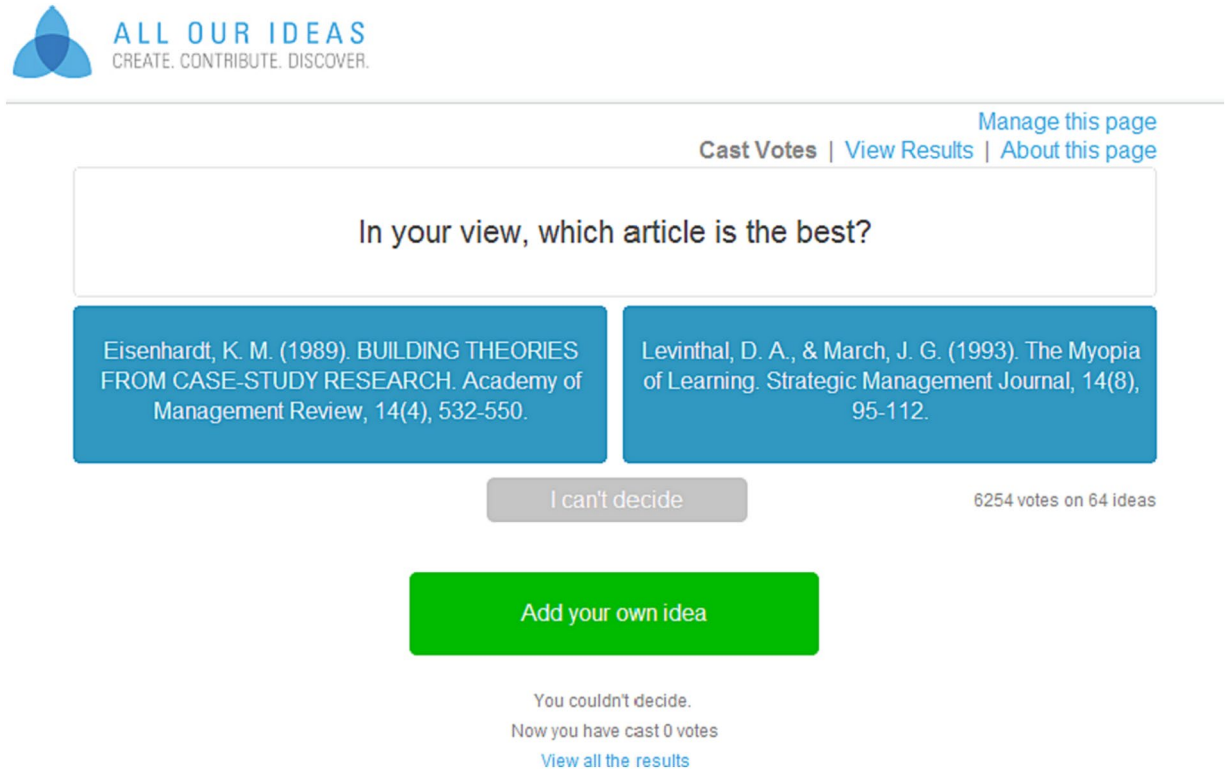


FIGURE 1
A screenshot of how the exploratory survey was conducted on the platform All Our Ideas.

We invited academics in management and psychology to participate in the survey by sending emails to lists managed by professional associations, including the Academy of Management and the American Psychology Association, and our professional networks. Appendix A documents the text of our invitation email. According to Google Analytics (a website traffic-tracking tool), for the management survey, we had 680 participants from 43 countries, who together cast 6,254 votes (each vote corresponding with one pairwise comparison, not including "I cannot decide" votes); for the psychology survey, we had a total of 943 participants from 27 countries, who together cast 3,524 votes.

We are interested in whether highly cited papers are viewed as higher in impact—that is, using our proxy for impact in the form of votes among academics. We analyzed an overall association between the citation count of articles and the average votes they received. If the number of citations is a good indicator of impact, the association between citations and expected quality should be a monotonically increasing function with strong positive correlation between the two variables. If the citation count is not a good indicator of merit, the correlation between citation and expected quality should be low, if not negative.

The results show that the associations between citation count and paper impact are positively correlated in both management (0.44) and psychology (0.37). Higher citation counts are associated with higher expected impact in both fields when both variables are included in a linear regression model. However, these initial analyses omit a more nuanced view of these associations and of the differences in patterns that emerged, which the next section details.

Explaining the "middle dip" using a chance model

To further examine the association between citation count and paper impact (using voting rank as a proxy), we first compute how papers' average voting rank, based on our survey responses, vary with their citation counts and then fit a spine to the association. As Figure 2 shows, there is a notable difference in the degree of monotonicity between the fields of management and psychology. Both relationships are not strictly monotonic (as indicated by the best-fitted spline[4]), and the dip in the middle range (articles with 250–400 citations) is much more salient in management than in psychology.

Our exploratory survey results (see Figure 2) present an interesting empirical pattern: Highly cited papers do not necessarily receive more votes, particularly in the middle range of citations in management. In particular, across fields, for the moderately highly cited papers, the correlation between citation count and votes is weak. The association is almost flat in psychology and even becomes negative in management.

In this N-shaped or "middle dip" pattern, the expected value first increases with input, then decreases or flattens, and then increases again for high values of the input. There are many possible explanations for this pattern, such as sampling issues regarding

4 We applied the cubic smoothing spline with a loss function that obtained the smoothest function without overfitting the data.

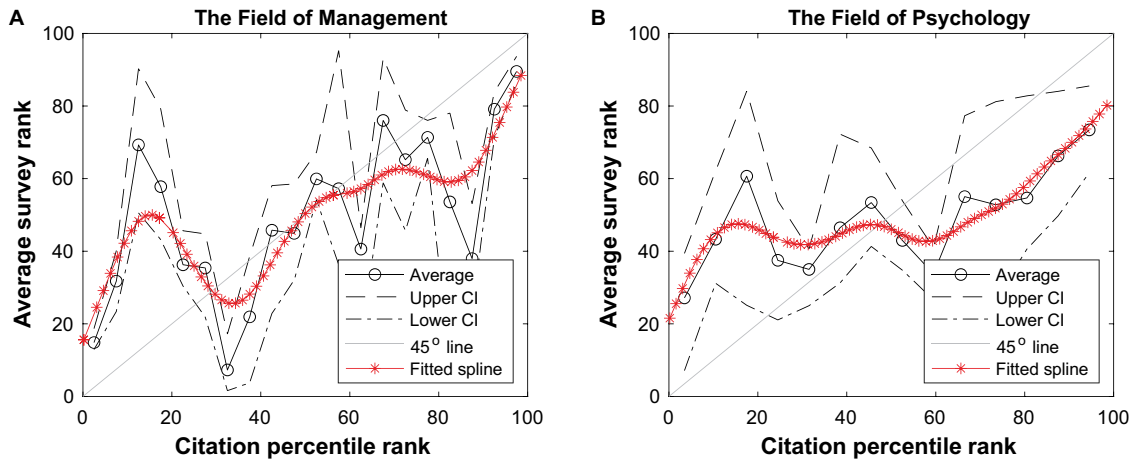


FIGURE 2
The association between papers' citation count and their impact (as measured by survey rank) in the field of **(A)** management and **(B)** psychology.

participants or seed papers.[5] We cannot examine these explanations directly due to limitations of the survey. However, we can use these exploratory survey results and the patterns they suggest to develop a chance model to examine one possible explanation: How initial recognition through citations, combined with the reinforcing mechanism, may generate the middle dip.

Our prediction, spurred by our survey results, is that when early citations are imperfect due to network effects, luck, or noise, a strong reinforcing mechanism (such as the Matthew Effect) can allow some papers to receive many citations despite having low impact—specifically, the papers that fall in the middle-dip region in management or the flattened region in psychology. In other words, the few papers that manage to get a cluster of initial citations may then be elevated to receiving more attention and more ensuing citations than comparable other papers. To reach top citation counts, however, papers need both high potential impact and good initial recognition (receiving early citations and then benefitting from the Matthew Effect), which would account for why the association between citation count and impact becomes strongly positive at the upper percentile ranks in both psychology and management.

To examine our proposed mechanism, consider a simple chance model where recognition (e.g., citing papers) is influenced by both merit or impact (e.g., a paper's contribution to the literature without the influence of the Matthew Effect) and other agents' choice behaviors (e.g., accumulated citation count thus far or strategic citations). Suppose there are n items, which can be products or services on recommendation systems or academic papers that can be cited by peers. The "quality" of item i is q_i, where q_i is drawn from a bell-shaped distribution between zero and one. "Quality" can represent the stable trait of a product or paper (Salganik et al., 2006), which we previously refer to in our exploratory surveys as impact, as operationalized by votes from academics. The appeal ($u_{i,t}$) of item i in period t is $u_{i,t} = aq_i + bm_{i,t-1}$, where $m_{i,t}$ represents the choice proportion of item i from $t=1$ up to period $t-1$ (we set $m_{i,0} = 1/n$). The parameter a represents the weight allocated to quality, such as recommendation system users' own judgment about an item's quality. The parameter b represents the weight allocated to "past data," such as the cumulative citation count of a paper or cumulated market share of items on the recommendation system. The probability that item i will be recognized by an agent (e.g., an author who chooses to cite one out of n papers) joining in period t follows the multinomial logistic choice model:

$$P_{i,t} = e^{u_{i,t}} / \sum_{j=1}^{n} e^{u_{j,t}}$$

Figure 3 shows how average quality varies with the choice proportion obtained after 1,000 periods (i.e., as if 1,000 academics have made their citation choices) for different values of b when $n=10$ (ten papers) and $a=1$. A higher choice proportion is associated with higher average quality only when the weight on past data is not high, such as $b=2$ (Figure 3A) or $b=3$ (Figure 3B). When the weight on past data is high (such as $b=4$, Figure 3C), outcomes can become a misleading indicator of quality. That is, there is a strong decoupling in the middle range. Consider academic citation counts: This means that papers with relatively low impact could gain moderately high citation counts if they were recognized early on. A strong Matthew Effect ensures many subsequent authors will cite these lucky papers, despite an absence of high impact or quality. In contrast, papers with high impact can get trapped with low citations when their early lack of recognition is augmented by the Matthew Effect, i.e., a poor-gets-poorer process. However, because parameter a is greater than zero, meaning that impact still plays a role in choice behaviors, low-impact papers would fail to receive endorsements from all citing academics, thereby limiting their highest possible citation counts. Only papers with top potential impact, combined with early recognition, would receive more global endorsements and achieve the highest ultimate recognition.

The decoupling is the strongest in the middle range when the reinforcement is strong (e.g., Figure 3C). Importantly, items with

5 The N-shaped pattern is not driven by the participant-added articles. Additional analyses show that papers in the middle dip (highly cited yet lowly voted) are mostly seed articles from certain fields (e.g., entrepreneurship).

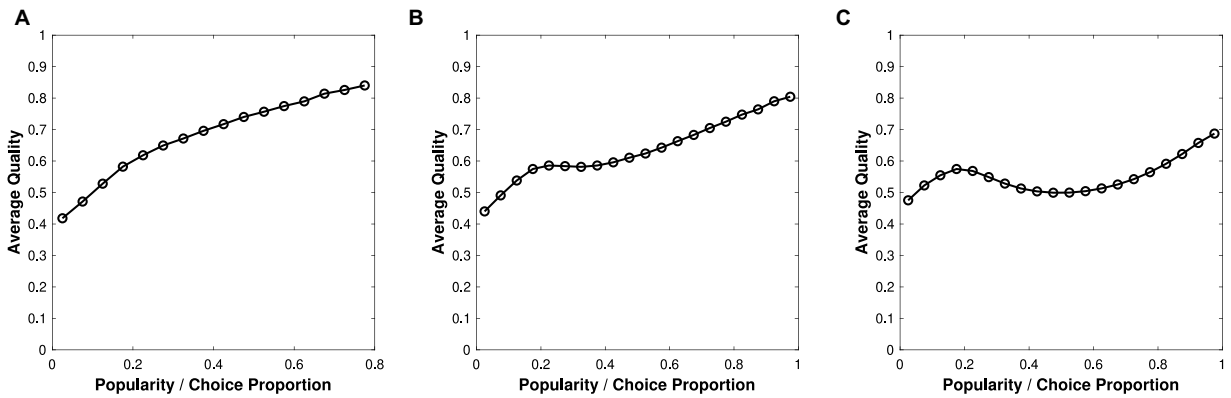


FIGURE 3
How average quality varies with recognition—proportion of item i being chosen at period t = 1,000 (i.e., after 1,000 participants made their choices) for three assumptions regarding the weight given to past popularity: **(A)** weak Matthew Effect, with $b = 2$; **(B)** moderate Matthew Effect with $b = 3$; **(C)** strong Matthew Effect with $b = 4$.

moderate quality (around 0.5, which represents the majority, assuming a bell-shaped distribution) are most sensitive to this decoupling: Early luck or recognition, instead of academic merit, is a strong predictor of the eventual outcomes to which such papers will be locked in. Outcomes may not reflect meritocratic processes if choice behaviors place too much weight on past success. More successes only strengthen, rather than correct for, any locked-in status and can create illusory predictive accuracy (e.g., such as the assumption that citation counts would be a reliable indicator of quality based on their continuous growth), generating a learning trap that is difficult to overcome (Liu, 2021c).

Discussion

As Figure 3 shows, a simple chance model that assumes a stochastic process in choice behaviors, in the presence of a reinforcing mechanism, can reproduce the empirical patterns we found from the exploratory survey (see Figure 2). In particular, the pattern from psychology—a flattened association in the middle range—resembles the results when the reinforcement effect is moderate ($b = 3$). The pattern from management—a middle dip— resembles the results when the reinforcement effect is strong ($b = 4$). All else being equal, the strength in how early recognition or luck is reinforced may account for differences we found across fields in the association between citation count and quality.

Ideally, the association should be strongly positively correlated, as Figure 3A suggests (when $b = 2$, with a weak reinforcement effect). This is when using citation metrics as an input for performance appraisals would be reasonable: Highly cited papers indicate superior impact across the citation range. However, the association between citation count and impact becomes negative for moderately highly cited papers. Our results thus suggest that the practice of using citation metrics in performance appraisals may be problematic even in psychology, where highly cited papers are not necessarily better than less cited ones. Instead, highly cited papers may simply be lucky and actually of comparable impact, based on early recognition and the receipt of more attention than the works deserve. That is, high but not top citation counts are more likely to reflect initial luck instead of impact or merit. Their lower-cited counterparts may actually be more impressive, in the sense of receiving a decent number of citations (e.g., around 100–150), despite having early bad luck, in the form of a lack of initial recognition. Thus, the practice of using citation counts to reward academics can become misleading and introduce a lack of fairness, particularly for management academics.

To further explore what accounts for "early luck," we examine one possible mechanism predicted by our model: Mediocre papers may receive high initial recognition or citations if they are published by authors in a favorable position in a network. If this is true, we can expect the works that cited the middling yet highly cited papers, relative to extremely highly cited ones, to be from more concentrated networks—e.g., with fewer authors, institutions, and/or journal titles. To examine this hypothesis, we first compare differences in the concentration degree between (a) the top five papers that were both highly cited and received highest numbers of votes and (b) the top five papers that were highly cited but received few votes in our survey. Specifically, we calculated the Herfindahl index for these ten selected articles[6]: $H = \sum_{1}^{N} P_i^2$, where H is the index for article X, P_i represents the citation share of a particular source i (e.g., author or journal) that cited article X, and N is the number of all sources that cited article X. The result is shown in Figure 4.

Our argument is supported by this concentration analysis, as Figure 4 shows. Relative to papers that received high values in both citations and votes, papers that were highly cited but received few votes are cited by more concentrated sources, including authors, institutions, and source titles, and the differences are significant.[7]

6 This number is selected arbitrarily for illustration purpose. We apply this analysis to all articles with the results reported below.

7 The only variable that shows an opposite concentration pattern is "Countries." This result may still support our argument in a general sense, considering that most extremely highly cited papers are primarily published

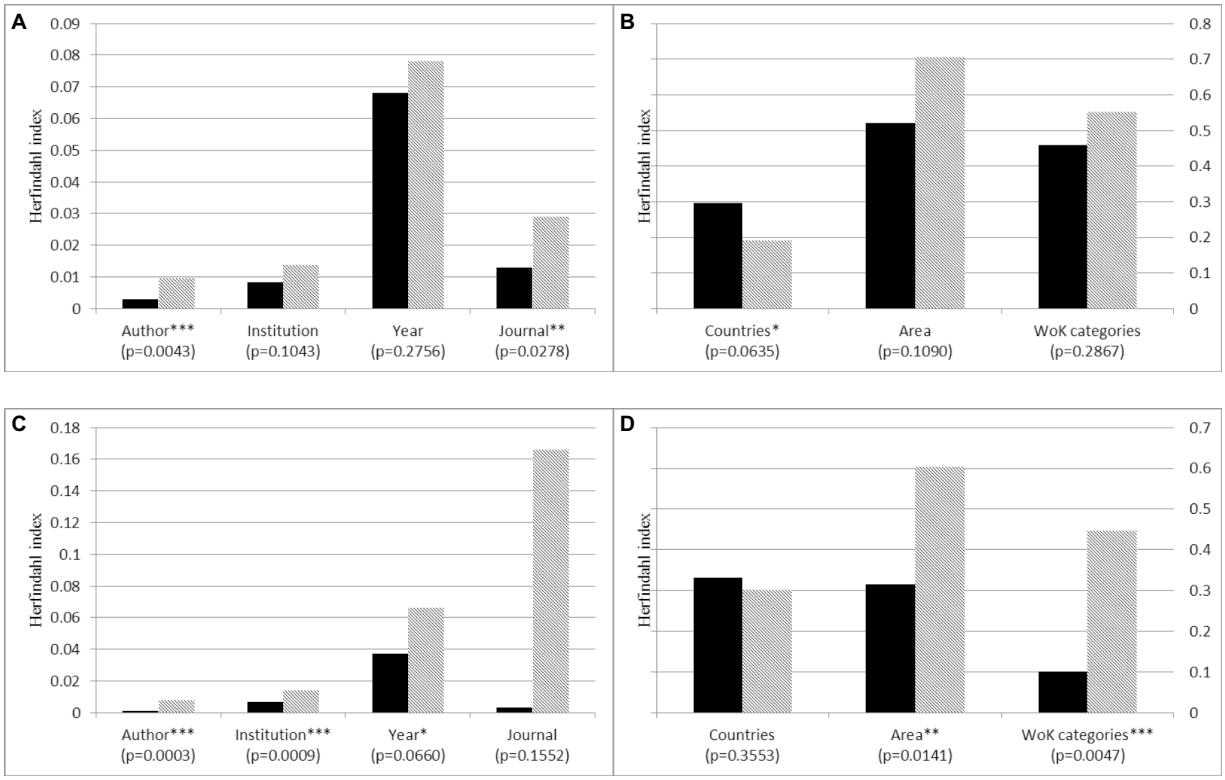


FIGURE 4
A comparison of the Herfindahl index between (I) the top five most highly cited and most highly voted papers, representing by solid black bars; and (II) the top five most highly cited but lowly voted papers, representing by grey lined bars. Figures 4A,B is the result in Management and Figures 4C,D is the result in Psychology. WoK stands for Web of Knowledge. *p = 0.1; **p = 0.05; ***p = 0.01.

Moreover, middling yet highly cited papers in psychology also received their citations from more concentrated years, implying that citations in psychology may be more influenced by fads, gaining the peak of their citation counts and losing that momentum more quickly than the papers that received high values in both citations and votes. Note that these patterns are shared across results in both surveys, implying that the same mechanisms may still operate in psychology. A difference between the two fields, as our simulation results suggest, may be a weaker reinforcement effect in psychology than in management. In management, some middling yet highly cited papers may accumulate their high citation counts as a result of a network diffusion dynamic combined with a stronger reinforcement effect, early recognition, or luck.

The above analysis is limited to the selected ten articles. We then further computed the Herfindahl index for all articles in our surveys based on how concentrated their citations were from the citing journals, whose sources can be identified more reliably. We were interested in how the degree of concentration (Herfindahl index) varies with citation counts. We fit cubic smoothing splines to the supplied data in both management and psychology; the results are shown on Figure 5.

The results in Figure 5 further support our "network explanation" for the middle dip and are consistent with our simulation analysis. For the results in management, the peak in the expected concentration degree coincides with the middle dip in the association between citations and impact (see Figure 4). This suggests that these moderately popular articles in management are more likely to receive their citation counts from a more limited set of sources. In contrast, the most highly cited articles in management are associated with the lowest expected Herfindahl index, implying that they receive their high recognition more evenly from different communities throughout the whole network. For the results in psychology, the association between expected concentration degree and citation is much flatter, implying that more highly cited articles do not necessarily gain their recognition only within limited communities. This is consistent with the monotonic association between votes and citation in Figure 2.

We also ran a regression analysis to examine how votes can be predicted by citation count, concentration degree, and the interaction between the two factors. The results for management are shown in Table 2. Model 1 shows that citation alone is a strong predictor for votes; highly cited articles tend to receive more votes in our survey. Model 2 shows that the concentration degree alone is also a good predictor for votes—i.e., the less concentrated the source of citations, the higher the votes are for a given article. Nevertheless,

by authors and journals based in the United States. One might imagine a handful of academics outside the United States could group together over time and cite each other frequently to gain legitimacy or out of greater familiarity. This finding suggests an interesting topic for future research in the sociology of science.

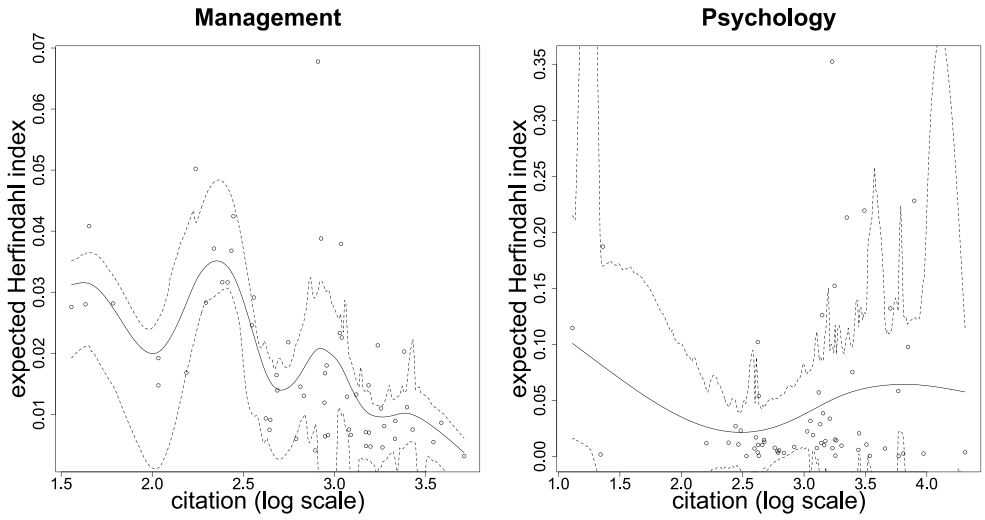


FIGURE 5
The exploratory survey results in management (left) and psychology (right). Both show how the expected Herfindahl index varies with the citation count (in log scale). The solid lines represent the best-fitted smoothing spine function to the relationship between citation and expected Herfindahl index. The dashed lines are the 95% confidence limits.

TABLE 2 Regression analysis predicting survey votes in the field of management.

	Model 1	Model 2	Model 3	Model 4
Citation count	8.24** (3.88)		6.19 (4.56)	23.18** (8.78)
Herfindahl index		−267.26* (146.28)	−146.67 (170.21)	2093.80** (1014.3)
Citation count*Herfindahl index				−801.03** (357.87)
Constant	26.57** (11.10)	54.69*** (3.33)	35.04** (14.85)	−15.36 (26.69)
R-squared	0.08	0.06	0.09	0.17
Adjusted *R*-squared	0.06	0.04	0.05	0.12
F-value	4.51**	3.34*	2.61*	3.54**

$N = 64$; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Standard errors are in parentheses.

Model 3 and Model 4 suggest an interesting interaction between the two variables: a non-linear relationship between votes, citation count, and concentration degree. In particular, Model 4 suggests an inverted U-shape pattern, consistent with our results in Figures 2, 5.

Next, we applied the same regression analysis for the data in psychology; the results are shown in Table 3. Consistent with our other results, citation count is the strongest predictor for votes in all models. While higher concentration degree predicts lower votes, unlike the results in management, the interaction between citation count and concentration degree is not significant. This suggests a less non-linear relationship for the results in psychology compared to those in management.

Finally, some evidence from the voting results complements our finding that middling yet highly cited papers receive their citation counts from a more concentrated set of sources. We predict that these articles may be well known and cited within their cliques, but they may be less well known to the broader set of management academics who participated in our survey.

The voting site of All Our Ideas enables us to examine our prediction that our voting participants as a whole are less familiar with middling yet highly cited papers. Note that in Figure 1, participants were able to choose "I cannot decide" if they did not wish to choose one of the two articles in the pair comparison. If a participant chose "I cannot decide," seven options were available, including (1) "I like both ideas," (2) "I think both ideas are the same," (3) "I do not know enough about either idea," (4) "I do not like either idea," (5) "I do not know enough about: [the idea on the left is shown]," (6) "I do not know enough about: [the idea on the right is shown]," and (7) "I just cannot decide." In particular, options (5) and (6) enabled us to examine our prediction that participants are more likely to choose "I do not know enough about…" when encountering these middling yet highly cited papers.

The results in both management and psychology support our prediction that participants were less familiar with these middling yet highly cited papers. This suggests that these articles may not have been well known outside their cliques and hence received less recognition from our participants, who were academics in different fields of literature. In contrast, very highly cited papers were much less likely to fall into this category. In both fields, most academics recognized these outliers. This result is consistent with our concentration analysis, which suggests that the high citation counts of these middling yet highly cited papers are more likely to come from the authors' cliques.

TABLE 3 Regression analysis predicting survey votes in the field of psychology.

	Model 1	Model 2	Model 3	Model 4
Citation count	12.17*** (3.20)		12.54*** (3.13)	13.94*** (4.22)
Herfindahl index		−47.02* (29.86)	−53.36* (26.65)	11.95 (134.53)
Citation count*Herfindahl index				−20.78 (41.95)
Constant	12.51 (9.84)	51.28*** (2.50)	13.78 (9.62)	9.51 (12.96)
R-squared	0.20	0.04	0.25	0.26
Adjusted R-squared	0.19	0.02	0.23	0.22
F-value	14.4***	2.48*	9.6***	6.39***

$N = 64$; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Standard errors are in parentheses.

Limitations and future directions

Our method, particularly the explorative surveys, have many limitations. We discuss several of them and highlight how future studies can better examine the robustness of our findings.

First, the sampling of the survey is imperfect. We used convenience sampling, and the sample size was small (680 management researchers and 943 psychology researchers), compared to the population size (tens of thousands researchers in each field). The respondents may also have been biased, particularly in management. The author who sent the survey was professionally connected to James March (the mentor of the mentor of the author), which suggests that people in management who responded to the survey may not necessarily have been representative. To strengthen the robustness of the middle-dip phenomenon between citation and impact, the survey can be replicated by sending through neutral contacts (e.g., association division representatives) with incentives to enhance response rate (e.g., vouchers for randomly drawn participants).

Second, the votes may have been driven by recognition heuristics, as academics may not necessarily know the content of all top-cited papers in their field. Our survey does allow the option of choosing "I cannot decide" when this occurs, but it does not exclude the possibility that votes were driven by participants' knowledge about the author and/or journal instead of by the content of the paper. Future research could address this concern through a two-stage design: Voting would only occur when a participant acknowledges familiarity with the content of both articles in comparison pairs.

Another limitation is that participants only saw the seed papers plus any participant-added papers that were added before their participation, meaning that some votes were not based on the full sample. With the benefit of hindsight, we probably overestimated the number of participant-added papers, despite the crowd-sourcing design. If we had foreseen this, we would have increased the number of seed articles. It is also noteworthy that methods papers were highly cited, as most papers need a standard reference to methods. Papers included in the current pool also tended to be older ones. Future research can attenuate these concerns by introducing a two-stage survey. The first stage can solicit responses from trusted scholars to formulate a pool of articles, excluding methods papers and limiting papers older than a certain threshold. Participants from the second stage then would have access to all the papers from the end of the first phase.

Fourth, merit or quality can have multiple meanings, making connections between our survey and the chance model ambiguous. In the chance model, the merit of an object is simply a time-invariant trait drawn from certain distribution. The merit of a paper can vary greatly, depending on the context. For our purposes, merit can mean potential impact, whereas citation number captures only the realized impact. The decoupling between potential versus realized impact due to randomness interacting with a reinforcing mechanism generates a middle-dip pattern in the association between citation and merit. Yet the meaning of impact can change over time and vary across fields. Future research can ensure that the "merit" of papers is clearly defined so that participants' answers/votes may be more commeasurable.

General discussion

A middle-dip version of the normative theory of luck

Many theories of luck exist. Some are based on studying the "luckiest" individuals (Wiseman, 2003) or unlucky incidents (Giustiniano et al., 2016); others study how a "serendipity mindset" could enhance the chance of important discoveries (Busch, 2022; Busch and Barkema, 2022); still others claim that most theories of luck are incoherent and by definition "wrong" (Hales, 2016).

This paper builds on a distinct theory of luck based on chance models that focuses on when higher performers indicate not just greater luck but also lower expected merit. We have reviewed three versions of a normative theory of luck and examined their predictions in the context of academic citations. The converging prediction, based on prior chance models, is that the most-cited papers are likely the luckiest and associated with lower expected merit.

Our results push back against this prediction and produce a novel version of the normative theory of luck: The performance non-monotonicity occurs not at the extremes, but in the middle range. The mechanism is that when both merit and past outcomes influence performance and when the reinforcing mechanism is strong, a high but not top level of performance entails greater uncertainty. Mediocre agents or objects can become sufficiently successful due to early good luck, plus a boost from that good luck. But a lack of merit bounds these objects' eventual performance, such that top performance is still associated with the highest level of merit.

As Table 1 suggests, this novel version of the normative theory of luck can be considered "semi-strong": it generates performance non-monotonicity, yet the location is not at the extreme range, as Denrell and Liu (2012) predict, but instead around high performance. The results of the chance models show one important difference in the assumption that generates the different pattern. In the current result,

the reinforcing mechanism (regulated by parameter *b*) is high but fixed, mapping to the empirical context where the Matthew Effect within a field is more or less the same for all academics. If we run the model with the assumption from Denrell and Liu (2012), where the reinforcing mechanism is strong and highly variable (e.g., *b* drawn from an exponential distribution with parameter of one), the current chance model can replicate the stylized pattern of the strong version of luck, i.e., the dip occurs at the top level of performance.

Hence, our findings enrich the chance model approach and a normative theory of luck by adding a commonly observed condition for predicting when performance non-monotonicity should be expected. We discuss the implications of our findings below.

When the Matthew effect casts doubts on quality

In studies of causal attribution processes, psychologists have argued that when an outcome has multiple possible causes, the presence of one cause casts doubt on others (Morris and Larrick, 1995). Our results fit with this normative framework of causal discounting. Moderately high citation counts can be achieved by either decent quality or initial luck (such as recognition), combined with a strong Matthew Effect. Since the presence of the Matthew Effect is well acknowledged in academia (Merton, 1968; Starbuck, 2005; Bol et al., 2018), caution may be needed in considering the quality of moderately highly cited papers.

Our chance model further suggests that a considerable discounting of moderately highly cited papers may not be unwarranted, as such papers can have lower expected quality than both their higher- and lower-cited counterparts. This is because low-quality papers are more likely to sustain moderately high citation counts when the Matthew Effect is strong (Denrell and Liu, 2021). The citation counts of high-quality papers tend to have a bimodal distribution: either exceptionally high citation counts with early recognition (i.e., initial high citations) or very low citation counts with an initial lack of recognition (i.e., initial low citations). In contrast, low-quality papers with initial recognition can ultimately gain high citation counts, but their lack of quality bounds their eventual performance despite a strong Matthew Effect.

Our survey results support this proposed mechanism. In both psychology and management, our results show an N-shaped pattern, with a "dip" in that for management and a flattening for that in psychology in the middle range. This suggests the presence of the Matthew Effect in both fields and a much stronger effect in management. Our additional analyses show that the source of the Matthew Effect may be related to network structures. Management as a field may be more fragmented than psychology, such that management academics are more likely to cite people in the same cliques, generating greater initial differences in citation behaviors and counts. This difference is then augmented by a strong Matthew Effect, partly because quality is more difficult to evaluate in a fragmented field that is short of a shared paradigm. Management academics may thus rely more on others' choices (i.e., accumulated citation counts) to infer quality, creating a greater decoupling in the association between citation count and quality, particularly in the middle range. A strong Matthew Effect should cast doubt not only on quality, as prior research suggests. In addition, according to a "more-is-less" nuanced policy, papers receiving moderately high citation counts should receive less attention and reward, as lower-quality papers are more likely to achieve this outcome.

Our results also imply that in academia, different evaluation approaches that reflect the non-monotonic relationship shown in our results may be warranted. In institutions such as business schools, where academics from different fields are evaluated based on the same criteria, such as the journals in which they publish, citation-count analyses should be adjusted for social processes. For example, if an article garners a high citation count, this may suggest that the article is in a domain where academics publish and cite each other more than in other domains, rather than that the article is of exceptionally high quality. Moreover, our findings imply that the most likely association between citation count and quality within a school is an inverted U-shape pattern. Since extremely highly cited papers are rare, the most highly cited papers within a school are likely to be moderately highly cited papers. These papers are more likely to also reflect strong social processes rather than solely or even primarily quality. Schools should more carefully evaluate less-cited authors, as their lower citation counts may be more likely to obscure the quality of their work than that of their more highly cited counterparts.

Our results also suggest a possible solution to the problem: introducing random selection in peer review process. Our results imply that academics may be good at differentiating the best and the worst from the rest, with the former being better associated with the citation counts they deserve. This implies a solution to judging academic merit: that during the peer review process, submitted manuscripts that receive a unanimous "yes" ("no") should (not) be published. Other manuscripts may then be published on the basis of random selection (Liu, 2021c). This solution is inspired by the recent finding that semi-random allocations of limited grant resources actually generate superior long-term outputs (Avin, 2018; Liu et al., 2020). This random process may balance the "luck factor" an article could gain from social processes.

In other words, when academics need to decide which published article to read and cite, they can rely on peer reviewers' judgments of the best and worst articles. Such judgments may be informative of the quality of articles, but individual academics will have to rely on their own judgment when evaluating the remainder "middling" articles, because a randomly published article will likely be perceived as uninformative about quality. As a result, the citations an article receives could again be informative about quality: Citation counts would be less associated with social processes, and citation count analyses could then provide a better foundation for judging academic merit. More generally, this "random selection" proposal is consistent with recent findings suggesting that evaluations in academia should consider domain size (Radicchi et al., 2008) and that random selection can improve performance by reducing the scope of biases (Berger et al., 2020).

Our findings also suggest an opportunity. When the "middle dip" is difficult to understand, this means that some achievements may be overrated, whereas others may be undervalued. In contrast, from past chance models, our findings suggest that greater misevaluations occur around the high but not top levels of performances. Articles (and their authors) that achieved high but not top citations may be overrated; their moderate success is more likely to reflect their early luck and the resulting boost. In contrast, their lower-performing counterparts may provide a more reliable indicator of merit that may be overlooked. Schools could modify their hiring policies and search for these "hidden gems."

Chance model applications

The chance model approach is not mainstream in management, except for the work of March and the Carnegie Perspective. This neglect is also found in psychology, aside form in a few studies; Hilbert (2012), for example, showed how a chance model that assumes noisy information processing could account for a variety of cognitive biases.

This paper aims to highlight the valuable contribution of chance models as a non-agentic worldview that is relevant to both management and psychology. The significance of chance models and the insights they offer have been underestimated, and this research demonstrates their potential to generate novel predictions with profound implications. Emphasizing the development of chance models to account for performance differences can address the historical bias toward heroic narratives of salient agents and instead direct attention to statistical analyses, distributions, and computational methods.

Arguably, chance models could be interpreted as endorsing defeatism, since they do not provide explicit causal explanations or immediate pragmatic implications. Telling students that performance differences can result from luck could be demotivational. By contrast, we propose that chance models offer causal explanations when their theoretical mechanisms produce predictions that closely approximate the empirical regularities they aim to explain. By systematically simulating counterfactual histories, management scholars and practitioners can extract more rigorous lessons from successes and failures, which often represent unique instances. Moreover, a deeper understanding of the role luck plays in performance can help individuals in management overcome the illusion of complete control, leading to improved performances within their control and better preparedness for unpredictable situations.

Given that the realized history is just one potential outcome drawn from a distribution of numerous possible histories, it becomes imperative for scholars to take chance models and the alternative histories they generate seriously. Relying solely on sophisticated regression methods may not rescue the biased lessons inherent in the realized history. Embracing chance models enables a more nuanced view of historical events that promotes a richer understanding of socio-behavioral dynamics and provides valuable insights for informed decision-making.

When the wisdom of the crowd fails

The idea of the wisdom of the crowd—that aggregating the independent estimates of a diversified group of people produces more accurate estimates than those produced by individuals—implies that popular choice is informative (Page, 2008). Prior studies have suggested several mechanisms that can undermine the wisdom of the crowd (Lorenz et al., 2011). Information about others' choices is likely to homogenize people's expressed beliefs in two ways. The informational aspect of social influence suggests that people may hold back private beliefs and sample popular choices because they believe others have superior information (Bikhchandani et al., 1992; Salganik et al., 2006). The normative aspect of social influence suggests that people may abandon private beliefs and conform to others' beliefs because they feel uncomfortable acting against the crowd (Asch, 1951; Kuran, 1997). Thus, rich-get-richer dynamics, or the Matthew Effect, can undermine the wisdom of the crowd because popular choices may reflect self-reinforcing expressed beliefs decoupled from actual private beliefs in the presence of social influence. The implication is that more popular objects can be worse when social influence is strong.

Our results suggest that the crowd can be wise globally but foolish locally when the Matthew Effect is present but bounded by structure. Many mechanisms that generate conformity operate through networks and are sensitive to the overall structure of connections. We have demonstrated that the local nature of social influence implies that conformity is likely bounded locally and operates only within cliques. Beyond local networks, normative social influence is weakened. People may be aware of popular objects (e.g., highly cited papers) due to informational aspects of social influence and rely on their own judgment when deciding whether to adopt objects (e.g., citing the papers or not). The implication is that local popularity—the crowd's choice within a clique—is likely to reflect situations where social influence collapses the wisdom of the crowd. In contrast, global popularity—the crowd's choice throughout different networks—is more likely to reflect situations where the wisdom of the crowd does trump social influence. Overall, results from our surveys, the chance model we then developed, and the analyses we iterate against the survey data generalize across conditions under which the crowd is wise or foolish.

Implications for diversity

Our findings, which build on the broader perspectives offered by the chance model, pose some discussion points that may be particularly timely as society grapples with issues relating to diversity, equity, and inclusion. Further, the implications of our work may be particularly relevant for academia, an institution that has come under scrutiny for how marginalized groups have remained underrepresented at every level, from students at elite universities to tenured professors who hold nearly unparalleled job security.

Historically, advantaged groups (e.g., men, White individuals) have been more privileged at each life milestone and round of professional evaluation (and rewards), ultimately accumulating important leadership roles that then position them to be more likely to perpetuate the same class structures through multiple mechanisms, including homophily in hiring and the transmission of intergenerational wealth. Though recent initiatives have made strides in remedying the lack of minority representation and the associated socioeconomic and health consequences that have disproportionately impacted minorities, one result may be backlash from those in advantaged groups who question the processes through which greater diversity was achieved. The polarized political landscape in the United States is one reflection of these competing narratives about what should be considered merit and fair allocation of valued rewards.

We return to one implication of our results, namely the idea that academic papers with low citation counts may need extra consideration, as citation counts may reflect a lack of initial recognition rather than a lack of quality. Although the argument that papers with fewer citations (or less recognition) may be of higher quality than those with moderately high citations (or more recognition) extrapolates beyond the limits of what our models would suggest, we propose that the underlying premise may still be informative in nudging people to consider whether a surface-level evaluation of present output or performance is sufficient. This sets aside longstanding issues with evaluation metrics, such as whether there is correspondence between HR processes and eventual hiring decisions, or whether impressions or scores at the point of hiring ultimately predict later job performance. Instead, we propose that by

thoughtfully deliberating the pathway candidates traversed to arrive at their current level of performance, a journey that may have been riddled with chance events both good and bad, there may be promising avenues for cultivating more sustainable and long-term quality performance.

We hope some aspects of our model may spur fruitful conversations. For example, a fresh look at the significant role of chance and initial successes or failures, which are then magnified through reinforcement, may offer new perspectives for decision-makers involved in crafting policies aimed at establishing fair systems of evaluation and compensation. These efforts may buffer against the systematic discounting of lower initial or current performance—which is often associated with marginalized groups—and foster organizational cultures that value not just the most accessible quantitative performance data but also data about the range of pathways to achievement.

Data availability statement

The codes and the data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Acknowledgments

The authors are grateful for ideas and input from Nick Chater, Thomas House, Christina Fang, Zur Shapira, James March, and seminar participants at the New York University, University of Warwick, the 2012 Carnegie School of Organizational Learning meeting, and the 2013 Theoretical and Organizational Models Society meeting. We are particularly grateful to Jerker Denrell and his contribution to the survey and the earlier version of this paper. The authors are also grateful to their editor and the two reviewers for their thoughtful guidance and suggestions.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

Asch, S. E. (1951). "Effects of group pressure upon the modification and distortion of judgments" in *Groups, leadership, and men*. ed. H. Guetzkow (Pittsburgh, PA: Carnegie Press), 222–236.

Avin, S. (2018). Policy considerations for random allocation of research funds RT. *J. Res. Policy Eval.* 6. doi: 10.13130/2282-5398/8626

Barney, J. B. (1997). "On flipping coins and making technology decisions: luck on an explanation of technological foresight and oversight" in *Technological innovation oversights and foresights*. eds. R. Garud, P. R. Nayyar and Z. B. Shapira (New York, NY: Cambridge University Press), 13–19.

Baron, J., and Hershey, J. C. (1988). Outcome bias in decision evaluation. *J. Pers. Soc. Psychol.* 54, 569–579. doi: 10.1037/0022-3514.54.4.569

Baum, J. A. C. (2011). Free-riding on power Laws: questioning the validity of the impact factor as a measure of research quality in organization studies. *Organization* 18, 449–466. doi: 10.1177/1350508411403531

Bearden, J. N., Wallsten, T. S., and Fox, C. R. (2007). Contrasting stochastic and support theory accounts of subadditivity. *J. Math. Psychol.* 51, 229–241. doi: 10.1016/j.jmp.2007.04.001

Berger, J., Osterloh, M., Rost, K., and Ehrmann, T. (2020). How to prevent leadership hubris? Comparing competitive selections, lotteries, and their combination. *Leadersh. Q.* 31:101388. doi: 10.1016/j.leaqua.2020.101388

Bikhchandani, S., Hirshleifer, D., and Welch, I. (1992). A theory of fads, fashion, custom, and cultural change as informational cascades. *J. Polit. Econ.* 100, 992–1026. doi: 10.1086/261849

Bol, T., de Vaan, M., and van de Rijt, A. (2018). The Matthew effect in science funding. *Proc. Natl. Acad. Sci.* 115, 4887–4890. doi: 10.1073/pnas.1719557115

Busch, C. (2022). Towards a theory of serendipity: a systematic review and conceptualization. *J. Manag. Stud.* doi: 10.1111/joms.12890 [E-pub ahead of print].

Busch, C., and Barkema, H. (2022). Planned luck: how incubators can facilitate serendipity for nascent entrepreneurs through fostering network embeddedness. *Entrep. Theory Pract.* 46, 884–919. doi: 10.1177/1042258720915798

Carson, L., Carson, P. F. L., and Martin, B. (1999). *Random selection in politics*. Westport: Greenwood Publishing Group.

Cohen, M. D., March, J. G., and Olsen, J. P. (1972). A garbage can model of organizational choice. *Adm. Sci. Q.* 17, 1–25. doi: 10.2307/2392088

Cosmides, L., and Tooby, J. (1994). Better than rational: evolutionary psychology and the invisible hand. *Am. Econ. Rev.* 84, 327–332.

Cronin, B. (2005). *The hand of science: Academic writing and its rewards*. Scarecrow Press: Lanham, MD.

Cyert, R. M., and March, J. G. (1963). *A behavioral theory of the firm*. Malden, MA: Blackwell Publishers Inc.

Denrell, J., and Fang, C. (2010). Predicting the next big thing: success as a signal of poor judgment. *Manag. Sci.* 56, 1653–1667. doi: 10.1287/mnsc.1100.1220

Denrell, J., Fang, C., and Liu, C. (2015). Chance explanations in the management sciences. *Organ. Sci.* 26, 923–940. doi: 10.1287/orsc.2014.0946

Denrell, J., Fang, C., and Liu, C. (2019). In search of behavioral opportunities from misattributions of luck. *Acad. Manag. Rev.* 44, 896–915. doi: 10.5465/amr.2017.0239

Denrell, J., and Liu, C. (2012). Top performers are not the most impressive when extreme performance indicates unreliability. *Proc. Natl. Acad. Sci.* 109, 9331–9336. doi: 10.1073/pnas.1116048109

Denrell, J., and Liu, C. (2021). When reinforcing processes generate an outcome-quality dip. *Organ. Sci.* 32, 1079–1099. doi: 10.1287/orsc.2020.1414

Denrell, J., Liu, C., and Le Mens, G. (2017). When more selection is worse. *Strat. Sci.* 2, 39–63. doi: 10.1287/stsc.2017.0025

Dosi, G., and Lovallo, D. (1997). "Rational entrepreneurs or optimistic martyrs? Some considerations on technological regimes, corporate entries, and the evolutionary role of decision biases" in *Technological innovation: Oversights and foresights*. eds. R. Garud, P. R. Nayyar and Z. B. Shapira (New York: Cambridge University Press)

Dougherty, M. R., and Hunter, J. (2003). Probability judgment and subadditivity: the role of working memory capacity and constraining retrieval. *Mem. Cogn.* 31, 968–982. doi: 10.3758/BF03196449

Fama, E. F. (1970). Efficient capital markets: a review of theory and empirical work. *J. Financ.* 25, 383–417. doi: 10.2307/2325486

Fischhoff, B. (1975). Hindsight not equal to foresight: effect of outcome knowledge on judgment under uncertainty. *J. Exp. Psychol. Hum. Percept. Perform.* 1, 288–299.

Fox, C. R., Rogers, B. A., and Tversky, A. (1996). Options traders exhibit subadditive decision weights. *J. Risk Uncertain.* 13, 5–17. doi: 10.1007/BF00055335

Frank, R. H. (2016). *Success and luck: Good fortune and the myth of meritocracy*. Princeton, NJ: Princeton University Press.

Freeman, J., Carroll, G. R., and Hannan, M. T. (1983). The liability of newness: age dependence in organizational death rates. *Am. Sociol. Rev.* 48, 692–710. doi: 10.2307/2094928

Gavetti, G., Levinthal, D., and Ocasio, W. (2007). Perspective-neo-Carnegie: the Carnegie School's past, present, and reconstructing for the future. *Organ. Sci.* 18, 523–536. doi: 10.1287/orsc.1070.0277

Gigerenzer, G., and Goldstein, D. G. (1996). Reasoning the fast and frugal way: models of bounded rationality. *Psychol. Rev.* 103, 650–669. doi: 10.1037/0033-295X.103.4.650

Giustiniano, L., Cunha, M. P., and Clegg, S. (2016). Organizational zemblanity. *Eur. Manag. J.* 34, 7–21. doi: 10.1016/j.emj.2015.12.001

Hales, S. D. (2016). Why every theory of luck is wrong. *Noûs* 50, 490–508. doi: 10.1111/nous.12076

Hewstone, M. (1989). *Causal attribution: From cognitive processes to collective beliefs*. London, UK: Wiley-Blackwell.

Hilbert, M. (2012). Toward a synthesis of cognitive biases: how noisy information processing can bias human decision making. *Psychol. Bull.* 138, 211–237. doi: 10.1037/a0025940

Kahneman, D. (2011). *Thinking, fast and slow*. London, UK: Penguin.

Kahneman, D., and Miller, D. T. (1986). Norm theory: comparing reality to its alternatives. *Psychol. Rev.* 93, 136–153. doi: 10.1037/0033-295X.93.2.136

Kahneman, D., and Tversky, A. (1982). "The simulation heuristic" in *Judgment under uncertainty: Heuristics and biases*. eds. D. Kahneman, P. Slovic and A. Tversky (New York, NY: Cambridge University Press), 201–208.

Kaplan, N. (1965). The norms of citation behavior: prolegomena to the footnote. *Am. Doc.* 16, 179–184. doi: 10.1002/asi.5090160305

Kelley, H. H. (1971). *Attribution in social interaction*. New York, NY: General Learning Corporation.

Keuschnigg, M., van de Rijt, A., and Bol, T. (2023). The plateauing of cognitive ability among top earners. *Eur. Sociol. Rev.* 39, 820–833. doi: 10.1093/esr/jcac076

Kuran, T. (1997). *Private truths, public lies: The social consequences of preference falsification*. Cambridge, MA: Harvard University Press.

Langer, E. J. (1975). Illusion of control. *J. Pers. Soc. Psychol.* 32, 311–328. doi: 10.1037/0022-3514.32.2.311

Levinthal, D. A. (1991). Random walks and organizational mortality. *Adm. Sci. Q.* 36, 397–420. doi: 10.2307/2393202

Levy, M. (2003). Are rich people smarter? *J. Econ. Theory* 110, 42–64. doi: 10.1016/S0022-0531(03)00024-3

Liu, C. (2020). *Luck: A key idea for business and society*. London, UK: Routledge.

Liu, C. (2021a). In luck we trust: capturing the diversity bonus through random selection. *J. Organ. Des.* 10, 85–91. doi: 10.1007/s41469-021-00100-8

Liu, C. (2021b). Why do firms fail to engage diversity? A behavioral strategy perspective. *Organ. Sci.* 32, 1193–1209. doi: 10.1287/orsc.2020.1425

Liu, C.. (2021c). *Don't underestimate the power of luck when it comes to success in business*. Brighton, MA: Harvard Business Review.

Liu, M., Choy, V., Clarke, P., Barnett, A., Blakely, T., and Pomeroy, L. (2020). The acceptability of using a lottery to allocate research funding: a survey of applicants. *Res. Integrity Peer Rev.* 5, 1–7. doi: 10.1186/s41073-019-0089-z

Liu, C., and de Rond, M. (2016). Good night and good luck: perspectives on luck in management scholarship. *Acad. Manag. Ann.* 10, 409–451. doi: 10.5465/19416520.2016.1120971

Liu, C., Olivola, C., and Kovacs, B. (2017). Co-authorship trends in the field of management: facts and perceptions. *Acad. Manag. Learn. Educ.* 16, 509–530. doi: 10.5465/amle.2016.0080

Liu, C., and Tsay, C.-J. (2021). The variance of variance. *Res. Sociol. Organ.* 2021:12252. doi: 10.5465/AMBPP.2021.85

Liu, C., Vlaev, I., Fang, C., Denrell, J., and Chater, N. (2017). Strategizing with biases: engineering choice contexts for better decisions using the Mindspace approach. *Calif. Manag. Rev.* 59, 135–161. doi: 10.1177/0008125617707973

Lorenz, J., Rauhut, H., Schweitzer, F., and Helbing, D. (2011). How social influence can undermine the wisdom of crowd effect. *Proc. Natl. Acad. Sci.* 108, 9020–9025. doi: 10.1073/pnas.1008636108

Lynn, F. B., Podolny, J. M., and Tao, L. (2009). A sociological (de)construction of the relationship between status and quality. *Am. J. Sociol.* 115, 755–804. doi: 10.1086/603537

Makridakis, S., Hogarth, R., and Gaba, A. (2009). *Dance with chance: Making luck work for you*. London, England: Oneworld.

March, J. G. (1991). Exploration and exploitation in organizational learning. *Organ. Sci.* 2, 71–87. doi: 10.1287/orsc.2.1.71

March, J. G. (2006). Rationality, foolishness, and adaptive intelligence. *Strateg. Manag. J.* 27, 201–214. doi: 10.1002/smj.515

March, J. G. (2012). Heroes and history: Lessons for leadership from Tolstoy's war and peace. Available at: https://www.gsb.stanford.edu/insights/heroes-history-lessons-leadership-tolstoys-war-peace (Accessed October 30, 2023).

March, J. C., and March, J. G. (1977). Almost random careers: the Wisconsin school superintendency, 1940-1972. *Adm. Sci. Q.* 22, 377–409. doi: 10.2307/2392180

March, J. C., and March, J. G. (1978). Performance sampling in social matches. *Adm. Sci. Q.* 23, 434–453. doi: 10.2307/2392419

March, J. G., and Simon, H. A. (1958). *Organizations*. New York: Wiley.

Mauboussin, M. J. (2012). *The success equation: Untangling skill and luck in business, sports and investing*. Cambridge, MA: Harvard Business School Press, *30*, 44–51.

Merton, R. K. (1968). The Matthew effect in science: the reward and communication systems of science. *Science* 159, 56–63. doi: 10.1126/science.159.3810.56

Milgrom, P. R. (1981). Good news and bad news: representation theorems and applications. *Bell J. Econ.* 12, 380–391. doi: 10.2307/3003562

Morris, M. W., and Larrick, R. P. (1995). When one cause casts doubt on another: a normative analysis of discounting in causal attribution. *Psychol. Rev.* 102, 331–355. doi: 10.1037/0033-295X.102.2.331

Page, S. (2008). *The difference: How the power of diversity creates better groups, firms, schools, and societies*. Princeton University Press.

Page, S. E. (2017). *The diversity Bonus: How great teams pay off in the knowledge economy*. Princeton, NJ: Princeton University Press.

Pluchino, A., Biondo, A. E., and Rapisarda, A. (2018). Talent versus luck: the role of randomness in success and failure. *Adv. Complex Syst.* 21:1850014. doi: 10.1142/S0219525918500145

Podsakoff, P. M., MacKenzie, S. B., Podsakoff, N. P., and Bachrach, D. G. (2008). Scholarly influence in the field of management: a bibliometric analysis of the determinants of university and author impact in the management literature in the past quarter century. *J. Manag.* 34, 641–720. doi: 10.1177/0149206308319533

Posen, H. E., Lee, J., and Yi, S. (2013). The power of imperfect imitation. *Strateg. Manag. J.* 34, 149–164. doi: 10.1002/smj.2007

Radicchi, F., Fortunato, S., and Castellano, C. (2008). Universality of citation distributions: toward an objective measure of scientific impact. *Proc. Natl. Acad. Sci.* 105, 17268–17272. doi: 10.1073/pnas.0806977105

Rendell, L., Boyd, R., Cownden, D., Enquist, M., Eriksson, K., Feldman, M. W., et al. (2010). Why copy others? Insights from the social learning strategies tournament. *Science (New York, N.Y.)* 328, 208–213. doi: 10.1126/science.1184719

Richerson, P. J., and Boyd, R. (2005). *Not by genes alone: How culture transformed human evolution*. Chicago, IL: University of Chicago Press.

Roese, N. J., and Olson, J. M.. (1995). *What might have been: The social psychology of counterfactual thinking*. Mahwah, NJ: Erlbaum.

Rosenzweig, P. (2007). *The halo effect*. New York, NY: Free Press.

Ross, L., and Nisbett, R. E. (1991). *The person and the situation: Perspectives of social psychology*. London, UK: McGraw-Hill.

Salganik, M. J., Dodds, P. S., and Watts, D. J. (2006). Experimental study of inequality and unpredictability in an artificial cultural market. *Science* 311, 854–856. doi: 10.1126/science.1121066

Sauder, M. (2020). A sociology of luck. *Sociol Theory*. 38, 193–216. doi: 10.1177/0735275120941178

Shleifer, A., and Vishny, R. W. (1997). The limits of arbitrage. *J. Financ.* 52, 35–55. doi: 10.1111/j.1540-6261.1997.tb03807.x

Simon, H. A. (1947). *Administrative behavior*. New York: Simon and Schuster.

Small, H. (2004). On the shoulders of Robert Merton: towards a normative theory of citation. *Scientometrics* 60, 71–79. doi: 10.1023/B:SCIE.0000027310.68393.bc

Starbuck, W. H. (2005). How much better are the most-prestigious journals? The statistics of academic publication. *Organ. Sci.* 16, 180–200. doi: 10.1287/orsc.1040.0107

Stone, P. (2011). *The luck of the draw: The role of lotteries in decision making*. Oxford, England: Oxford University Press.

Taleb, N. N. (2001). *Fooled by randomness: The hidden role of chance in life and in the markets*. London, England: Penguin.

Teigen, K. H. (2005). "When a small difference makes a large difference: counterfactual thinking and luck" in *The psychology of counterfactual thinking*. eds. D. Mandel, D. Hilton and P. Catelani (London, UK: Routledge)

Thaler, R. H. (2015). *Misbehaving: The making of behavioral economics*. New York, NY: WW Norton & Company.

Tversky, A., and Koehler, D. J. (1994). Support theory: a nonextensional representation of subjective probability. *Psychol. Rev.* 101, 547–567. doi: 10.1037/0033-295X.101.4.547

Wiseman, R. (2003). *The luck factor*. New York, NY: Miramax.

Appendix A: Survey invitation email text

Title: The BEST Management [Psychology] journal articles – Have your say!

Greetings,

We develop an on-line voting tool (using 'All of Our Ideas') for finding out the best journal articles published in Management [Psychology]. We have selected 45 [60] articles in the voting pool (the top 3 most cited articles in the 15 [20] Management [Psychology] journals, see the list below). Feel free to add your favorite articles to the pool (as long as it's published in one of the selected 15 [20] journals)!

Here is what you need to do to express your views on the best article in Management [Psychology]:

First, log on [link] and begin voting! You will be presented with randomly selected pair-wise comparisons. Keep voting for as long as you like!

Second, feel free to select 'I cannot decide' in cases such as you are not

familiar with the article(s) in the pair or you do not believe there is significant difference between them.

Third, forward this email or the link to your colleagues and let them have their say on this issue!

We thank you for your attention and participation!

==Journal List==.

1 Academy of Management Journal (AMJ)
2 Academy of Management Review (AMR)
3 Administrative Science Quarterly (ASQ)
4 California Management Review (CMR)
5 Harvard Business Review (HBR)
6 Human Resource Management (HRM)
7 Journal of Applied Psychology (JAP)
8 Journal of Business Venturing (JBV)
9 Journal of International Business Studies (JIBS)
10 Journal of Management Studies (JMS)
11 Management Science (MS)
12 Organization Science (OS)
13 Organizational Behavior & Human Decision Processes (OBHDP) (formerly Organizational Behavior and Human Performance)
14 Sloan Management Review (SMR)
15 Strategic Management Journal (SMJ).

[For Psychology].

==Journal List==

1 BEHAV BRAIN SCI
2 ANNU REV PSYCHOL
3 PSYCHOL BULL
4 TRENDS COGN SCI
5 ANNU REV CLIN PSYCHO
6 PSYCHOL REV
7 ADV EXP SOC PSYCHOL
8 PERS SOC PSYCHOL REV
9 AM PSYCHOL
10 MONOGR SOC RES CHILD
11 CLIN PSYCHOL REV
12 J PERS SOC PSYCHOL
13 PERSPECT PSYCHOL SCI
14 PSYCHOL MEN MASCULIN
15 DEV PSYCHOPATHOL
16 J EXP PSYCHOL GEN
17 J APPL PSYCHOL
18 J ABNORM PSYCHOL
19 PERS PSYCHOL
20 PSYCHOL SCI

frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 14 September 2023
DOI 10.3389/fpsyg.2023.1166023

OPEN ACCESS

EDITED BY
Daniella Laureiro Martinez,
ETH Zürich, Switzerland

REVIEWED BY
Jon Atwell,
Stanford University, United States
Shirley Wang,
University of Hartford, United States
Ren Li,
Hong Kong Polytechnic University,
Hong Kong SAR, China

*CORRESPONDENCE
Özgecan Koçak
✉ ozgecan.kocak@emory.edu

RECEIVED 14 February 2023
ACCEPTED 02 August 2023
PUBLISHED 14 September 2023

CITATION
Koçak Ö, Puranam P and Yegin A (2023) Decoding cultural conflicts.
Front. Psychol. 14:1166023.
doi: 10.3389/fpsyg.2023.1166023

Decoding cultural conflicts

Özgecan Koçak[1]*, Phanish Puranam[2] and Afşar Yegin[3]

[1]Goizueta Business School, Organization & Management Area, Emory University, Atlanta, GA, United States, [2]INSEAD, Singapore, Singapore, [3]Faculty of Economics, Administrative, and Social Sciences, Department of Business Administration, Kadir Has University, Istanbul, Türkiye

As pioneers of the Carnegie Perspective recognized, conflicts in organizations can exist even when incentives of all parties are aligned. These can often be traced to differences in cognitions such as beliefs and values, which are foundational components of any given culture. This paper refines the operationalization of cultural clashes by identifying differences in beliefs about causality ("which actions cause which outcomes") and morality (in the broad sense of "what is evaluated as desirable") as two fundamental sources of conflict. In our first study, we demonstrate empirically that participants recognize and distinguish between these two sources of conflict. In our second study, we test the hypotheses that while misalignments in either causal or moral codes increase observers' perceptions of relationship conflict, negative affect, likelihood of avoidance, and lower perceived likelihood of conflict resolution, the effects are stronger for misalignments in moral codes than misalignments in causal codes and strongest when both causal and moral codes are misaligned. We test these arguments using vignette-based experimental studies. Our findings support our hypotheses. This research has significant implications for the understanding of conflict dynamics within and beyond organizational contexts. By recognizing the pivotal role of cultural differences in shaping conflicts, organizations and decision-makers can better anticipate, manage, and potentially preempt such conflicts.

KEYWORDS

culture, conflict, vignettes, experiments, Carnegie perspective

1. Introduction

Central to *A Behavioral Theory of the Firm* (Cyert and March, 1963) is the idea that organizations cannot be treated as unitary entities with a single goal. When an organization's members have different goals, conflict naturally ensues. Moreover, the Carnegie perspective highlights that differences in information, attention, and problem representation can also be consequential for conflict, even if there is alignment on ultimate goals (Simon, 1947; March and Simon, 1958). For instance, in an early articulation of this idea, Dearborn and Simon (1958) documented how structural differentiation within a company may lead executives in different units to reach different and ultimately conflicting interpretations of the same business situation.

Yet, the importance of cognition-driven sources of conflict appears to have disappeared from the agenda of behavioral theories of the firm. Concluding a recent survey of the extensive literature on information processing and organization design, which is to a large extent inspired by the Carnegie perspective, Joseph and Gaba (2020) noted that: "… the literature largely overlooks the potential for conflict in decision-making. This shortcoming reflects, inter alia, the belief that conflict results from divergent interests and poor incentive design (Gibbons, 2003)." We believe this lacuna points to an emergent division of labor between organization science and organizational economics, in which the latter is presumed to be adequately covering conflict through its focus on problems of misaligned interests between principals and their agents, leaving the former free to pursue other topics. However, as Joseph and Gaba (2020) point out, such a division of labor rests on the faulty premise that conflicts result only from imperfect incentive design. Incentives are rewards (such as payments, career progression, or benefits) that individuals (expect to) get out of certain outcomes, and they divide value between

the principal and agents (Lazear, 2018). Poorly designed incentives are an important source of conflict within organizations, both among peers and between superior and subordinates (Gibbons and Roberts, 2013), but they are by no means the only source of conflict.

In parallel, research on organizational culture has progressed largely independent of the behavioral theories of decision-making and learning that Joseph and Gaba (2020) reviewed and has developed a substantial body of theory and a repertoire of tools that are relevant to studying cognition-driven conflicts in organizations. Like psychological studies of national cultures and sociological studies of social groups, studies of organizational cultures conceptualize "culture" most basically as shared cognitive constructs such as values, beliefs, and norms (Chatman and O'Reilly, 2016). In this view, different organizations within the same country can have distinct organizational cultures. This is because organizational cultures, as shared cognitions, evolve as a learned response to organizational problems. This idea is reflected in Schein's definition of culture as: "(1) A pattern of shared basic assumptions, (2) invented, discovered, or developed by a given group, (3) as it learns to cope with its problems of external adaptation and internal integration, (4) that has worked well-enough to be considered valid and, therefore (5) is to be taught to new members as the (6) correct way to perceive, think, and feel in relation to those problems." (Schein, 2010, 2012, p.313).

However, the *extent* to which cognitions are shared within an organization—what is referred to as the "strength" of a culture (Chatman and O'Reilly, 2016; Marchetti and Puranam, 2022)—can vary significantly. Furthermore, different sub-cultures can exist in the same organization, leading to divergent interpretations and strategies for action (e.g., Howard-Grenville, 2006). The idea that a group can have a weak culture or that it might contain sub-groups with different cultures is central to organizational studies adopting the "culture as toolkit" view of culture from sociology, which studies how agents can strategically exploit such variability (Swidler, 1986; Giorgi et al., 2015). It is also a central assumption in the literature on moral reframing within psychology, which studies how mediators can create support for polarizing issues across sub-cultures by bridging differences in beliefs and values (Feinberg and Willer, 2019).

In any setting (within or outside organizations), individuals might disagree about the core tenets of an issue because they belong to different groups with distinctive cultures (e.g., sub-units of an organization or different tribes in a nation) or because the group that they both belong has a weak culture. Thus, sub-cultural and intra-cultural variation in organizations is an important source of potential conflict in organizations, even if individuals have the same incentives. Cognitive conflicts ultimately involve differences in cognitions *between* people (and between groups of people) and research on culture gives us access to a powerful set of ideas about the nature and stability of differences in beliefs and values among people. We do not claim that culture is the only source of such differences but rather that it is a sufficiently important one.

In this study, we attempt to extend and refine the idea of cognition-driven conflicts through three contributions. First, we link the problem of cognition-driven conflict in organizations to cultural clashes. This broadens (beyond incentive misalignment) the notion of conflict in organizational settings, which was salient to pioneers of the Carnegie perspective, but which has since receded in importance in research within this perspective (Joseph and Gaba, 2020). Second, we refine the operationalization of cultural clashes by identifying differences in beliefs about causality ("which actions cause which outcomes") and morality (in the broad sense of "what is evaluated as desirable") as two fundamental sources of conflict. In doing this, we draw on the construct of cultural codes—defined as fuzzy mappings between distinct types of cognitive constructs (Koçak and Puranam, 2023). In our first study, we demonstrate empirically that participants recognize and distinguish between these two sources of conflict based on differences in cognitions pertaining to causality or morality. Third, we build on research on inter-personal conflict in teams, attitude polarization, and moral conviction to propose that conflicts whose roots lie in differences in causal codes are perceived by third parties as easier to resolve than conflicts that arise from differences in moral codes. In our second study, we test the hypotheses that while misalignments in either causal or moral codes increase observers' perceptions of relationship conflict, negative affect, likelihood of avoidance, and lower perceived likelihood of conflict resolution, the effects are stronger for misalignments in moral codes than misalignments in causal codes. We end with a discussion of implications for organizations and potential interventions to forestall or resolve conflicts.

2. Micro-foundations of cultural clashes

Insights about cultural clashes come to us from at least three different bodies of literature—on culture and cognition, interpersonal conflict in teams, and attitude moralization and polarization. In what follows, we first review the relevant literature. Next, we build on and extend the literature on culture and cognition to develop the notion of a "chain of reasons" that capture the cognitive underpinnings of behavior and its justification. We then use the literature on attitude polarization and team conflict to theorize about the different effects of beliefs and attributions about links in the chain that are concerned with causality vs. links pertaining to morality.

2.1. Related literature

Culture clash exists when interacting individuals do not share one or more cultural cognitions. Studies show that clashes can give rise to failures of communication and coordination, and even outright conflict, especially in task groups with members separated by occupational histories or geography (e.g., Bechky, 2003; Carlile, 2004). Representational gaps ("rGaps")—inconsistencies between individuals' definitions of a team's problem—limit knowledge integration and increase the likelihood of conflict (Cronin and Weingart, 2007, 2019). Not all differences in assumptions, values, or beliefs need to be detrimental, however. For instance, the diversity of cognitive styles and views is thought to spur innovation (Corritore et al., 2020).

Research on interpersonal conflict in work groups also focuses on differences in beliefs and values and can therefore be treated as pertaining to cultural clashes. This research suggests that

the *content* of disagreement leads to different types of conflict, some of which are more detrimental than others for team performance. Four types of inter-personal conflict have received the most attention: task, process, relationship, and status (see Greer and Dannals, 2017, for a review). Task conflict stems from disagreements about "the content of the tasks being performed, including differences in viewpoints, ideas, and opinions" (Jehn, 1995, p. 258). "Task-related debates can be about either the content or the process of the task. Task content is about what to do (e.g., a new marketing campaign), in contrast to task process, which is about how to do it (e.g., delegation of responsibilities)" (Jehn et al., 1999, p. 743). The latter is often separated from the former and referred to as process conflict (Jehn, 1995; Jehn et al., 1999). Relationship conflict refers to "conflict over workgroup members' personal preferences or disagreements about interpersonal interactions, typically about non-work issues such as gossip, social events, or religious preferences (Jehn, 1995, 1997)." (Jehn et al., 1999, p. 745). Status conflict refers to disagreements over relative status positions in a team's social hierarchy (Bendersky and Hays, 2012). Recently, Brown et al. (2022) have added ethical conflicts—stemming from disagreements about moral convictions and normative conventions—as a fifth type of workplace conflict.

Note that relationship conflict is different from the other types of conflict in that it does not (only) refer to the content of disagreement but also to conflict attitudes and behaviors—to there being "tension, animosity, and annoyance among members within a group" (Jehn, 1995, p. 258), i.e., to disagreements being "hot." This is important to note because empirical studies find that task conflict can have a positive impact on group performance when it does not co-occur with relationship conflict (De Wit et al., 2012). Conversely, an inductive study of conflict-resolution tactics used by autonomous work groups (study groups) finds that successful teams share a tendency to focus on content rather than style (Behfar et al., 2008). Another study finds that groups that can use coping strategies to decouple task conflict from relationship conflict are more likely to benefit from it (Pluut and Curşeu, 2013).

While informative, the prior literature leaves open two issues that are crucial to progress on our research agenda.

First, a relevant question is whether disagreements rooted in particular content lead to affective reactions and relationship conflict. On the one hand, it is possible that the content of cognition is unrelated to whether disagreements generate relational or emotional conflict. Research on team conflict suggests that presumably, disagreements over any topic (including ethical, status, process, or task issues) can all turn "hot." For instance, Brown and colleagues find that task or ethical conflicts have the same propensity to create or co-exist with relationship conflict (Brown et al., 2022, p. 1135). Others find that the likelihood of task conflicts to develop into relationship conflicts depends on factors such as intergroup trust (Simons and Peterson, 2000) and coping strategies (Behfar et al., 2008; Pluut and Curşeu, 2013). Similarly, research on attitude polarization, which identifies antecedents of emotionally charged attitude conflicts characterized by parties' intolerance of each other's positions (Minson and Dorison, 2022) does not mention the content of cognitions at all. Rather, it focuses on three antecedents: outcome importance, actor interdependence, and evidentiary skew (parties' belief that the weight of evidence overwhelmingly supports their respective points of view).

On the other hand, some studies suggest that content and emotion are not entirely divorced. Research on moral conviction shows that individuals' *perception that some decisions, choices, judgments, and attitudes are moral* leads to conflict when there is disagreement on those attitudes (Skitka et al., 2021). People who feel their preferences to be motivated by moral commitments are less tolerant of others with dissimilar preferences and avoid interacting with them (Skitka et al., 2015). While suggestive, the moral conviction literature does not fully explore the link between content of disagreements and the negative affect and relationship conflict that might follow. For instance, Skitka et al. (2021, p. 350) emphasize that "morality is not an essential feature of some decisions, choices, judgments, or attitude domains—rather, it is a meta-perception people have about some of their decisions, choices, judgments, and attitudes that can vary in strength." Instead, the focus of this literature has been on the range of application of beliefs. Moral beliefs are assumed to be universally applicable, and thus distinguished from preferences (held by individuals) and normative conventions (recognized as being specific to particular social groups). It is this belief in universality that, when violated by perceptions of difference, leads to moral conflict. In other words, while "the moral significance people attach to different issues varies over time, cultures, and individuals," issues that are seen as morally significant—and thus distinguished from preferences and conventions—are tied to emotions, resist change, and create intolerance for differing viewpoints. That said, studies in this line of research do not examine whether certain types of cognitions (across a range of issues) might more or less likely be perceived as morally significant (across cultures).

A second shortcoming we perceive is that neither the literature on conflict nor the literature on moralization explicitly examines differences in causal reasoning. The literature on managerial cognition, in contrast, is overwhelmingly about causal understandings (Walsh, 1995). Methods used for strategy formulation also focus on clearly mapping cause–effect relationships (Carroll and Sϕrensen, 2021), suggesting that strategic decision-making requires an explicit focus on cognitions about causality.

While "task conflict" in the team conflict literature comes close to finding sources of conflict in disagreements about cause–effect relationships, it is much broader in that it can include disagreements on what the team's task is and what the goals of the team are. For instance, the task conflict sub-scale within the intragroup conflict scale uses items such as "How frequently are there conflicts about ideas in your work unit?" and "How often do people in your work unit disagree about opinions?" (Jehn et al., 1999). Meanwhile, "process conflict" refers to the team's understanding of how the task can be accomplished, but is too narrow, in that it refers to how the task is to be accomplished by the team, through division of labor. The sub-scale consists of three questions: "How often do members of your work unit disagree about who should do what?," "How frequently do members of your work unit disagree about the way to complete a group task?," and "How much conflict is there about delegation of tasks within your work unit?" (Jehn et al., 1999). Thus, neither scale focuses on the cause–effect relationships as being the source of contention. If a conflict arose from differences in beliefs about causality—for instance, the effectiveness of particular tools or materials for building a product, or whether a proposed initiative will contribute

to employees' felt inclusion—both the task conflict and the process conflict scales might pick it up but neither would be able to distinguish it from differences in how much individuals value the various actions or outcomes—such as whether the team should place greater value on the effectiveness of tools or their impact on the environment or whether felt inclusion or demographic diversity should be a goal of the team.

In what follows, we address these two shortcomings by considering the cognitive underpinnings of such disagreements. We propose a typology of cognitions about causality and desirability that in combination motivate preferences and behavior and, when they differ, can lead to disagreements.

2.2. Causal and moral codes in a chain of reasons that underpin behavior

Within behavioral strategy, representations play a central conceptual role in explaining strategic reasoning and choice (e.g., Gavetti and Levinthal, 2000; Gavetti and Rivkin, 2007; Levinthal, 2011; Csaszar and Levinthal, 2016; Puranam and Swamy, 2016; Csaszar, 2018). Most often, the term refers to individual decision-makers' understanding of their task environment, connecting potential actions to their expected payoffs. However, this umbrella term can encompass a wide range of cognitions. In this study, we focus on two types of cognitions that are relevant for decision-making in organizations: desirability of outcomes and ways to achieve outcomes.

Following Koçak and Puranam (2023), we express these two cognitions as codes. The construct of a "code" builds on that of "schema"—as networks of connected cognitive elements that store cultural knowledge and guide action (DiMaggio, 1997; Strauss and Quinn, 1997; Hunzaker and Valentino, 2019; Cerulo et al., 2021). As with schema, a code specifies a *mapping* between concepts, where the strength of mapping is adjusted through experience. Unlike schema, a code specifies the type of concepts that are joined and implies a directional tie (e.g., mapping cause to consequence). When codes shape an individual's behavior, we say they are *using* a code. Individuals can also have *expectations* about the codes others use.

"Causal codes" are beliefs about how the world works, expressed as (fuzzy) mappings between causes and effects. Similar concepts have been used in research on managerial cognition, referred to variously as "cause maps" (Bougon et al., 1977), "beliefs about causes and effects" (Ford and Hegarty, 1984), and "causal beliefs" (Porac et al., 1989). *Using* a causal code (e.g., about how new technology affects the emissions from a production process), an agent can choose or advocate for a particular action (e.g., to adopt the technology). *Expecting* another agent to use a particular causal code, an agent might tacitly align their actions to it (e.g., only suggest the new technology to leaders who believe it to be effective).

By "moral codes," we are referring to evaluations of entities, actions, or outcomes as desirable or undesirable, again expressed as a (fuzzy) mapping from the former to the latter. We construe these broadly, to include desirability attached to any outcome that is relevant to organizational behavior (including profitability), and not only pro-social outcomes (such as social impact).[1,2] *Using* a moral code (e.g., about whether reducing emissions beyond the legally mandated limit is a moral duty), an agent can defend an action (e.g., adopting the technology despite its high costs). *Expecting* a moral code to be used by their leaders, an agent can advocate for a particular action (e.g., not adopting the technology) even if it conflicts with their own moral code.

In Figure 1, we illustrate causal and moral codes concerning another hypothetical issue—the opening of a daycare center in a company. The causal code refers to whether opening a daycare center on company premises would provide relief to employees with children. The moral code refers to whether providing relief to parents would support the positively valued dimension of inclusivity (because it demonstrates care) or if it would be non-inclusive because it leaves out employees without children (and is therefore unfair). A combination of codes such as this depicts how decisions could be motivated or rationalized with a "logic of consequences" (March and Olsen, 2011), under the assumption that any goal-directed behavior requires people to have an understanding of what outcome they want (specified in a moral code) and also of how to reach that outcome (specified in a causal code).[3]

Note that this schematic representation does not necessarily show how people might describe their own reasoning. We do not assume people to expressly articulate the codes that motivate their actions or to separate them into causal and moral codes. Nor do we assume that people can consciously access the codes that drive their own behaviors. People have a broad set of codes, only a part of

1 In this usage, we differ from research on moral psychology, where the term "moral" has a socially prescriptive component and typically refers to other-regarding values that are perceived to set universal standards of conduct (Skitka et al., 2021). Our usage of the term is broader and includes what this literature refers to as "social conventions." Also note that we do not assume different dimensions of desirability (e.g., financial performance and social impact) to be commensurable. In other words, moral codes may not be reducible to utility functions. This is why different interests may not be resolved through incentive design.

2 This distinction we make between causal and moral codes is similar to the distinction Haidt and Kesebir (2008) make between plain facts and anthropocentric facts, the latter being facts whose truth value depends on moral, ontological, religious, linguistic, legal, metaphysical, or political reasoning about the social world and thus can only be defended with reference to a cultural system. The distinction also roughly reflects the difference between "beliefs" and "values"—roughly, because (a) "beliefs" and "values" have been used in reference to slightly different concepts across different research programs and (b) codes are mappings, whereas beliefs and values need not be (see Koçak and Puranam, 2023).

3 In contrast with "logic of consequences," "logic of appropriateness" (or "rule based action") corresponds to use of codes based on associated situations or identities, rather than likelihood and value of potential consequences (March and Olsen, 1989; March and Simon, 1993; March and Olsen, 2011). For instance, a parents' representative might advocate for any measure that is intended to support parents, regardless of the likelihood of its success or other effects. The logic of appropriateness is a form of deontological reasoning, and while it can be represented through particular codes, we defer a deeper discussion of this to future work.

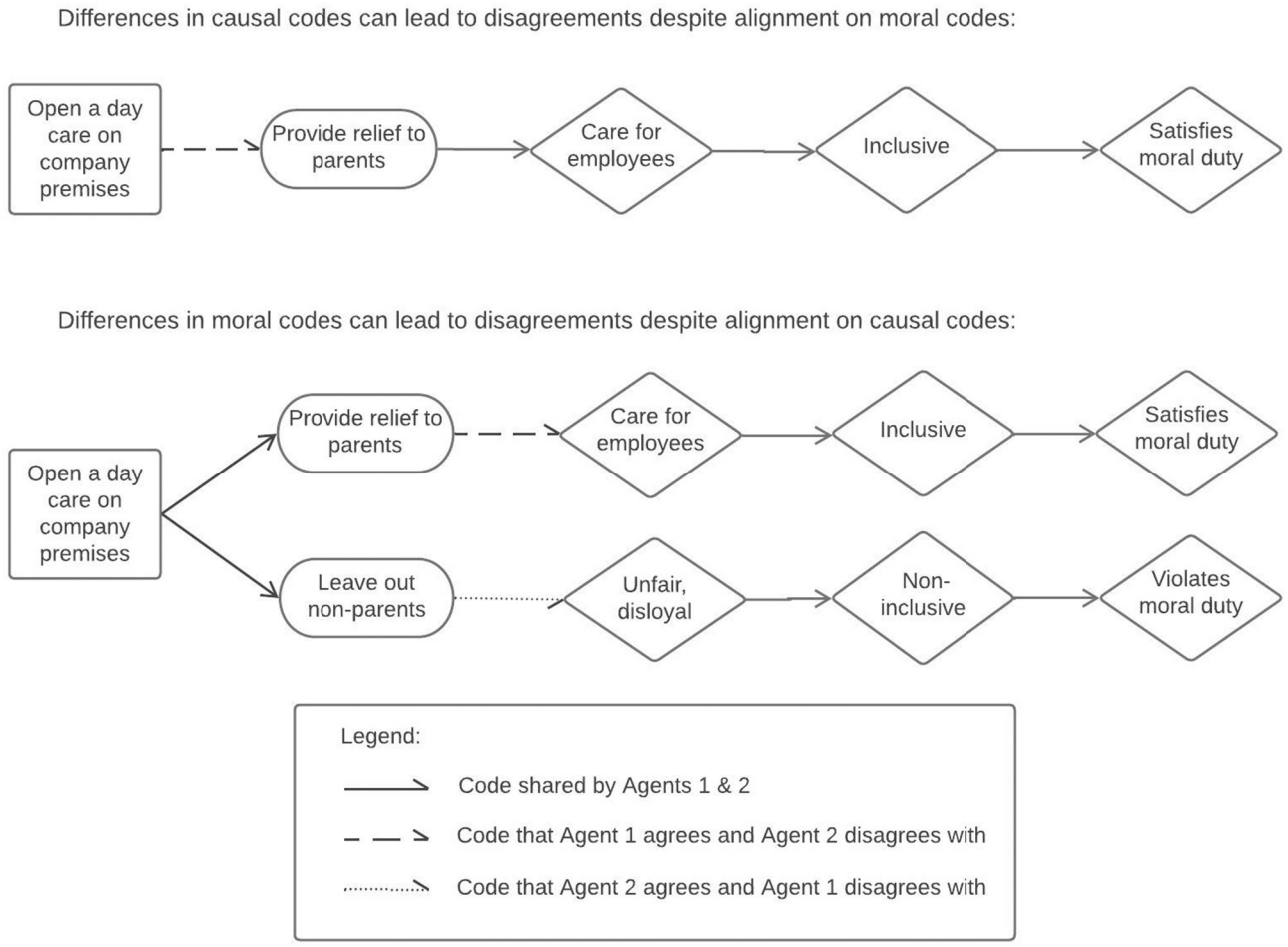


FIGURE 1
Schematic representation of disagreements that arise from differences in causal or moral codes.

which is activated at any given time. In any given situation, codes may be activated automatically without conscious deliberation or with deliberation. The chain of reasons may remain tacit and unarticulated until agents are asked to explain their behavior. And even then, people may not be able to accurately pinpoint what had driven their behavior or preferences. As a result, codes that motivate action need not be the same as the codes that are used to justify action.

Both causal and moral codes can be acquired through personal experiences or socially transmitted between people. In either case, because experiences that shape codes are likely to vary across groups and because transmission of codes is more likely within than across groups, codes are more likely to be similar (but not identical) within groups and different across groups. It is in this sense that individual cognition is "cultural" and groups have distinct cultures (Strauss and Quinn, 1997). Thus, while we focus on conflicts that arise from differences in individuals' codes, these differences are ultimately reflections of differences within and between (sub)-cultures.

The key premise of our argument is that differences in either causal or moral codes can lead to disagreements on preferred courses of action. In the top panel in Figure 1, a difference in opinion arises from differences in causal codes, as one agent believes that a daycare center on company premises would support parents while the other agent does not. In the lower panel, the disagreement arises from differences in moral codes: one agent believes that supporting only employees with children would be unfair, while the other one does not.

Fuzziness in codes (i.e., the mapping between concepts being one-to-many, many-to-one, or many-to-many) can also create disagreements. In the lower panel of Figure 1, both agents believe that daycare centers both provide relief to parents and leave out non-parents. Situational cues or particular ways of framing the debate may focus agents on the first belief while others focus them on the second belief. Thus, even with very similar codes, fuzziness in codes can, in some situations, create disagreements between these two agents.

In this study, we focus on a potential observer's perspective, corresponding to the viewpoint of a potential mediator of conflicts. Third parties observing other agents' disagreements may perceive or analyze these in terms of causal and moral codes. In doing so, they are likely to rely on their *expectations* about the codes that others have and use. For instance, a third agent, who expects that peoples' beliefs about the consequences of daycare centers for

parents' welfare will vary, may accurately diagnose the source of disagreement depicted in the top panel of Figure 1 as arising from differences in causal codes. Conversely, an observer who does not recognize the possibility for this variability or uncertainty in causal codes might erroneously assume that the disagreement stems from a difference in moral codes.

2.3. Effects of perceived misalignments in causal and moral codes

Whether or not they are accurate (i.e., correspond to the codes that motivated agents' behavior), the way agents diagnose the root causes of a conflict is likely to impact the actions they take and therefore the likelihood of conflict resolution. Therefore, the effects of third-party mediation of conflicts should depend on how this party diagnoses the root cause of cultural conflict.

We propose that conflicts that are traced to misalignments in causal codes will appear to be easier to resolve than moral codes, in turn generating attitudes and behaviors that increase the likelihood of conflict resolution. There are several reasons to think so.

People may intuitively understand that cause–effect relationships lend themselves to evidence-based reasoning and debate, while moral codes do not. Knowing that cause–effect relationships can lend themselves to evidence-based resolution, individuals can hold off moralizing differences of opinion. Even in the absence of required evidence, this can make way for reasoned debate and easier resolution by preventing relationship conflicts, negative affect, and avoidance behaviors.

Conversely, attributions of misalignments in moral codes can lead to relationship conflict, negative affect, and avoidance behaviors (Jehn, 1995; Behfar et al., 2008; Pluut and Curşeu, 2013). This would close off avenues for resolution through debate. Research on moral conviction shows that this might happen because moral codes are assumed to be universally applicable and any argument that they are not, any encounter with people who contest this universality may be perceived as an affront to the way the world is supposed to be (Skitka et al., 2021). Perceptions of misalignments in moral codes can make resolution less likely also if these (more than causal code differences) are associated with any of the three antecedents that the attitude polarization literature identifies as increasing likelihood of conflict: outcome importance, actor interdependence, and evidentiary skew (parties' belief that the weight of evidence overwhelmingly supports their respective points of view) (Minson and Dorison, 2022). Finally, it might be possible that differences in moral codes (which are associated with emotions) generate negative emotion because people want to be aligned in their emotional responses toward issues. That is, we want to feel positive or negative affect toward the same objects and failure to do so creates barriers to convergence.

Thus, we hypothesize:

Hypothesis 1. Perceived misalignment of either causal or moral codes decreases perceived likelihood of reaching an agreement.

Hypothesis 2. Perceived misalignment of moral codes decreases perceived likelihood of reaching an agreement to a greater extent than misalignment of causal codes.

Hypothesis 3. Perceived misalignment in moral codes amplifies the effect of causal codes on perceived likelihood of reaching an agreement.

3. Study 1

The study's purpose was 2-fold; to develop an instrument that allows us to measure attributions of sources of conflict to misalignments in causal and/or moral codes and to test if individuals distinguish between causal and moral codes. We generated scale items that reflect our conceptualization of causal codes as pertaining to cause–effect relationships between actions and their consequences and of moral codes as assigning desirability to actions or their consequences. We then tested whether study participants can reliably use these items to diagnose the source of disagreement in vignettes presenting a fictional debate between two managers about their organization opening a daycare center for the children of employees. Although we had not designed Study 1 to test our hypotheses, we also report exploratory tests of H2.

3.1. Participants

We recruited participants from the USA using the Prolific.co platform. Prolific.co is an online platform similar to Amazon Mturk (Buhrmester et al., 2018; Aguinis et al., 2021) that allows researchers to recruit participants for online studies. It has been shown to yield data quality comparable to Amazon Mturk with lower participant dishonesty and higher naiveté (Peer et al., 2017). Our target sample size was 100 participants (Hair et al., 2010). A total of 107 participants attempted the survey, of which seven left before completion. In addition, we excluded data from five participants whose response to the comprehension check question was not accurate. The final sample of 95 participants ranged between the ages of 18 and 66 years ($M = 32.65$, $SD = 11.31$) and predominantly identified as white ($n = 71$), followed by "Other" ($n = 14$), African American ($n = 7$), and Hispanic ($n = 3$).

Given the content of the vignette, we also included questions about whether participants had children and if daycare services were available to the participants at their place of employment. Most participants ($n = 74$) did not have children. Of those with children, none had access to daycare on company premises. Finally, participants responded to two questions inquiring about their political orientation on social and economic issues using an 11-point response scale (1-strongly liberal/left-wing, 11-strongly conservative/right-wing). The items had good reliability using the Spearman–Brown coefficient ($r = 0.894$), allowing us to create a single political orientation measure. The majority of our participants self-identified on the left of moderate ($n = 70$) with 21% ($n = 20$) indicating that they were strongly liberal (picking the left-most point on the scale). A minority indicated that they were either moderate ($n = 12$) or right-wing ($n = 13$).

3.2. Procedure

The study used a vignette design. After reading and accepting the informed consent form, participants were presented with a brief introduction, which indicated that they would read a conversation between two HR managers at a mid-sized company. The managers were discussing an employee suggestion to open a daycare center for employees' children at their workplace. This introduction was identical for all participants. Thereafter, participants were randomly assigned to one of two conditions (misalignments based on moral codes or causal codes) and viewed slightly different versions of a brief conversation. Specifically, the content of the arguments presented by the HR managers differed across conditions. The full text of the conversation is presented below. Italics indicate causal condition arguments. In the causal code misalignment condition, both parties relied on the consequences of a daycare center to support their position. In the moral code misalignment condition, they emphasized the moral obligations associated with opening a daycare center.

> Wilson: We should open a day care center on company premises, for employees' kids.
>
> Smith: I think that's a bad idea.
>
> Wilson: *Opening a day care center might reduce absenteeism and thus help the bottomline./*This is the right thing to do. We say we are a family, we should act like one.
>
> Smith: *But it opens the company to legal liability around running a childcare center./*I don't think it's fair to use company funds for a project that will only benefit some of the employees.

After reading the vignette, participants responded to an open-ended question about the root cause of the disagreement ("Why do you think Wilson and Smith disagree about opening a daycare center at their workplace? What is the root cause of their disagreement?") and a multiple-choice question about the likelihood of conflict resolution ("How likely do you think it is that Wilson and Smith can reach an agreement?"). They were then presented with two versions of the instrument, one distal and abstract and the other proximate and concrete. Sample items from the distal instrument include "They disagree about the consequences of their respective proposed actions" and "They disagree because they have conflicting values." Sample items from the proximate instrument include "They disagree because they expect different consequences to follow from a company-owned day care center" and "They disagree about whether it is morally acceptable for a company to offer day care for its employees' kids" (see Appendix 1 for a list of all items). Participants assessed each statement using a 5-point Likert response scale (1-strongly agree, 5-strongly disagree). The scale scores were reversed during the analysis such that higher scores indicated higher perceived misalignment in codes. This question block was followed by the intragroup conflict scale, also evaluated on a 5-point Likert response scale (1-strongly agree, 5-strongly disagree) (Jehn and Mannix, 2001). The questionnaire concluded after participants provided brief demographic information.

3.3. Analyses and results

We report analyses here on the distal scale, which we subsequently use to check our manipulations in Study 2 (see Appendix 2 for analyses on the proximate scale, which yield the same pattern of results). All analyses of the code misalignment instrument were conducted on Jamovi 2.2 (The jamovi project, 2022). Confirmatory factor analysis supported a two-factor structure [Comparative Fit Index (CFI) = 0.998, Root Mean Square Error of Approximation (RMSEA) = 0.017] by common acceptance levels (Bentler, 1990; Hu and Bentler, 1998; Ullman, 2006) (see Appendix 1 for further details, as well as an exploratory factor analysis and additional validation with an independent sample). Moreover, the sub-scales exhibited good reliability ($\alpha_{causal} = 0.820$, $\alpha_{moral} = 0.872$). Thus, we calculated mean moral code misalignment and causal code misalignment scores to be used for the second part of the analysis, which we display by condition in Figure 2.

To assess whether participants were able to identify sources of disagreement in misalignment of moral and causal codes, we conducted *t*-tests of attributions across conditions. Participants in the causal code difference condition attributed the disagreements to misalignments in causal codes significantly more ($M = 4.08$, $SD = 0.73$) than participants in the moral code misalignment condition ($M = 3.26$, $SD = 0.92$), $t_{(93)} = 4.66$, $p < 0.001$. In contrast, participants in the moral code difference condition showed a significantly higher tendency to attribute disagreements to misalignments in moral codes ($M = 3.54$, $SD = 0.89$) compared to participants in the causal code difference condition ($M = 2.15$, $SD = 0.77$), $t_{(93)} = -0.790$, $p < 0.001$. These findings demonstrate that individuals were able to reliably distinguish between moral code misalignments and causal code misalignments.

However, we also observe some spillover effects: even when we manipulated the vignette to indicate that the managers disagreed on moral codes, participants' attributions to causal code misalignments were almost as high as attributions to moral codes. Comparing the scale scores *within* each condition, we find that the difference between moral and causal code misalignment scores was significant in the causal code condition, $\Delta = 1.93$, $t_{(38)} = 12.338$, $p < 0.001$, but only marginally significant in the moral code condition, $\Delta = 0.28$, $t_{(55)} = -1.715$, $p = 0.092$.

Finally, while our main concern in this study was not hypothesis testing, we expected, per H2, that participants' perceptions of ease of conflict resolution would vary across conditions. A one-way ANOVA revealed that there was not a statistically significant difference in the perceived likelihood of conflict resolution between the two conditions [$F_{(1,93)} = 0.006$, $p = 0.936$]. Thus, initial evidence suggests that both types of conflicts are perceived to be equally difficult to resolve, in contrast to H2.

4. Study 2

Study 2 tests Hypotheses 1 through 3, using the instrument developed in Study 1 to check the effectiveness of our manipulations. In this study, we used two vignettes, one concerning the same daycare problem used in Study 1 and a second one concerning investment in technology to reduce

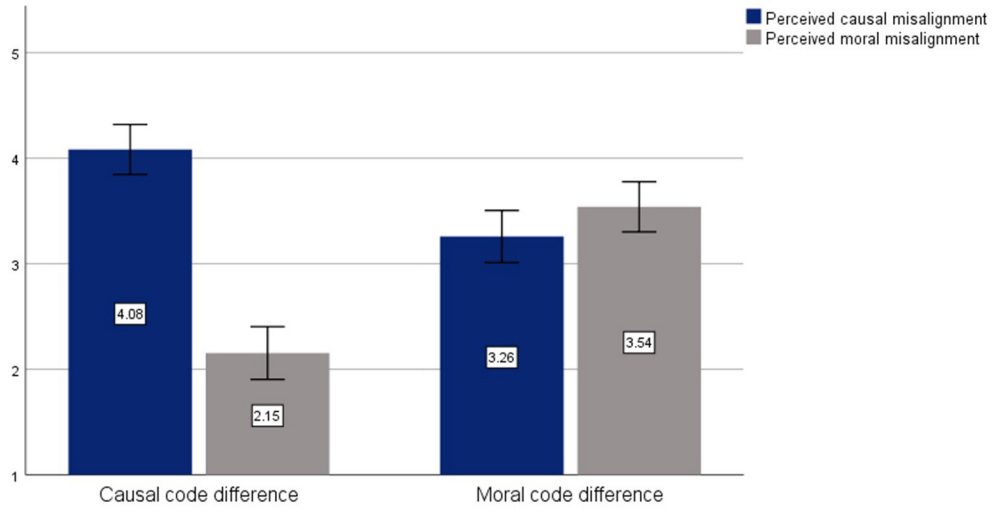


FIGURE 2
Study 1 results: perceived code misalignment by condition (distal scale).

greenhouse emissions. We employed a 2 (vignette) × 2 (moral code aligned/misaligned) × 2 (causal code aligned/misaligned) experimental design. The vignette was a within-subject factor; each of the moral code and causal code misalignment was a between-subject factor. Rather than asking participants to infer sources of disagreements from conversations, the vignettes stated whether two managers in an organization disagreed due to misalignments in causal or moral codes and asked for predictions about the likelihood that the managers would be able to resolve their conflict. Notably, the vignettes did not mention "culture" or whether others in the organization shared the managers' opinions.

In our first attempt at Study 2 (which we will henceforth call Study 2a, preregistered at https://doi.org/10.17605/OSF.IO/T28WE), we combined three items to measure the outcome variable (likelihood of conflict resolution): perceived difficulty of reaching an agreement, extent of conflict experienced, and desirability of future collaboration. Using this DV, we found support for Hypothesis 1 in a sample of 463 participants. Tests for Hypothesis 2 were insignificant when the items were combined ($p = 0.55$). In *post-hoc* models separately examining the three items of the outcome measure, we found a misalignment in moral codes to have a marginally stronger effect on the desire to collaborate in the future ($p = 0.09$). However, misalignment in causal codes had a stronger effect on perceived difficulty of reaching an agreement and there was no difference between misalignment in the two codes on experience of conflict. We had not registered Hypothesis 3 for this experiment, but we did find misalignment in the two codes together to have a greater effect on all three items relative to misalignment in causal codes alone. We present the full set of results in Appendix 3.

Given the inconclusive results in tests of H2, and realizing that the three outcome items may tap into different dimensions of the overall outcome measure, we designed Study 2b (preregistered at https://doi.org/10.17605/OSF.IO/VZ6NA), using the same factorial design as Study 2a but decomposing the outcome into four sub-categories and measuring each with multiple items. Our hypotheses, revised to account for the finer grained decomposition of the outcome variable (perceived likelihood of reaching an agreement), are as follows:

Hypothesis 1. Perceived misalignment of either causal or moral codes (i) decreases the perceived likelihood of reaching an agreement on the current problem, (ii) increases the perception of relationship conflict, (iii) increases the perceived likelihood of parties avoiding (vs. engaging with) each other in the future, and (iv) increases perceptions of negative affect developing between the two parties.

Hypothesis 2. Perceived misalignment of moral codes (i) decreases the perceived likelihood of reaching an agreement on the current problem, (ii) increases the perception of relationship conflict, (iii) increases the perceived likelihood of parties avoiding (vs. engaging with) each other in the future, and (iv) increases perceptions of negative affect developing between the two parties to a greater extent than misalignment of causal codes.

Hypothesis 3. Perceived misalignment in moral codes amplifies the effect of causal codes on (i) the perceived likelihood of reaching an agreement on the current problem, (ii) the perception of relationship conflict, (iii) the perceived likelihood of parties avoiding (vs. engaging with) each other in the future, and (iv) perceptions of negative affect developing between the two parties.

We report the results of hypothesis tests using data from Study 2b below.

In addition to hypothesis tests, we explore whether people might be more likely to attribute disagreements to moral or causal codes in the absence of any information about (mis)alignment in their codes. To do this, we included a "no information" condition in addition to the experimental conditions in Study 2b, in which we state that there is a disagreement but do not state

whether these stem from disagreements on moral or causal codes. Moral codes receive greater coverage than causal codes in the literature on conflict, which suggests that people may generally (and especially when there is limited information about the sources of disagreement) be more likely to attribute conflicts to misalignments in moral codes than to causal codes. This might arise because prevailing lay theories of conflict may see conflicting interests (rather than differences in perception or information) as the primary source of collaboration failure. We also suspect, however, that the degree to which a disagreement is assumed to arise from causal or moral code misalignments varies by (culturally specific) priors across topics and we might therefore find differences in attributions across the two vignettes.

Finally, we also report exploratory analyses on responses to an open-ended question we included in Study 2a, asking participants to recommend interventions that might increase likelihood of agreement.

4.1. Participants

We recruited participants in the USA using the Prolific.co platform. We paid all participants a fixed compensation (5 USD). A total of 502 participants completed the survey. We discarded 27 responses where the participant had failed either of two attention check questions, leaving a final sample of 475 participants. The sample ranged between the ages of 18 and 83 years ($M = 36.73$, $SD = 13.42$) and predominantly identified as white ($n = 330$). There were 235 male and 230 female participants, the remaining identified as non-binary ($n = 10$). In response to a question asking about the level at which they received science education, 37.7% ($n = 179$) reported they had scientific training at or below the high school level, 56.6% ($n = 269$) at the college level, and 5.7% ($n = 27$) of the participants indicated they had studied science in graduate school. Only 14 participants worked in an organization that offered childcare services. An additional 22 participants received childcare support from their employer. Majority of our participants ($n = 289$) considered climate change to be a global emergency and believed that the world should urgently do everything necessary to combat it. Only 40 participants did not consider climate change to be an emergency.

4.2. Materials and procedure

The study employed a 2 (order of vignettes) × 2 (causal code misalignment) × 2 (moral code misalignment) fully crossed repeated measures design. The order of vignettes was a between-subjects factor. We do not find order effects and therefore do not report them. The source of disagreement (causal and/or moral) was a within-subjects factor and was randomly assigned for each vignette. This created four conditions, that we refer to as C(m)M(m) (misalignments in both causal and moral codes), C(m)M(a) (misalignment only in causal codes), C(a)M(m) (misalignment only in moral codes), and C(a)M(a) (no misalignments in either causal or moral codes). We also included a "no information" condition for both vignettes where no information was given on the source of disagreement.

After participants read and accepted the consent form, they were informed that they would read two workplace scenarios concerning two different sets of mid-level managers. Both vignettes indicated that the managers were working for a mid-sized company and had been asked to consider a proposed initiative. In one vignette, the proposal concerned opening a daycare facility for employees' children. In the second, the managers were to evaluate a carbon emission reduction technology that might reduce emissions below the legal threshold, which the company was already meeting. In both cases, the text presented participants with the private and independent thoughts and opinions of each manager, which served as our manipulation. Table 1 presents the manipulations for each condition and each vignette.

After reading each vignette, participants responded to an open-ended question inquiring about the root cause of the disagreement between the two individuals, the dependent variable items, a series of control measures, our instrument for attributing sources of disagreements to causal or moral codes from Study 1, and the intrateam conflict measure (Jehn and Mannix, 2001). The questionnaire concluded with questions about demographics, participants' opinions about climate change, and their current experience regarding daycare services offered by their employers.

4.3. Measures

We report Cronbach's alpha values for each measure in Table 2, separately for each vignette.

Dependent variables: Participants viewed outcome measures in two separate blocks, both of which also included filler items. Different scale anchors were used in each block to facilitate participants' evaluation of the items. To test our hypotheses, we calculate mean scores by vignette for each dependent variable.[4]

Relationship conflict was measured with three items from the intra-team conflict measure used in Study 1 that we sourced from Jehn and Mannix (2001). Participants indicated their agreement with each item using a 5-point response scale (1-strongly disagree, 5-strongly agree), with higher values indicating greater conflict. A sample item is "They are experiencing tension in their relationship."

Likelihood of reaching an agreement was measured with three items including "Reach a joint position on this matter," "Come to an agreement on the proposal," and "Resolve the differences in their opinions." Participants indicated how likely they viewed each item to be using a 5-point response scale (1-Extremely unlikely, 5-Extremely likely). We recoded the responses during our analysis such that a higher score indicates less likelihood of reaching an agreement.

Likelihood of negative affect developing between the parties was measured with three items, which we developed based

4 Exploratory factor analyses of the pooled items for each vignette show a factor structure in line with our expectations for the green technology vignette. However, items relating to relationship conflict and negative affect did not distinguish from each other for the daycare vignette.

10.3389/fpsyg.2023.1166023

TABLE 1 Study 2—conditions and vignettes.

Condition	Vignette: green technology	Vignette: daycare
C(a)M(m) Causal codes aligned, moral codes misaligned	In thinking independently and privately about this proposal, Price and Powell **agreed** that the project would **yield substantial carbon emission reductions**, bringing total emissions **far below the legally required threshold**. However, they also had **different views about the moral implications** of the project. **Price thought it was a moral duty** for the company to do as much as it can for the environment, including reducing emissions below what is required by law but **Powell did not**.	In thinking independently and privately about this proposal, Smith and Wilson **agreed that an on-site daycare facility would serve to provide relief to parents**. However, they also had **different views about the moral implications** of the project. **Smith thought it was a moral duty** for the company to do something to help parents better manage work-life balance but **Wilson did not**.
C(m)M(a) Causal codes misaligned, moral codes aligned	In thinking independently and privately about this proposal, Price and Powell **disagreed** on whether the project would yield **substantial carbon emission reductions**, bringing total emissions **far below the legally required threshold**. Price thought it would but Powell did not. However, they **both thought it was a moral duty** for the company to do as much as it can for the environment, including surpassing the legal emissions threshold.	In thinking independently and privately about this proposal, **Smith and Wilson disagreed on whether an on-site daycare facility would serve to provide relief to parents**. Smith thought it would but Wilson did not. However, they **both thought it was a moral duty** for the company to do something to help parents better manage work-life balance.
C(a)M(a) Causal codes aligned, moral codes aligned	In thinking independently and privately about this proposal, Price and Powell **agreed** that the project would **yield substantial carbon emission reductions**, bringing total emissions **far below the legally required threshold**. They also **both thought it was a moral duty** for the company to do as much as it can for the environment, including surpassing the legal emissions threshold.	In thinking independently and privately about this proposal, Smith and Wilson **agreed that an on-site daycare facility would serve to provide relief to parents**. Moreover, they **both thought it was a moral duty** for the company to do something to help parents better manage work-life balance.
C(m)M(m) Causal codes misaligned, moral codes misaligned	In thinking independently and privately about this proposal, Price and Powell **disagreed on whether the project would yield substantial carbon emission reductions**, bringing total emissions **far below the legally required threshold**. Price thought it would but Powell did not. They also had **different views about the moral implications** of the project. **Price thought it was a moral duty** for the company to do as much as it can for the environment, including reducing emissions below what is required by law but **Powell did not**.	In thinking independently and privately about this proposal, Smith and Wilson **disagreed on whether an on-site daycare facility would serve to provide relief to parents**. Smith thought it would but Wilson did not. They also had **different views about the moral implications** of the project. **Smith thought it was a moral duty** for the company to do something to help parents better manage work-life balance but **Wilson did not**.
No information condition	In thinking independently and privately about this proposal, Price and Powell **had differing opinions**.	In thinking independently and privately about this proposal, Smith and Wilson **had differing views**.

TABLE 2 Reliability of measures used in Study 2.

Measure	# of items	$\alpha_{daycare}$	$\alpha_{greentech}$
Perceived likelihood of reaching agreement	3	0.882	0.892
Perceived relationship conflict	3	0.850	0.880
Perceived negative affect between the parties	3	0.902	0.908
Likelihood of future engagement	3	0.933	0.916
Likelihood of developing a positive evaluation	3	0.855	0.872
Perceived moral code misalignment	4	0.918	0.946
Perceived causal code misalignment	4	0.933	0.932

on other-condemning emotions previously identified by moral psychologists (Haidt, 2003; Brandt et al., 2019). Participants assessed whether the parties in the vignette were likely to feel disgust, contempt, and angry toward each other.

Likelihood of avoiding future engagement[5] was measured with three items including "Be willing to collaborate in future projects," "Want to work together again after this project," and "Seek each other's opinion in the future." We recoded the items such that higher values indicate a higher perceived likelihood of avoiding future engagement.

Manipulation check and other measures: We included our code misalignment scale from Study 1 to confirm that the manipulations functioned as expected (see Appendix 4 for details

5 An additional item "Want to avoid each other in the future" was included as part of this construct. However, in exploratory factor analyses, this item exhibited high factor loadings with both this factor as well as likelihood of negative affect development. Thus, we omitted it in our calculations of dependent measures.

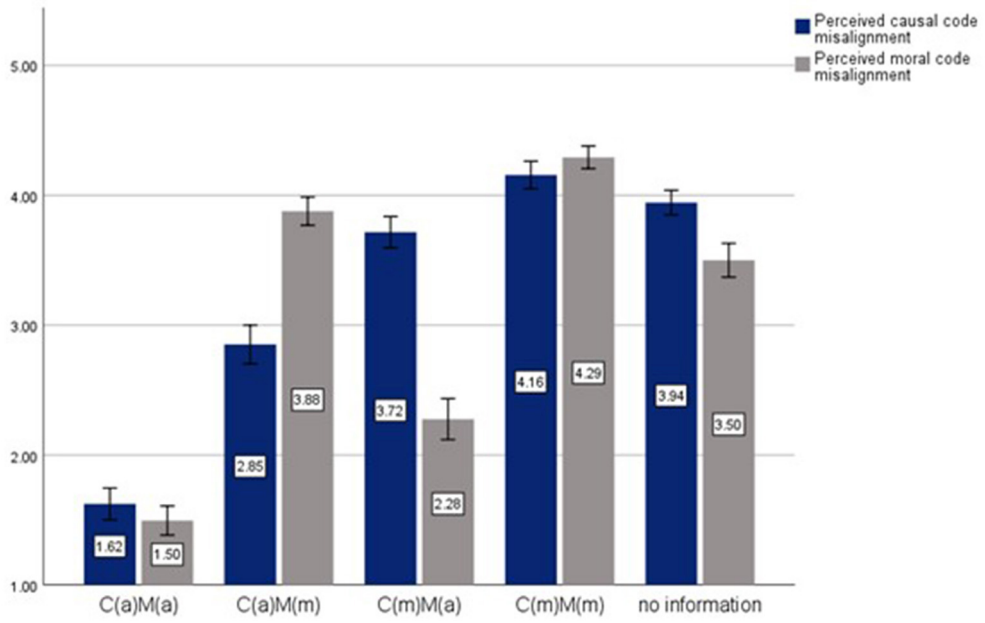


FIGURE 3
Study 2 manipulation check: perceived code misalignment by condition.

on factor analyses of the scale). In addition, we included three items along with the likelihood of negative affect development, which we intended to measure a more generalized evaluation between the parties. A sample item was "Have a generally favorable view of each other." Finally, we included some exploratory items, including several adapted from the Behavioral Trust Inventory (Gillespie, 2003) and the team psychological safety measure developed by Edmondson (1999). These are not included in our theoretical framework and not reported in our analyses.

4.4. Analyses and results

4.4.1. Manipulation checks

Figure 3 presents mean code misalignment attributions for each experimental condition. To confirm that our causal and moral code misalignment manipulations performed as expected, we conducted a set of *t*-tests for each vignette where we compared the aggregate mean code misalignment perceptions across conditions where the source of misalignment differed.

Specifically, in the daycare scenario, mean attributions to misalignments in moral codes in the moral code misalignment conditions [C(a)M(m) and C(m)M(m)] were significantly higher than those in the remaining three groups ($M = 4.05$, $SD = 0.72$ vs. $M = 2.50$, $SD = 1.20$), $t_{(473)} = -16.62$, $p < 0.001$. Participants were also significantly more likely to make attributions to moral code differences in these two conditions where they were informed of a moral code misalignment relative to the "no information condition" ($M = 3.43$, $SD = 0.94$), $t_{(306)} = -6.344$, $p < 0.001$). Moreover, participants in the causal code misalignment conditions [C(m)M(a) and C(m)M(m)] perceived significantly higher causal code misalignment compared to the remaining three groups [($M = 3.95$, $SD = 0.71$) vs. ($M = 2.86$, $SD = 1.27$), $t_{(473)} = -10.81$, $p < 0.001$]). However, we found no statistically significant differences in perceived causal code misalignment between the causal-code misalignment groups and the "no information" group ($M = 4.06$, $SD = 0.62$), $t_{(283)} = 1.24$, $p = 0.215$).

Similarly, in the case of the green technology vignette, attributions of disagreements to causal and moral code differences in the two groups where these codes were misaligned [C(m)M(a) and C(m)M(m) in the case of causal code differences and C(a)M(m) and C(m)M(m) in the case of moral code differences] were significantly higher than the remaining three groups' aggregate means [Causal code differences: $M = 3.95$, $SD = 0.91$ vs. $M = 2.79$, $SD = 1.29$, $t_{(473)} = -10.774$, $p < 0.001$; Moral code differences: $M = 4.13$, SD = 0.74 vs. $M = 2.39$, SD = 1.28, $t_{(473)} = -16.843$, $p < 0.001$]. As with the daycare vignette, comparing against the "no information" group yielded significant results for moral code differences ($M = 3.57$, $SD = 0.88$), $t_{(279)} = -5.637$, $p < 0.001$, but not for causal code differences ($M = 3.83$, $SD = 0.69$), $t_{(284)} = -1.147$, $p = 0.253$.

As can be seen in Figure 3, the lack of a difference between perceptions of causal code misalignment in the "no information" control condition and the two treatment conditions with misaligned causal codes is partly due to participants perceiving a high degree of causal misalignment in the "no information" condition and partly due to them perceiving a lower degree of causal misalignment when the moral codes are aligned (these patterns are similar across the vignettes). The former may suggest that in the absence of specific information regarding the source of conflict, individuals tend to default to causal codes to "explain" the perceived conflict, an effect that we explore in Section 4.4.3 below. The latter is one instance of several spillover effects we find between perceptions of causal and moral code alignment.

In addition, we find the following spillover effects: In the daycare vignette, we find significantly higher causal attributions

when comparing C(a)M(m) to C(a)M(a) [$M = 2.70$, $SD = 0.98$ vs. $M = 1.71$, $SD = 0.93$, $t_{(188)} = -7.07$, $p < 0.001$] and significantly higher moral attributions when comparing C(m)M(a) to C(a)M(a) [$M = 2.39$, $SD = 0.10$ vs. $M = 1.55$, $SD = 0.10$, $t_{(165)} = -6.04$, $p < 0.001$]. Similarly in the green technology vignette, we find significantly higher causal attributions when comparing C(a)M(m) to C(a)M(a) [$M = 3.03$, $SD = 0.12$ vs. $M = 1.55$, $SD = 0.08$; $t_{(187)} = -10.78$, $p < 0.001$] and significantly higher moral attributions when comparing C(m)M(a) to C(a)M(a) [$M = 2.18$, $SD = 0.12$ vs. $M = 1.45$, $SD = 0.07$; $t_{(192)} = -5.36$, $p < 0.001$]. As a whole, the results echo those of Study 1, showing that even though participants were reliably able to distinguish between causal and moral code misalignments, the presence of either misalignment led them to see more of the other.

4.4.2. Hypothesis tests

To test our first hypothesis that misalignments in either causal or moral codes increase perceptions about how challenging a conflict will be to resolve, we conducted a series of regressions on the likelihood of conflict resolution, the likelihood of future engagement, perceived relationship conflict, and negative affect between the parties (Table 3). We use mixed (multi-level linear regression) models, performed on Stata 17 (StataCorp, 2021). These models pool data from both vignettes, estimate a participant-specific intercept, and report the variance as a random effect. We exclude the "no information" condition and control for vignette type in all models.

We test H1 through the estimated effects of dummy variables for conditions with only causal code misalignment [C(m)M(a)] or moral code misalignment [C(a)M(m)] against the omitted category of no misalignment [C(a)M(a)]. Both variables have the expected effects on all dependent variables, supporting H1.

To test H2, we compare the coefficient estimates for the dummy variables corresponding to the C(m)M(a) and C(a)M(m) conditions (conditions where only one code is misaligned). As predicted, we find that moral code misalignments had a higher impact on the outcomes than causal code misalignments. These differences are significant for all DVs.

To test H3, we test the difference between the estimated effect for the C(m)M(m) (both codes in misalignment) condition and the C(m)M(a) (only causal codes misaligned) condition. Tests (presented in the last row) show that misalignment in both codes do have greater effects than misalignment only in causal codes, supporting H3.

In a supplemental analysis that we had not registered, we perform two sets of OLS models, one for each vignette (Appendix 5). While this reduces the sample size to half of what we had expected to provide adequate power in study design, it permits us to examine vignette-specific effects. Analyses support H1 and H3 for both vignettes. Differences in estimated effects of causal and moral code misalignments fail to reach conventional levels of statistical significance for the daycare vignette for the likelihood of conflict resolution, perceived relationship conflict, and negative affect between the parties. However, results remain directionally consistent.

Even though we had not hypothesized or registered it, we also test if misalignment in both types of codes increases the impact of having misalignment only in moral codes. Tests comparing the estimated effect for the C(m)M(m) (both codes in misalignment) condition and the C(a)M(m) (only moral codes misaligned) condition show that misalignment in both codes has a significantly greater effect than misalignment in moral codes alone for all dependent variables and this effect is observed in the multi-level analyses as well as OLS regressions for each vignette type.

In additional analyses with control variables (available upon request), we examine the effects of participant perceptions of importance of the issue to the managers featured in the vignette, strength of the managers' beliefs and opinions about the issue, how interdependent the managers' outcomes are, and how confident the managers are that their own beliefs are correct and the other has wrong beliefs. These variables are informed by the prior literature that finds outcome importance, actor interdependence, and evidentiary skew (parties' belief that the weight of evidence overwhelmingly supports their respective points of view) to be the principal antecedents of attitude polarization (Minson and Dorison, 2022). While these variables have statistically significant effects in some models, including them does not have appreciable effects on the results we have reported above. This indicates that perceptions of cultural misalignment are distinct from attitude polarization and strength (Howe and Krosnick, 2017).

We also examine the effect of perceptions of how open and receptive managers in the vignette perceive the other manager to be toward their ideas. This variable is highly correlated with our four dependent variables ($r = -0.63$ to -0.73) and is moderately correlated with the "both codes clash" condition ($r = -0.36$). Including it in the regression models makes the effect of causal misalignment statistically indifferent from zero, as well as statistically indifferent from the effect of moral misalignment. This suggests that perceptions of cultural misalignment and the effect they have on perceived likelihood of conflict resolution overlap at least partially with some processes documented in the moral conviction literature (Skitka et al., 2021).

Finally, we do not see incentive-compatibility as a potential problem for our studies, for a few reasons. First, we do not ask participants to provide their own opinions on a potentially conflictual topic (which might have created a problem in eliciting truthful responses). Second, we present the protagonists of our vignettes as employees of the same organization solving a business problem, so that participants would assume aligned incentives. Third, if the incentive we provided for participation in the study was not sufficient to elicit effort, we would see noise. That is, there is no reason to expect systematically different effects across conditions. Finally, even though there is no reason for participants to implicate themselves in the scenarios where they assume the role of observers, we did collect measures of potential personal investment in the questions of daycare provision (whether they have school age children and whether their employer provides daycare) and climate change (whether they believe climate change to be an urgent problem and whether they believe enough is being done on this matter). In regression models, we did not find these to affect our findings.

TABLE 3 Study 2 hypothesis tests: estimates from mixed effect regressions ($N = 759$).

	Likelihood of conflict resolution		Likelihood of avoiding future engagement		Relationship conflict		Negative affect	
Fixed effects parameters	β	p	β	p	β	p	β	p
Causal code misalignment only [C(m)M(a)]	0.582	<0.001	0.778	<0.001	1.115	<0.001	0.618	<0.001
Moral code misalignment only [C(a)M(m)]	0.874	<0.001	1.133	<0.001	1.416	<0.001	0.907	<0.001
Misalignment in both C and M [C(m)M(m)]	1.680	<0.001	1.811	<0.001	1.97	<0.001	1.454	<0.001
Vignette: green tech	0.072	0.18	0.054	0.317	−0.095	0.064	0.019	0.72
Intercept	1.483	<0.001	1.576	<0.001	1.64	<0.001	1.514	<0.001
Random effects parameters	**Estimate**	**SE**	**Estimate**	**SE**	**Estimate**	**SE**	**Estimate**	**SE**
σ^2 (ID)	0.166	0.039	0.267	0.048	0.295	0.047	0.273	0.048
σ^2 (res)	0.510	0.041	0.519	0.043	0.452	0.038	0.51	0.042
LR (1)	18.49	<0.001	33.21	<0.001	43.58	<0.001	34.63	<0.001
Wald X^2 (4)	439.60	<0.001	460.27	<0.001	617.72	<0.001	299.9	<0.001
LL	−919.467		−966.966		−941.07		−964.881	
Tests of H2 and H3:								
$X^2(1)$ $B_{C(m)M(a)} = B_{C(a)M(m)}$	12.2	<0.001	16.24	<0.001	12.74	<0.001	10.87	0.001
$X^2(1)$ $B_{C(m)M(m)} = B_{C(m)M(a)}$	175.22	<0.001	139.79	<0.001	104.37	<0.001	92.29	<0.001

10.3389/fpsyg.2023.1166023

4.4.3. Exploratory analysis

In pre-registered exploratory analysis of whether participants' attributions to causal or moral misalignments differ in the absence of any information about codes, we examine the manipulation checks in the "no information" group. Table 4 provides descriptive statistics. We find that when specific information regarding the source of conflict was not provided, participants made higher attributions to causal code misalignments ($M = 3.94$, $SD = 0.66$) than to moral code misalignments [$M = 3.50$, $SD = 0.91$, $t_{(190)} = 6.686$, $p < 0.001$], and this pattern held for each vignette. We find the same if we only focus on the first vignette that the participants saw, with perceived misalignment in causal codes ($M = 3.90$, $SD = 0.66$) greater than perceived misalignment in moral codes [$M = 3.43$, $SD = 0.88$, $t_{(107)} = -5.918$, $p < 0.001$]. Additionally, while perceived moral code misalignment does not vary between vignettes [$M_{daycare} = 3.43$, $SD_{daycare} = 0.94$; $M_{greentech} = 3.57$, $SD_{greentech} = 0.88$, $t_{(189)} = 1.070$, $p = 0.286$], causal code misalignment was higher for the daycare vignette ($M = 4.06$, $SD = 0.62$) compared to the green technology vignette [$M = 3.83$, $SD = 0.69$, $t_{(189)} = 2.453$, $p = 0.015$].

These results could be driven by the nature of the codes or their measurement. In the absence of specific guidance in the vignettes, participants may have emphasized causal code misalignments because items in the causal code misalignment subscale may have been perceived as more practical, proximate, or relevant to an organizational setting than moral code misalignment items. This should not be a concern within the treatment condition where both codes are in alignment. However, in that condition, the results reveal a similar pattern: participants perceive significantly higher causal code misalignment between the parties ($M = 1.70$, $SD = 0.88$) than moral code misalignment ($M = 1.57$, $SD = 0.81$), $t_{(90)} = -2.507$, $p = 0.014$. That is, even participants who were told that the managers agreed on both causal and moral codes perceived some misalignment, and the misalignment they perceived in causal codes was greater than the misalignment they perceived in moral codes.

It is also interesting to consider what the participants in our studies thought about how to resolve the cultural conflicts we described for them. Using an analysis of text based on word embedding methods, we identified key themes in the open-ended responses from our participants to a question we asked in Study 2a about their proposed resolution mechanisms for each vignette. The results indicate that "mediation" is suggested as a mechanism for resolution in all cases except for pure moral code misalignment, and "research" or "statistical data" come up only in the case of pure causal code misalignment. This reiterates our findings from Study 1 that people find the distinction between misalignments in moral and causal codes to be meaningful and suggests that they also have theories about specific interventions that might work for each type of misalignment.

5. Discussion and conclusion

As pioneers of the Carnegie perspective recognized, conflicts in organizations are not limited to divergent interests rooted in misaligned incentives. As subsequent behavioral studies have shown, differences in representations alone (even when incentives are aligned) can create disagreements and conflict: "*Variations in perceptions may fuel debate concerning the best course of action in response to feedback* (Kaplan, 2008) *and may provide managers the chance to 'self-enhance* (Jordan and Audia, 2012) *through over-favorable interpretation of feedback* (Joseph and Gaba, 2015). *Divergent interpretations may lead to disagreements about the best course of action or the evaluation of alternatives. For example, it might shape whether new opportunities are viewed as threats or opportunities* (Gilbert, 2005). *It may also lead to inaction as organizational members continually undo or reverse decisions already made* (Denis et al., 2011)" (Joseph and Gaba, 2020, p. 289).

We have built on this prior work to examine cultural conflicts as a distinct category of conflicts that can arise even when incentives are aligned. A hallmark of cultural conflicts is the difference in interpretation and evaluation of the same information across individuals and groups, which are in turn driven by differences in the pre-existing cognitive constructs across them. The key premise of this study is that resolution of such cultural conflicts should begin with a diagnosis of the sources of conflicts in cultural cognitions. This is likely to be useful for at least two reasons. First, different forms of cultural conflict may require different kinds of interventions to resolve, and diagnosis can help match the intervention to the problem. Second, some types of cultural conflict may just be easier to resolve, so that diagnosis can aid prioritization. To develop this line of reasoning, we propose that people (1) can perceive differences in the sources of cultural conflicts and (2) ascribe different levels of difficulty to resolving cultural conflicts arising from different sources.

We draw on the concept of cultural codes (Koçak and Puranam, 2023) to develop a simple basis for differentiating the sources of cultural conflict as perceived by observers (i.e., potential mediators)—into misalignments in moral and causal codes. Because moral codes allow for multiple dimensions of desirability, individuals may have additional objectives (and constraints), in addition to the rewards arising from incentives. Whether individuals share moral codes or not, they might also have differing beliefs about means–ends relationships (causal codes). Differences in moral *or* causal codes can produce cultural conflicts in organizations, and incentive alignment may not be sufficient for resolving cultural conflicts.

In Study 1, we find that study participants are receptive to this distinction between moral and causal codes and attribute sources of disagreement to each code accurately in line with our manipulations. In Study 2, we show that perceived misalignments in causal and moral codes both lead to heightened perceptions about how challenging a conflict will be. Furthermore, the joint presence of both kinds of misalignments amplifies the effect of each source on perceptions about how challenging a conflict will be to resolve. It is also the case that perceived misalignment of moral codes increases perceptions about how challenging a conflict will be to resolve to a greater extent than misalignment of causal codes. Put simply, if observers believe a cultural conflict arises from differences in moral codes, they may not even see it as worthwhile to attempt a resolution.

Our findings point to two classes of interventions that mediators can implement to resolve cultural conflicts. First,

TABLE 4 Study 2 exploratory analysis of the "no information" condition.

	Daycare ($N = 95$)		Green technology ($N = 96$)		Total	
	M	SD	*M*	SD	*M*	SD
Perceived misalignment in moral codes	3.43	0.94	3.57	0.88	3.50	0.91
Perceived misalignment in causal codes	4.06	0.62	3.83	0.69	3.94	0.66
t-tests of differences in means	$t_{(94)} = 6.99$		$t_{(95)} = 2.75$		$t_{(190)} = 6.69$	

preventing misdiagnosis of conflicts as arising from misaligned moral codes and focusing public debates on causal code misalignments before issues become moralized can help overcome some disagreements that will otherwise appear intractable. In this way, we offer a connection to the literature on conflict and negotiation, which already offers rich insights into how cultural cognitions impact the inputs, processes, and outputs of negotiations within and across social groups (Gunia et al., 2016). We suggest that future research might attempt to identify optimal tactics for conflict resolution (such as moral suasion vs. appeals to scientific analyses), contingent on whether these arise from misalignments in causal or moral codes.

A second possibly more controversial intervention is to reframe conflicts that arise from either kind of misalignment as being primarily about causality (perhaps when codes are fuzzy and it is genuinely unclear as to what the underlying truth of the matter is). This focuses efforts toward resolution, which would not even be undertaken if the source of misalignment was perceived to be primarily differences in moral codes. It does not guarantee resolution, but rather an effort toward resolution.

A third intervention can be aimed not at resolving cultural conflict but rather at stimulating useful kinds of conflict. For instance, one may compose groups of individuals selected to be homogenous on moral codes but not on causal codes—so that the resulting diversity of views on the links between causes and consequences may promote innovation and creativity, whereas the converse may not.

These interventions are likely to be most relevant for collective decision-making, where multiple parties need to make a joint decision in a committee-like structure. Thus, our research helps advance prior recommendations to improve the effectiveness of strategy-formulation meetings by separating objectives and the roadmaps to achieve them (Bourgoin et al., 2018) or by using strategy mapping tools to debate strategic options (Carroll and Sϕrensen, 2021). They are likely to be of greatest use in situations where agents individually or collectively hold multiple goals (Ethiraj and Levinthal, 2009; Gaba and Greve, 2019; Audia and Greve, 2021).

Going forward, a fruitful follow-up to our study would be to examine the effect of attributions made by agents that directly participate in a conflict. As prior literature shows, individuals experiencing a conflict make inferences about how likely they are to resolve their disagreement and this in turn shapes their behavior (Minson and Dorison, 2022). Our study suggests that these inferences will be shaped by whether individuals perceive misalignments in causal or moral codes to be at the core of their disagreements. However, our finding that third parties can make such diagnoses does not imply that active participants in a conflict can do the same. Third parties might more easily remove themselves from the "hot" emotions of a conflict situation and make more attributions to misalignments in causal rather than moral codes. That said, our findings that even third-party attributions carry some spillover effects (seeing moral code differences where we only say there are causal code differences and the reverse) suggest that the same might happen with parties to a conflict.

The spillover effects we find may more generally explain why causal and moral misalignments might remain tangled in ordinary life. They might point to a type of "halo effect" (previously shown for judgments of individual character, e.g., Judd et al., 2005) that pertains to relationships, whereby a pair's failure to agree in one (causal or moral) domain creates a perception of misalignment in the other domain. They might also stem from lay theories about cultural codes. We are unable to examine the reasons for spillover effects in this study the way the halo effect has been examined (Stellar and Willer, 2018) and we leave it to future work.

Another promising direction for future studies is to examine how the moralization of issues in public discourse might impact attributions and the effect of attributions on perceptions of conflict resolution. The stronger tendency we found in our studies to infer causal code misalignments than moral code misalignments is not universal. For instance, in recent years, we have seen some disagreements that appear to be resolvable through scientific research to instead become fodder for "culture wars" (Macy et al., 2019; Brońić and Miles, 2021). The COVID-19 pandemic saw debates about mask mandates in some countries stay centered on the efficacy of masks for preventing contagion, whereas in others they evolved to pit value for personal freedom (defended by one party) against value of public concern (defended by another party). Debates on how to address climate change have undergone a similar transformation in some settings, from a technological problem to a moralized and politicized issue. We can expect H2 and H3 to be even more strongly supported for issues that are moralized or politicized.

In sum, the systematic study of cultural conflicts within organizations is at a nascent stage. The theme is relevant particularly to organizations attempting to balance disparate objectives such as social impact and profitability, but also more generally to any organization that is not monocultural. We believe our approach to modeling differences in cultural codes in terms of morality and causality can be useful to develop this agenda further.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by INSEAD Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

ÖK, PP, and AY contributed to conception and design of the study, performed statistical analyses, and wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1166023/full#supplementary-material

References

Aguinis, H., Villamor, I., and Ramani, R. S. (2021). Mturk research: review and recommendations. *J. Manage.* 47, 823–837. doi: 10.1177/0149206320969787

Audia, P. G., and Greve, H. R. (2021). *Organizational Learning From Performance Feedback: A Behavioral Perspective on Multiple Goals: A Multiple Goals Perspective*. Cambridge: Cambridge University Press.

Bechky, B. A. (2003). Sharing meaning across occupational communities: the transformation of understanding on a production floor. *Org. Sci.* 14, 312–330. doi: 10.1287/orsc.14.3.312.15162

Behfar, K. J., Peterson, R. S., Mannix, E. A., and Trochim, W. M. (2008). The critical role of conflict resolution in teams: a close look at the links between conflict type, conflict management strategies, and team outcomes. *J. Appl. Psychol.* 93, 170. doi: 10.1037/0021-9010.93.1.170

Bendersky, C., and Hays, N. A. (2012). Status conflict in groups. *Organ. Sci.* 23, 323–340. doi: 10.1287/orsc.1110.0734

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychol. Bull.* 107, 238. doi: 10.1037/0033-2909.107.2.238

Bougon, M., Weick, K., and Binkhorst, D. (1977). Cognition in organizations: An analysis of the Utrecht Jazz Orchestra. *Admin. Sci. Q.* 22, 606–639. doi: 10.2307/2392403

Bourgoin, A., Marchessaux, F., and Bencherki, N. (2018). We need to talk about strategy: How to conduct effective strategic dialogue. *Business Horizon.* 61, 587–597. doi: 10.1016/j.bushor.2018.03.008

Brandt, M. J., Crawford, J. T., and Van Tongeren, D. R. (2019). Worldview conflict in daily life. *Soc. Psychol. Pers. Sci.* 10, 35–43. doi: 10.1177/1948550617733517

Broćić, M., and Miles, A. (2021). College and the "culture war": assessing higher education's influence on moral attitudes. *Am. Sociol. Rev.* 86, 856–895. doi: 10.1177/00031224211041094

Brown, M. E., Vogel, R. M., and Akben, M. (2022). Ethical conflict: conceptualization, measurement, and an examination of consequences. *J. Appl. Psychol.* 107, 1130. doi: 10.1037/apl0000854

Buhrmester, M. D., Talaifar, S., and Gosling, S. D. (2018). An evaluation of Amazon's Mechanical Turk, its rapid rise, and its effective use. *Perspect. Psychol. Sci.* 13, 149–154. doi: 10.1177/1745691617706516

Carlile, P. R. (2004). Transferring, translating, and transforming: an integrative framework for managing knowledge across boundaries. *Org. Sci.* 15, 555–568. doi: 10.1287/orsc.1040.0094

Carroll, G. R., and Sørensen, J. B. (2021). Making Great Strategy: Arguing for Organizational Advantage. Columbia University Press.

Cerulo, K. A., Leschziner, V., and Shepherd, H. (2021). Rethinking culture and cognition. *Ann. Rev. Sociol.* 47, 63–85. doi: 10.1146/annurev-soc-072320-095202

Chatman, J. A., and O'Reilly, C. A. (2016). Paradigm lost: reinvigorating the study of organizational culture. *Res. Org. Behav.* 36, 199–224. doi: 10.1016/j.riob.2016.11.004

Corritore, M., Goldberg, A., and Srivastava, S. B. (2020). Duality in diversity: how intrapersonal and interpersonal cultural heterogeneity relate to firm performance. *Adm. Sci. Q.* 65, 359–394. doi: 10.1177/0001839219844175

Cronin, M. A., and Weingart, L. R. (2007). Representational gaps, information processing, and conflict in functionally diverse teams. *Acad. Manag. Rev.* 32, 761–773. doi: 10.5465/amr.2007.25275511

Cronin, M. A., and Weingart, L. R. (2019). Conflict across representational gaps: threats to and opportunities for improved communication. *Proc. Nat. Acad. Sci. U. S. A.* 116, 7642–7649. doi: 10.1073/pnas.1805866116

Csaszar, F. A. (2018). What makes a decision strategic? Strategic representations. *Strateg. Sci.* 3, 606–619. doi: 10.1287/stsc.2018.0067

Csaszar, F. A., and Levinthal, D. A. (2016). Mental representation and the discovery of new strategies. *Strateg. Manag. J.* 37, 2031–2049.

Cyert, R. M., and March, G. (1963). *A Behavioral Theory of the Firm.* Englewood Cliffs, NJ: Prentice-Hall.

De Wit, F. R., Greer, L. L., and Jehn, K. A. (2012). The paradox of intragroup conflict: a meta-analysis. *J. Appl. Psychol.* 97, 360. doi: 10.1037/a0024844

Dearborn, D. C., and Simon, H. A. (1958). Selective perception: a note on the departmental identifications of executives. *Sociometry* 21, 140–144. doi: 10.2307/2785898

Denis, J. L., Dompierre, G., Langley, A., and Rouleau, L. (2011). Escalating indecision: Between reification and strategic ambiguity. *Organ. Sci.* 22, 225–244. doi: 10.1287/orsc.1090.0501

DiMaggio, P. (1997). Culture and cognition. *Ann. Rev. Sociol.* 23, 263–287. doi: 10.1146/annurev.soc.23.1.263

Edmondson, A. (1999). Psychological safety and learning behavior in work teams. *Adm. Sci. Q.* 44, 350–383. doi: 10.2307/2666999

Ethiraj, S. K., and Levinthal, D. (2009). Hoping for A to Z while rewarding only A: complex organizations and multiple goals. *Org. Sci.* 20, 4–21. doi: 10.1287/orsc.1080.0358

Feinberg, M., and Willer, R. (2019). Moral reframing: A technique for effective and persuasive communication across political divides. *Soc. Pers. Psychol. Compass.* 13, e12501. doi: 10.1111/spc3.12501

Ford, J. D., and Hegarty, W. H. (1984). Decision makers' beliefs about the causes and effects of structure: An exploratory study. *Acad. Mang. J.* 27, 271–291. doi: 10.5465/255925

Gaba, V., and Greve, H. R. (2019). Safe or profitable? The pursuit of conflicting goals. *Org. Sci.* 30, 647–667. doi: 10.1287/orsc.2018.1280

Gavetti, G., and Levinthal, D. (2000). Looking forward and looking backward: Cognitive and experiential search. *Admin. Sci. Q.* 45, 113–137. doi: 10.2307/2666981

Gavetti, G., and Rivkin, J. W. (2007). On the origin of strategy: Action and cognition over time. *Organ. Sci.* 18, 420–439. doi: 10.1287/orsc.1070.0282

Gibbons, R. (2003). Team theory, garbage cans and real organizations: Some history and prospects of economic research on decision-making in organizations. *Indust. Corp. Chang.* 12, 753–787.

Gibbons, R., and Roberts, J. (2013). *Handbook of Organizational Economics*. Princeton, NJ: Princeton University Press.

Gilbert, C. G. (2005). Unbundling the structure of inertia: Resource versus routine rigidity. *Acad. Manag. J.* 48, 741–763. doi: 10.5465/amj.2005.18803920

Gillespie, N. (2003). "Measuring trust in work relationships: the behavioral trust inventory," in *Paper Presented at the Annual Meeting of the Academy of Management* (Seattle, WA).

Giorgi, S., Lockwood, C., and Glynn, M. A. (2015). The many faces of culture: Making sense of 30 years of research on culture in organization studies. *Acad. Manag. Ann.* 9, 1–54. doi: 10.1080/19416520.2015.1007645

Greer, L. L., and Dannals, J. E. (2017). "Conflict in teams," in *The Wiley Blackwell Handbook of Team Dynamics, Teamwork, and Collaborative Working*, eds R. Rico, E. Salas, and N. Ashkanasy (Somerset, NY: Wiley Blackwell), 317–344.

Gunia, B. C., Brett, J. M., and Gelfand, M. J. (2016). The science of culture and negotiation. *Curr. Opin. Psychol.* 8, 78–83. doi: 10.1016/j.copsyc.2015.10.008

Haidt, J. (2003). "The moral emotions," in *Handbook of Affective Sciences* eds R. J. Davidson, K. R. Scherer, and H. H. Goldsmith (Oxford: Oxford University Press), 852–870.

Haidt, J., and Kesebir, S. (2008). "In the forest of value: Why moral intuitions are different from other kinds," in *Intuition in Judgment and Decision Making*, eds H. lessner, C. Betsch, and T. Betsch (Psychology Press), 209–229.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., and Tatham, R. L. (2010). *Multivariate Data Analysis, 7th Edn.* Upper Saddle River, NJ: Pearson Prentice Hall.

Howard-Grenville, J. A. (2006). Inside the "black box" how organizational culture and subcultures inform interpretations and actions on environmental issues. *Org. Environ.* 19, 46–73. doi: 10.1177/1086026605285739

Howe, L. C., and Krosnick, J. A. (2017). Attitude strength. *Annu. Rev. Psychol.* 68, 327–351. doi: 10.1146/annurev-psych-122414-033600

Hu, L. T., and Bentler, P. M. (1998). Fit indices in covariance structure modeling: sensitivity to underparameterized model misspecification. *Psychol. Methods* 3, 424. doi: 10.1037/1082-989X.3.4.424

Hunzaker, M. F., and Valentino, L. (2019). Mapping cultural schemas: From theory to method. *Am. Sociol. Rev.* 84, 950–981. doi: 10.1177/0003122419875638

Jehn, K. A. (1995). A multimethod examination of the benefits and detriments of intragroup conflict. *Adm. Sci. Q.* 256–282. doi: 10.2307/2393638

Jehn, K. A. (1997). A qualitative analysis of conflict types and dimensions in organizational groups. *Admin. Sci. Q.* 42, 530–557. doi: 10.2307/2393737

Jehn, K. A., and Mannix, E. A. (2001). The dynamic nature of conflict: a longitudinal study of intragroup conflict and group performance. *Acad. Manag. J.* 44, 238–251. doi: 10.2307/3069453

Jehn, K. A., Northcraft, G. B., and Neale, M. A. (1999). Why differences make a difference: a field study of diversity, conflict and performance in workgroups. *Adm. Sci. Q.* 44, 741–763. doi: 10.2307/2667054

Jordan, A. H., and Audia, P. G. (2012). Self-enhancement and learning from performance feedback. *Acad. Manag. Rev.* 37, 211–231. doi: 10.5465/amr.2010.0108

Joseph, J., and Gaba, V. (2015). The fog of feedback: Ambiguity and firm responses to multiple aspiration levels. *Strateg. Manag. J.* 36, 1960–1978.

Joseph, J., and Gaba, V. (2020). Organizational structure, information processing, and decision-making: a retrospective and road map for research. *Acad. Manag. Ann.* 14, 267–302. doi: 10.5465/annals.2017.0103

Judd, C. M., James-Hawkins, L., Yzerbyt, V., and Kashima, Y. (2005). Fundamental dimensions of social judgment: Understanding the relations between judgments of competence and warmth. *J. Pers. Soc. Psychol.* 89, 899–913. doi: 10.1037/0022-3514.89.6.899

Kaplan, S. (2008). Framing contests: Strategy making under uncertainty. *Organ. Sci.* 19, 729–752. doi: 10.1287/orsc.1070.0340

Koçak, Ö., and Puranam, P. (2023). Decoding culture: tools for behavioral strategists. *Strat. Sci.* doi: 10.1287/stsc.2022.0008

Lazear, E. P. (2018). Compensation and Incentives in the workplace. *J. Econ. Perspect.* 32, 195–214 doi: 10.1257/jep.32.3.195

Levinthal, D. A. (2011). A behavioral approach to strategy-what's the alternative?. *Strateg. Manag. J.* 32, 1517–1523. doi: 10.1002/smj.963

Macy, M., Deri, S., Ruch, A., and Tong, N. (2019). Opinion cascades and the unpredictability of partisan polarization. *Sci. Adv.* 5, eaax0754. doi: 10.1126/sciadv.aax0754

March, J. G., and Olsen, J. P. (1989). *Rediscovering Institutions. The Organizational Basis of Politics*. New York, NY: The Free Press.

March, J. G., and Olsen, J. P. (2011). "The Logic of Appropriateness", in *The Oxford Handbook of Political Science* Goodin. R, ed (Oxford Academic). doi: 10.1093/oxfordhb/9780199604456.013.0024

March, J. G., and Simon, H. A. (1958). *Organizations*. New York, NY: John Wiley and Sons, Inc.

March, J. G., and Simon, H. A. (1993). *Organizations*, 2nd Edn. Cambridge, MA: Blackwell Business/Blackwell Publishers.

Marchetti, A., and Puranam, P. (2022). Organizational cultural strength as the negative cross-entropy of mindshare: a measure based on descriptive text. *Humanit. Soc. Sci. Commun.* 9, 1–14. doi: 10.1057/s41599-022-01152-1

Minson, J. A., and Dorison, C. A. (2022). Toward a psychology of attitude conflict. *Curr. Opin. Psychol.* 43, 182–188. doi: 10.1016/j.copsyc.2021.07.002

Peer, E., Brandimarte, L., Samat, S., and Acquisti, A. (2017). Beyond the Turk: alternative platforms for crowdsourcing behavioral research. *J. Exp. Soc. Psychol.* 70, 153–163. doi: 10.1016/j.jesp.2017.01.006

Pluut, H., and Curşeu, P. L. (2013). Perceptions of intragroup conflict: The effect of coping strategies on conflict transformation and escalation. *Group Process. Intergr. Relat.* 16, 412–425. doi: 10.1177/1368430212453633

Porac, J. F., Thomas, H., and Baden-Fuller, C. (1989). Competitive groups as cognitive communities: The case of Scottish knitwear manufacturers. *J. Manag. Stud.* 26, 397–416. doi: 10.1111/j.1467-6486.1989.tb00736.x

Puranam, P., and Swamy, M. (2016). How initial representations shape coupled learning processes. *Organ. Sci.* 27, 323–335. doi: 10.1287/orsc.2015.1033

Schein, E. H. (2010). *Organizational Culture and Leadership*, 4th Edn. San Francisco, CA: Jossey-Bass; John Wiley & Sons.

Schein, E. H. (2012). "What is culture?," in *Sociology of Organizations: Structures and Relationships*, eds M. Godwyn and J. H. Gittell (Thousand Oaks, CA: Pine Forge Press; Sage Publications Inc), 311–336.

Simon, H. A. (1947). *Administrative* Behavior.

Simons, T. L., and Peterson, S. R. (2000). Task conflict and relationship conflict in top management teams: the pivotal role of intragroup trust. *J. Appl. Psychol.* 85, 314–322. doi: 10.1037/0021-9010.85.1.102

Skitka, L. J., Hanson, B. E., Morgan, G. S., and Wisneski, D. C. (2021). The psychology of moral conviction. *Annu. Rev. Psychol.* 72, 347–366. doi: 10.1146/annurev-psych-063020-030612

Skitka, L. J., Washburn, A. N., and Carsel, T. S. (2015). The psychological foundations and consequences of moral conviction. *Curr. Opin. Psychol.* 6, 41–44. doi: 10.1016/j.copsyc.2015.03.025

StataCorp. (2021). *Stata Statistical Software: Release 17*. College Station, TX: StataCorp LLC.

Stellar, J. E., and Willer, R. (2018). Unethical and inept? The influence of moral information on perceptions of competence. *J. Pers. Soc. Psychol.* 114, 195–210. doi: 10.1037/pspa0000097

Strauss, C., and Quinn, N. (1997). *A Cognitive Theory of Cultural Meaning (No. 9)*. Cambridge University Press.

Swidler, A. (1986). Culture in action: Symbols and strategies. *Am. Sociol. Rev.* 51, 273–286. doi: 10.2307/2095521

The jamovi project (2022). *jamovi (Version 2.3) [Computer Software]*. Retrieved from: https://www.jamovi.org (accessed March 30, 2022).

Ullman, J. B. (2006). Structural equation modeling: reviewing the basics and moving forward. *J. Pers. Assess.* 87, 35–50. doi: 10.1207/s15327752jpa8701_03

Walsh, J. P. (1995). Managerial and organizational cognition: Notes from a trip down memory lane. *Org. Sci.* 6, 280–321. doi: 10.1287/orsc.6.3.280

frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 30 November 2023
DOI 10.3389/fpsyg.2023.1141454

OPEN ACCESS

EDITED BY
Daniella Laureiro Martinez,
ETH Zürich, Switzerland

REVIEWED BY
Timo Vuori,
Aalto University, Finland
Jose Pablo Arrieta,
University of Amsterdam, Netherlands

*CORRESPONDENCE
Jutta Stumpf-Wollersheim
✉ jutta.stumpf-wollersheim@bwl.tu-freiberg.de

RECEIVED 10 January 2023
ACCEPTED 26 October 2023
PUBLISHED 30 November 2023

CITATION
Stumpf-Wollersheim J, Oehler PJ, Rimbeck M, Spörrle M and Welpe IM (2023) When is it good to feel bad? How sadness and fear differ in their effects on routine development. *Front. Psychol.* 14:1141454. doi: 10.3389/fpsyg.2023.1141454

When is it good to feel bad? How sadness and fear differ in their effects on routine development

Jutta Stumpf-Wollersheim[1]*, Patrick J. Oehler[2], Marlen Rimbeck[1], Matthias Spörrle[3] and Isabell M. Welpe[2]

[1]Chair of International Management and Corporate Strategy, Technische Universität Bergakademie Freiberg, Freiberg, Germany, [2]Chair for Strategy and Organization, Technical University of Munich, Munich, Germany, [3]Private University Schloss Seeburg, Seekirchen am Wallerseee, Austria

Introduction: This study follows recent calls to explore the emotional foundations of routine development. Routine development forms a nexus between stability and change and is thus crucial for studying organizational decision-making and organizational change. Individuals and teams going through organizational change often experience sadness and fear.

Methods: We conducted a laboratory experiment with 84 teams to study the effect of sadness and fear on routine development.

Results and discussion: In the sadness condition, we observed positive effects on repetitiveness, speed, reliability, and attentiveness in action. Teams experiencing fear reacted better to 'performance traps' in which pre-established routines are ineffective. Our findings show how the behaviors elicited by sadness and fear might ultimately affect team behavior, and therefore managerial practices.

KEYWORDS

affect, organizational routines, decision-making, organizational evolution and change, group processes and performance, cognitive stimuli

1 Introduction

In order to understand organizational decision-making, the exploration of routine development is central. In the context of the Carnegie perspective, routines represent the basic unit for analyzing decision behavior (Gavetti et al., 2007). Routines are examined as "repetitive, recognizable patterns of interdependent actions, carried out by multiple actors" (Feldman and Pentland, 2003, p. 95). Routine development provides stability through repetitiveness and allows for quick and reliable performances (Cohen and Bacdayan, 1994) as well as effective cooperation in teams (Annosi et al., 2020; Blume et al., 2021). Understanding routine development is crucial to understanding whether and how organizations and teams take decisions under organizational change, as routines may simultaneously represent inhibitors as well as sources of change (Feldman and Pentland, 2003).

Both early research on human behavior (Dewey, 1922) and routine research provide theoretical indications that emotions are connected with the development of behavioral patterns and routines (Adler and Obstfeld, 2007; Krisberga-Sinigoi et al., 2019; Zietsma et al., 2019). Further, in the context of the Carnegie perspective, it is also suggested to study emotional behavior in order to better understand organizational decision-making (Gavetti et al., 2007). One of the few studies that address routines related to emotions stems from Døjbak Håkonsson et al. (2016), finding that negative emotions generally relate to a lower likelihood of adaption to new routines than positive emotions and may thus inhibit organizations from changing their routines. However, while Døjbak

Håkonsson et al.'s (2016) study is highly valuable, as it suggests that the evolution of routines is in part shaped by highly contagious negative emotions (Bartel and Saavedra, 2000; Barsade, 2002), our understanding of the differential and microfoundational effects of distinct negative emotions on routine development remains limited. Understanding these effects is important for developing "new theory and research […] to shed light on the generative mechanisms through which firms might […] harness the […] emotional capacities of individuals and groups" (Hodgkinson and Healey, 2014, p. 1306).

The two distinct negative emotions sadness and fear are particularly relevant in the context of routine development. First, sadness and fear are likely to result in different effects on routine development. For instance, lab studies show that whereas sadness relates to uncertainty acceptance, fear relates to uncertainty avoidance (Raghunathan and Pham, 1999; Lerner and Keltner, 2001). Second, sadness and fear are particularly likely to be experienced in the context of routine development. Routine development is closely connected to organizational decision-making under change conditions, which is often accompanied by sadness and fear (Kabanoff et al., 1995; Fugate et al., 2002). While developing routines during times of change, organizational members are likely to feel sad about leaving a past state, for instance, due to layoffs of beloved colleagues or due to the breakup of their team (Appelbaum et al., 2000; Basch and Fisher, 2000), and they often experience fear about the future, for instance, fear of losing their jobs or situational control (Appelbaum et al., 2000). Third and finally, sadness and fear are among the most often observed forms of emotional distress (Selye, 1956; Raghunathan and Pham, 1999) and may, for instance, be caused by dysfunctional supervision in change contexts (Oh and Farh, 2017).

Despite the relevance of sadness and fear in contexts in which routine development occurs, so far we do not know how they affect routine development. This research gap is regrettable given the potential consequences of sadness and fear for routine development. In the context of the Carnegie perspective, we follow repeated calls in the extant literature to "also account for emotions […] to complete the microfoundations of our theories" (Hodgkinson and Healey, 2011). At the same time, we follow Barsade and Gibson's (2007, p. 52) call, who note that "[r]esearch and practice should be directed to the important questions of, "Under what conditions can negative affective responses lead to positive organizational outcomes?." Specifically, we ask, how do sadness and fear differentially affect routine development? We use a laboratory experiment to causally address this research question. Our findings lead to a better understanding of the mechanisms through which negative emotions affect routine development, thus simultaneously increasing the comprehension of organizational decision-making under change. Our experimental study provides causal evidence that the individual dimensions of routine development processes are differently affected by sadness and fear and thus suggest that distinct emotions as well as different dimensions of routine development should be differentiated in order to understand the effects of negative emotions on routine development. Our findings may lead to the development of more emotion-sensitive change practices and might sensitize organizations to better understand and predict the effects of negative emotions in change processes.

2 Theoretical foundation and relevance for the Carnegie perspective

2.1 Routine development and its operationalization

Well-known representatives of the Carnegie perspective argue that rational decision-making at the organizational and individual level is limited by various factors. These factors include, for example, that knowledge about specific circumstances and consequences is never complete and not all behavioral alternatives can be fully addressed (Simon, 1947). Simon's insights highlight the fundamental role of bounded rationality in shaping decision-making within organizations, including that (negative) emotions influence the rationality of decisions. Considering the behavioral theory of the firm according to Cyert and March (1963), routines are required "to deal with the cognitive constraints posed by bounded rationality" (Pentland and Hærem, 2015, p. 475). In other words, decision-making by managers and employees is defined by rule-driven behavior (De Boer and Zandberg, 2012), which is reflected in routine development. Simultaneously, individual behavior and subsequent decision-making are influenced by individually perceived stimuli (March and Simon, 1958; Tosi, 2008). These stimuli encompass, for instance, changes in the external or internal firm environment, which may evoke different perceptions, expectations, and emotions, and consequently unintended behavioral responses. Thus, it is highly relevant to examine routine development, as a central unit of analysis for exploring heuristic decision-making under the influence of (negative) stimuli induced by organizational changes.

The literature on routine development differentiates between the emergence of routines and the adaptation of existing routines. Accordingly, the behavioral theory describes two processes that address both aspects of routine development. The first process refers to the emergence of operating routines and of ecologies of operating routines as repetitive practices that evolve through internal dynamics (Parmigiani and Howard-Grenville, 2011). The second process describes the external modification of operating routines through dynamic capabilities, i.e., "a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness" (Zollo and Winter, 2002: 340). Both the emergence and the adaptation of existing routines are closely intertwined, and to understand routine development, both processes need to be analyzed jointly (Levinthal and Rerup, 2006).

To determine an operationalization of routine development, one might draw from microfoundational perspectives on routines (Felin et al., 2012, p. 1352). Microfoundational studies of routines have found helpful means to operationalize operating routines, their emergence, and the mechanisms through which they are regulated. For instance, in their pioneering experimental work on organizational routines, Cohen and Bacdayan (1994) introduced four dimensions to operationalize routines and their development. These four dimensions show overlaps with alternative operationalizations of routines (Pentland, 2003a,b; Becker, 2005; Laureiro-Martinez, 2014) and have been used to operationalize both operating routines (Cohen and Bacdayan, 1994) and dynamic capabilities (Wollersheim and Heimeriks, 2016). Considering studies on routine development at the individual level (e.g., Laureiro-Martinez, 2014) and recognizing that

people are complex beings, it becomes clear that introducing (negative) emotions can have distinct effects on their routinization. Three out of the four dimensions introduced by Cohen and Bacdayan (1994) capture the emergence of operating routines by means of three important characteristics of routines: (1) repetitiveness in action, (2) speed in action, and (3) reliability in action. The fourth of Cohen and Bacdayan's (1994) dimensions captures to what extent teams are able to recognize 'performance traps' and, accordingly, to attentively modify their routines in situations in which adjustments may lead to increased performance. This fourth dimension, (4) attentiveness in action, provides a meaningful operationalization of routine modification.[1] All four dimensions capture different facets of routine development, and (as we discuss below) they may be differently affected by sadness and fear.

2.2 The effects of sadness and fear on routine development

2.2.1 Repetitiveness in action

Routine development involves the emergence of action sequences, which through repetition develop into operating routines and which, due to their repetitiveness, are recognizable as such (Feldman and Pentland, 2003; Becker, 2004). In the context of our research model, repetitiveness in action corresponds to the question: Which operating routines or ecologies of operating routines develop, and how much control do they provide?

There is some indication that sadness and fear may affect repetitiveness in action. Emotions generally "provide[…] the motivating force driving strong commitment to novel choices" and actions (Hodgkinson and Healey, 2014: 1310), while negative emotions may decrease the likelihood of teams adopting novel actions (Døjbak Håkonsson et al., 2016). Consequently, both sadness and fear are likely to result in the development of more-repetitive operating routines. This expectation is supported by appraisal perspectives on emotions, which associate both sadness and fear with high levels of situational control (Smith and Ellsworth, 1985). That is, in change processes, sad and fearful teams and their members are likely to attribute the control of their situation to uncontrollable circumstances (Smith and Ellsworth, 1985), for instance, to the market environment or to the management. We may expect that teams of sad and fearful individuals restore a feeling of control by increasing the repetitiveness of their actions (Nelson and Winter, 1982; Becker, 2004). Consistent with this prediction, Staw et al.'s (1981) threat-rigidity thesis suggests that external threats, which tend to be accompanied by fear, generally lead to more repetitiveness in behavior. Further, Gill and Burrow (2018) reveal that fear leads to conforming behavior and accurate reproduction of familiar working practices, suggesting fear to be an influencing factor for organizational performance. In conclusion, we expect the development of more repetitive, recognizable, and thus controllable operating routines for teams whose members share a feeling of sadness or fear relative to teams whose members do not feel these emotions. However, we expect no differences between sadness and fear regarding repetitiveness in action.

2.2.2 Speed in action

Routine development allows "for the rapid processing of large amounts of information with little effort" (Laureiro-Martinez, 2014, p. 1113) and for economizing on cognitive resources (Becker, 2004). While developing routines, the actors store the components of the operating routines in their procedural memory (Cohen and Bacdayan, 1994). This 'off-loading' enables them to act at increasingly higher speeds and to increase their output per unit of time (Cohen and Bacdayan, 1994; Healey et al., 2015). Hence, routine development can be associated with increases in the speed in action (Cohen and Bacdayan, 1994). Overall, speed in action corresponds to the question: How automatically are operating routines executed, i.e., how developed is the execution of operating routines?

There is some indication that sadness and fear may affect speed in action. For instance, sadness has been associated with local impatience, i.e., sad individuals tend to seek instant gratification when facing choices between immediate and future payoffs, an observation that Lerner et al. (2013) denote as 'myopic misery'. In a change context, sadness may thus translate into an increased tendency to develop operating routines–quick and reliable behavioral patterns that may provide instant gratification (Cohen and Bacdayan, 1994). Likewise, with regard to fear, Vuori and Huy (2016) find that structurally based fear within organizations (e.g., about the future of the company) may lead to temporal myopia, i.e., a focus on short-term activities and failure at implementing long-term activities. In their case study, fear, i.e., the "dread of impending disaster and an intense urge to defend oneself, primarily by getting out of the situation" (Öhman, 2008, p. 710), pressured organizational members to act urgently (Lazarus, 1991; Vuori and Huy, 2016). Thus, with both sadness and fear, we may expect increases in the speed at which operating routines are enacted. In the extant literature, we have found no indication of differences between sadness and fear regarding their effects on speed in action.

2.2.3 Reliability in action

Routine development is targeted toward reliability in action, i.e., toward reducing any risk and uncertainty attached to organizational actions (Becker, 2004). Operating routines tend to be highly reliable, and their outcomes are almost certain (Cyert and March, 1963; Cohen and Bacdayan, 1994). Accordingly, routine development reduces the

1 Please note that Wollersheim and Heimeriks (2016) rely on Cohen and Bacdayan (1994) to capture the regulation of routines through dynamic capabilities. In contrast to this study, they use an experimental design that challenged participants' capacity to identify appropriate procedures following a change in the environment and that required modification of operating routines. In their experiment, they primarily base their identification of the characteristic qualities of dynamic capabilities on Cohen and Bacdayan's (1994) dimensions by analyzing differences between groups in low vs. high dynamic capability conditions in this change situation. In this study, we use a comparatively stable environment in which participants jointly form and modify routines. In this comparatively stable environment, we employ three of Cohen and Bacdayan's (1994) dimensions, (1) repetitiveness in action, (2) speed in action, and (3) reliability in action, to describe the emergence of operating routines, given that these dimensions describe aspects of operating routines that may be observed irrespective of change. (4) Attentiveness in action, in turn, describes to what extent teams are able to *deliberately* adjust routines in the more stable, yet due to the different card configurations changing environment. Thus, in this study, we relate this dimension to the modification of routines.

emotional costs that result from risk and uncertainty (Cohen and Bacdayan, 1994; Laureiro-Martínez et al., 2015). In fact, it has been argued that routine development may be "viewed as an uncertainty decreasing strategy" (Becker, 2004, p. 658). Reliability in action reveals how well-developed a routine is at fulfilling this function, and thus, it corresponds overall to the question: How functionally developed are operating routines?

There is an indication that sadness and fear may affect demands for reliability in action (Delgado-García et al., 2010). For instance, sadness generally relates to more uncertainty acceptance and to more risk taking and, accordingly, to a comparatively decreased demand for reliable actions that reduce uncertainty and risk (Raghunathan and Pham, 1999). In contrast, fear relates to uncertainty avoidance and to less risk taking and, accordingly, to a comparatively increased demand for reliability (Raghunathan and Pham, 1999; Lerner and Keltner, 2001; Liu and Perrewe, 2005). In a change context, we may thus expect a lower demand for reliability and hence a lower tendency toward the development of reliable operating routines when sadness is experienced and a higher demand for reliability and hence a higher tendency toward the development of reliable operating routines when fear is experienced.

2.2.4 Attentiveness in action

Routine development draws from collective activities–dynamic capabilities (Levinthal and Rerup, 2006)–that are dedicated to the creation and modification of operating routines (Zollo and Winter, 2002). Whereas dynamic capabilities themselves may represent mindless activities that are unknown to their actors, they shape operating routines through mindfulness and deliberation in action (Zollo and Winter, 2002) by disciplining collective attention toward operating routines and their enactments (Weick and Sutcliffe, 2006). From a cognitive perspective, the dynamic capability concept is matched by the concept of attention control (Laureiro-Martínez et al., 2015). Dynamic capabilities draw from individuals' ability to focus their attention on activities that improve effectiveness. For instance, previous research has shown that individual attention guides choices between exploration and exploitation (Laureiro-Martínez et al., 2015). Likewise, dynamic capabilities direct collective attention toward the creation and modification of operating routines (Weick and Sutcliffe, 2006). They allow one to find the optimal balance between stability and change, i.e., to understand when operating routines do not require attention and when they should be attentively enacted and modified. Dynamic capabilities become visible through the attentiveness that is put at work in the enactment and modification of operating routines in situations where routines require attention. Overall, attentiveness in action corresponds to the question: How effectively are operating routines enacted and modified to match the dynamics of their environment?

There is some indication that sadness and fear may affect attentiveness in action. In general, Baldessarelli et al. (2022) states that emotions affect the emergence and willingness to maintain routines. Negative emotions may lead to a modification of routines, especially in the way how patterns of action are realized. In this context, Soderstrom and Weber (2020) dealt with the influence of emotions on integration processes and revealed that the experience of an emotional alignment may affect longer-term motivation as well as commitment structures. These findings can be transferred to our study context in that negatively experienced emotions, such as fear and sadness, can have a lasting and potentially harmful effect on subsequent interactions and routine development. More specifically, Smith and Ellsworth (1985) generally associate sadness with comparatively lower levels of attention and fear with comparatively higher levels of attention. Gable and Harmon-Jones (2010) find that emotions associated with low motivational intensity (sadness) lead to widened attention, whereas emotions associated with high motivational intensity (fear) lead to narrowed attention. This finding implies that sadness might shift the focus of attention away from local stimuli toward global stimuli–for instance, away from the regulation of operating routines to the environment (e.g., toward issues not related to the task at hand). In contrast, fear is likely to lead to an attention shift from the environment toward the regulation of operating routines.

2.3 Our research model

Building on previous studies of routines, our research model features three different dimensions that capture the emergence of operating routines: (1) repetitiveness in action, (2) speed in action, and (3) reliability in action (Cohen and Bacdayan, 1994). Moreover, we operationalize the regulation of operating routines as a team's capability to (4) attentively modify operating routines in order to optimize performance. All four dimensions of routine development may be subject to emotional influences, and we expect several differences in the effects of sadness and fear. Figure 1 presents our research model.

3 Data and methods

3.1 Task

As an experimental task, we used the Target the Two (TTT) card game developed by Cohen and Bacdayan (1994), which has already been used in several other studies to exemplify organizational routines (Egidi and Narduzzo, 1997; Wollersheim and Heimeriks, 2016; Oehler et al., 2019). TTT shares essential aspects with typical routine development situations in organizational settings (e.g., asymmetry of authorities, information asymmetry) and thus serves as a well-recognized laboratory-suited analog of organizational routine development. The game features two team members who are randomly assigned to each other and who need to quickly develop a new routine at solving repeated tasks, which vary slightly over time. Specifically, the card game involves six cards in total (2♥, 3♥, 4♥ and 2♣, 3♣, 4♣). Four of these cards lie on the playing board, and the other two cards are assigned as personal cards to each of the two team members. That is, each team member holds one personal card, which cannot be seen by the other team member. The remaining cards are on the playing board, with two lying face-up and two lying face-down. One of the face-up cards occupies a special position, the target position. The team members' common goal is to put 2♥ in the target position as quickly as possible and with the least possible number of moves. They alternately exchange their personal card with one of the cards on the playing board until the relative hand is completed–i.e., until 2♥ is placed in the target position. This process requires coordination, given that a special rule applies to the target position. The special rule differs depending on the authority the respective team member represents in the card game: one of the team members is given the authority of a Numberkeeper, which means that he or she can only exchange his or her personal card with the card in the target position if the cards are of the same number; the other team

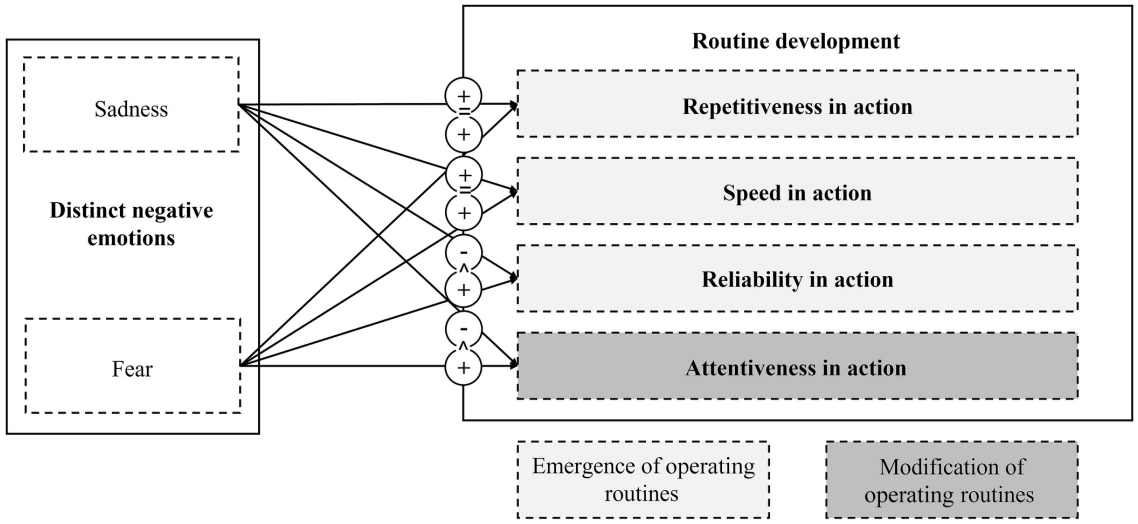


FIGURE 1
Expected effects of sadness and fear on different dimensions of routine development. The figure illustrates the expected effects of the distinct emotions sadness and fear on different dimensions of routine development. = denotes no effect; + denotes positive effect; – denotes negative effect; > denotes more positive effect when compared to other emotion rather than to control condition.

member is given the authority of a Colorkeeper, which means that he or she can only exchange his or her personal card with the card in the target position if his personal card has the same suit as the one in the target position. In each hand, the Colorkeeper moves first. In total, TTT involves 40 hands with various card constellations, and takes up to 40 min. Following Cohen and Bacdayan (1994), we instructed the teams to play up to 40 hands of TTT while not exceeding the maximum time frame of 40 min. Twenty-seven of the 40 original card constellations conceived by Cohen and Bacdayan (1994) are designed in a way that allows both Numberkeepers and Colorkeepers to effectively target the 2♥ card in the target field. In these hands, teams need to coordinate on one authority (Numberkeeper or Colorkeeper), who places the 2♥ card in the target field, whereas the other team member assumes a supportive role (Egidi, 1996; Egidi and Narduzzo, 1997). Teams can only succeed in these tasks if they find a way to coordinate their respective authorities. Because they are urged not to communicate openly, team members may implicitly communicate through 'signal cards' to inform the team member about intended actions (Egidi, 1996; Egidi and Narduzzo, 1997).

3.2 Procedure

3.2.1 Introduction

On their arrival in the experimental laboratory, participants were assigned a computer. We then introduced our participants to the general background, procedure, and incentive structure of the experiment. The following computerized training included a written explanation of the rules of the game and a sample hand, which illustrated the rules of the game. The computerized training was followed by a short question-and-answer session. In addition to answering the questions raised publicly, the experimenter repeated answers to some general questions that–according to pretests and observations from other studies with this card game (Wollersheim and Heimeriks, 2016)–appeared regularly. After the question-and-answer session, we distributed printed rule cards indicating the respective roles (i.e., Colorkeeper or Numberkeeper) and summarizing the rule that applied to the respective role of the participants. The participants were randomly allocated to teams, which–without their knowledge–were assigned to our three different emotion induction conditions.

3.2.2 Emotional manipulation

We implemented the emotion intervention by inducing fear, sadness, or no specific emotions. We only induced one emotion per team (i.e., emotions were not mixed within teams). After introducing the experimental procedure, we instructed the participants to write a short essay for 5 min. Specifically, we instructed them to write a detailed description of an event that made them feel either deeply sad (sadness condition) or afraid (fear condition) or one that regularly occurs and does not have any obvious emotional influence (control condition). This emotion induction procedure is widely used in economic studies (e.g., Nelissen et al., 2011; Siedlecka and Denson, 2019) in which decisions have to be made directly after finishing the writing task. Because this study needed to sustain these emotions for up to 40 min, we additionally used a combination of music and pictures for the emotion induction during the game (Lench et al., 2011). Previous research has shown that combining music and pictures is more effective for inducing emotions than using pictures alone (Baumgartner et al., 2006b), and several studies have successfully combined auditory and visual stimuli for inducing emotions (Drace et al., 2009; Haase and Silbereisen, 2011). To avoid that participants notice the emotional manipulation and to ensure that the results of the experiment are influenced in this respect, the emotional state was not queried until the end of the experiment.[2]

2 Please note that, additionally, at the end of the experiment, we instructed the participants to inform us about what they believe the objective of the study was. Based on the data that we gathered in this way, we feel confident that nobody understood that we sought to manipulate emotions.

TABLE 1 Manipulation check pre-test.

	Control condition		Sadness condition			Control condition		Fear condition	
	Mean	SD	Mean	SD		Mean	SD	Mean	SD
Reported sadness					*Reported fear*				
After 5 min.	1.21	1.62	4.08	2.43	*After 5 min.*	1.63	2.26	3.50	3.31
After 20 min.	1.46	1.56	3.71	2.68	*After 20 min.*	1.04	1.46	2.36	2.63
After the game	1.25	1.57	3.21	2.60	*After the game*	0.54	0.78	1.54	2.06

During the experimental task, we played music that was used in previous research (Krumhansl, 1997; Etzel et al., 2006) to the participants via headphones (headphones were also used in previous studies, e.g., Stephens et al., 2010). Specifically, the musical stimulus material consisted of soundtrack (Etzel et al., 2006) and classical music (Mayer et al., 1995; Baumgartner et al., 2006a) to induce sadness and fear. The music excerpts were played in a random order. Participants in the control condition wore headphones without listening to music (Niedenthal et al., 2001), because "neutral music does not exist" (Baumgartner et al., 2006a, p. 41).

The visual stimulus material consisted of 10 pictures per experimental condition (i.e., 10 pictures for inducing sadness, 10 pictures for inducing fear, and 10 pictures for the control condition). Most of the pictures were taken from the International Affective Picture System (IAPS). Those pictures that were not taken from the IAPS were collected from the internet (IAPS pictures were also supplemented with pictures that had been collected by the authors in Baumgartner et al., 2006a). During the experimental task, the pictures regularly popped up on participants' computer screens. Participants in the control condition were exposed to neutral objects. All pictures that were used for the main study had been pretested. For the visual induction, each picture was presented at the center of the screen for 30 ms (e.g., Soussignan et al., 2010), and there was a time lag of 10 s between the picture presentations. The pictures were presented in random order.

Because this study induced emotions for such a long time frame, we pretested the whole emotion induction procedure. Participants ($N = 72$) who did not take part in the main study were asked after five minutes, after 20 min, and after completion of the game to what degree they currently felt sad and to what degree they currently felt afraid. As shown in Table 1, the manipulation was successful across all time spans, indicating that the combination of different stimuli allowed the emotions to be maintained over the entire duration of the experiment. In the main study, we conducted further manipulation checks, which were all successful. Yet, in contrast to the pre-tests, we tested emotions only at the end of the study to avoid distractions from the task. Accordingly, the manipulation checks could not have influenced routine development in our main sessions.

3.2.3 Measurement of routine development

Following Wollersheim and Heimeriks (2016) we used a computerized version of TTT (Cohen and Bacdayan, 1994). Our version of TTT was programmed as a client–server-solution that displayed cards in the same order on each screen as the original game. We measured routine development in the game by means of four different dependent variables, of which the first three captured the emergence of operating routines by means of (1) repetitiveness in action, (2) speed in action, and (3) reliability in action, and of which the fourth captured the modification of operating routines by means of (4) attentiveness in action.

(1) To measure repetitiveness in action, we identified distinct action patterns and their repetitions in the TTT game (Cohen and Bacdayan, 1994). In the game, action patterns can be identified and differentiated according to the field positions with which team members exchange the cards in their hands in their efforts to solve TTT. Every move in TTT either represents a card exchange with a field position on the virtual table or an activation of the pass button. Individual moves may, hence, be aggregated into action sequences that capture the chronological order of moves over the course of one hand. We can use these orders to differentiate distinct action sequences and their repeated enactment throughout the game. Specifically, we analyzed either the last four moves of a hand if a hand was solved within four or more moves or the last three moves of a hand if the hand was solved within three moves (Cohen and Bacdayan, 1994). We chose this approach because the first few moves of each action string tend to be very specific to the different constellations of cards on the playing field, whereas the last few moves of each hand can be replicated throughout various constellations of cards. Thus, for each team and each hand, we determined the combination of the last three to four moves that led to the solution of the hand. The respective solutions are stored in our variable 'distinct action sequences'. To determine repetitiveness in these distinct action sequences, we counted the recurrences of each 'distinct action sequence' for each team by means of our variable 'repetitiveness of distinct action sequences'.

(2) To measure speed in action, we followed Cohen and Bacdayan (1994) in measuring the 'average move time per hand' and changes in this variable throughout the TTT game (Laureiro-Martinez, 2014). That is, for each hand played by each team, we individually assessed the average time it took the team members to execute the moves of this hand. Measuring speed in action for each hand separately enabled us to assess how speed in action changed over the course of the TTT game.

(3) To measure reliability in action, we analyzed the 'deviation in number of moves relative to the best team'. That is, for each team and each hand, we determined the difference in the number of moves required by the analyzed team and the number of moves required by the team that required the lowest number of moves for the respective hand. Thereby, we refine Cohen and Bacdayan's (1994) measure for reliability, which is limited in its explanatory power, in that it basically only compares two out of all participating teams to each other.

(4) To measure attentiveness in action, we looked at occasional suboptimality. Cohen and Bacdayan (1994) find that the development

of operating routines, such as the so-called UU*T sequence (named after the sequence of activated fields *U*p, *U*p, *Anything, *T*arget), may contribute to occasional suboptimality. In their experimental setting, players tend to stick to pre-established action patterns even in situations in which different solutions would have been more efficient. Yet, Wollersheim and Heimeriks (2016) find that teams playing TTT may benefit from dynamic capabilities that are reflected in an increased attentiveness in teams' enactments of routines and that result in a lower likelihood of falling prey to the negative side-effects of operating routines. In TTT, there are several individual hands in the game, for which it can be shown that the use of stable operating routines leads to suboptimal performance. Following Cohen and Bacdayan (1994), we set up three 'traps' in our experimental setting (hands eight, 15, and 38). These hands can be comparatively easily solved by teams that do not rely on previously established action sequences, such as UU*T action sequences, to place the 2♥ card in the target field and instead choose an alternative approach. To measure attentiveness in action we determined for each team, which percentage of the three 'traps' we had set up were successfully avoided. We thus call our measure for attentiveness in action 'percentage of traps avoided'.

3.2.4 Final questionnaire and remuneration

Upon completion of the TTT game, the participants were asked to fill out a questionnaire, which included manipulation checks and demographical questions. Participants were paid their winnings in cash shortly after the end of the study. Basic data analyzes contributed to determining the amount to be paid. Specifically, we made a fixed payment of €6.15 and paid participants an additional amount according to performance (M = €4.02, SD = €1.46, Min = €-3.60, Max = €5.18). To meet the requirements of the laboratory where we collected our data, we guaranteed that each participant would receive at least €6.00. Regarding the incentives, we followed the procedure of Wollersheim and Heimeriks (2016). Specifically, we informed the participants that–in addition to a fixed payment of 6.16 euro–they jointly earn 50 cents with each successfully completed hand. For every move (including passing) they required to successfully complete the hand, 5 cents were subtracted from their payoff. Consequently, participants could maximize their outcome by acting quickly, but still in a thoughtful manner.

3.3 Sample

In total, 168 participants arranged into teams of two players participated in the study. Participants were randomly assigned to teams, and the teams were randomly assigned to the experimental conditions. 54 participants (i.e., 27 teams) were assigned to the control condition, 56 participants (i.e., 28 teams) were assigned to the sadness condition, and 56 participants (i.e., 28 teams) were assigned to the fear condition. The participants were recruited using the software ORSEE (Greiner, 2004). For one pair of players, technical problems occurred; they could not finish the experiment and were thus excluded from the dataset prior to the analyzes. The final sample—N = 166—consisted of 118 men (71.1%) and 48 women (28.9%), with ages ranging from 18 to 50 and a mean age of 21.91 years (SD = 3.08).

4 Experimental results

4.1 Summary statistics

Table 2 provides descriptions and correlations for the most important variables. We found correlations among all three dimensions that capture the emergence of operating routines. In contrast, we found no significant correlations between attentiveness in action–the dimension of routine development that captures the modification of operating routines–and the three dimensions that capture the emergence of operating routines. These findings support our assumption that operationalizing the emergence and modification of operating routines separately is reasonable.

4.2 The effects of sadness and fear on routine development

4.2.1 Repetitiveness in action

To understand to what extent routine development differed between experimental conditions, we analyzed the 'repetitiveness of distinct action sequences'. On average, teams across all conditions repeated each action sequence 2.80 times (SD = 0.38). Teams in the sadness condition (M = 2.87, SD = 0.33) repeated their action sequences significantly more often than teams in the control condition (M = 2.62, SD = 0.49), $t(53) = 2.23$, p = 0.030, d = 0.599. We thus observe a medium-sized effect of sadness on repetitiveness in action. We did not find additional significant differences for repetitiveness in action sequences between the other condition comparisons (fear condition: M = 2.78, SD = 0.43).

Thus, consistent with our expectations, we observed that teams experiencing sadness generally acted more repetitively than teams in the control condition. Accordingly, teams in the sadness condition developed comparatively more stable operating routines, presumably in order to increase control over their actions. Regarding fear, our findings do not robustly support our expectation that fear would generally lead to more repetitiveness in action.

4.2.2 Speed in action

To test whether sadness and fear affect how automatically operating routines are executed, we followed Cohen and Bacdayan (1994) in analyzing speed in action. Specifically, we observed the 'average move time per hand' in the TTT game. For each team and each hand, we measured the average number of seconds the team required to finish each move of that hand. This way, we were able to test absolute speed in action and changes in speed in action throughout the game.

We started our analysis by comparing how teams in our experimental conditions differed regarding their absolute speed in action. Simple group-comparisons revealed that the 'average move time per hand' was significantly lower in the sadness condition (M = 5.35, SD = 1.87) than in the control condition (M = 5.60, SD = 2.25), $t(2174) = 2.84$, p = 0.005, d = 0.122. We found no significant differences in the 'average move time per hand' between the fear condition (M = 5.56, SD = 2.13) and the control condition, $t(2174) = 0.39$, p = 0.695, d = 0.017, but we found significantly quicker moves in the sadness condition relative to the fear condition, $t(2238) = 2.53$, p = 0.012, d = 0.107. Thus, sadness generally led to comparatively quicker moves, yet the observed effects are small.

TABLE 2 Descriptive statistics and correlations (Level of analysis: team).

		Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1)	**Repetitiveness in action** Average no. of repetitions of each action sequence	2.802	0.381	1.000							
(2)	**Speed in action** Average move time per hand	5.460	0.739	−0.168	1.000						
				(0.128)							
(3)	**Reliability in action** Average deviation in number of moves relative to best team	1.647	0.650	−0.548	0.213	1.000					
				(0.000)	(0.054)						
(4)	**Attentiveness in action** Percentage of traps avoided	0.388	0.322	−0.168	0.003	−0.074	1.000				
				(0.140)	(0.981)	(0.518)					
(5)	**Share of UU*T moves** UU*T moves in relation to all moves	0.220	0.052	0.430	−0.094	−0.563	0.026	1.000			
				(0.000)	(0.397)	(0.000)	(0.819)				
(6)	**Money gained** Money gained per team	856.646	156.999	0.527	−0.194	−0.986	0.050	0.572	1.000		
				(0.000)	(0.079)	(0.000)	(0.663)	(0.000)			
(7)	**Sadness** Mean sadness among team members	2.278	1.728	−0.054	0.062	−0.043	0.057	−0.047	0.041	1.000	
				(0.627)	(0.577)	(0.701)	(0.620)	(0.670)	(0.715)		
(8)	**Fear** Mean fear among team members	1.222	1.556	−0.028	0.252	−0.011	0.010	0.218	0.031	0.274	1.000
				(0.805)	(0.022)	(0.922)	(0.933)	(0.048)	(0.781)	(0.012)	

P-values in parentheses.

To analyze the evolution of the 'average move time per hand' throughout the TTT game, we conducted an OLS regression analysis of speed in action, which we present in Table 3. Our regression analysis predicts that across all conditions, with each hand of the game, the 'average move time per hand' decreased by 0.10 s ($SE = 0.00$, $p < 0.001$, $R^2 = 0.258$). Hence, every 10 hands of the game, the 'average move time per hand' decreased by roughly 1 sec. With the regression model, we tested for interaction effects between the emotional manipulations and game progress, which in the regression analysis is represented by the variable hand index. We found a significant positive interaction effect between sadness and the hand index ($b = 0.02$, $SE = 0.01$, $p < 0.001$) and a slightly significant positive interaction effect between fear and the hand index ($b = 0.01$, $SE = 0.01$, $p < 0.086$). With respect to the overall improvement in "average move time per hand," the positive coefficients suggest that both, teams in the sadness and in the fear conditions, could not decrease their "average move time per hand" (and thus, increase their speed in action) during the game to the same extent as the teams in the control condition.

Figure 2 illustrates this finding and provides a deeper insight into the change in "average move time per hand" during different phases of the game. In the first few hands (i.e., in the initial rounds of play), teams in the sadness condition (and to a lesser extent, teams in the fear condition) managed to decrease their "average move time per hand" more than teams in the control condition. However, as the game progressed, teams in the control condition achieved comparable speeds.

Thus, consistent with our expectations, we generally observed more speed in action in the sadness condition relative to the control condition. Contrary to our expectations, teams in the sadness condition not only acted generally quicker than teams in the control condition but also than teams in the fear condition. Yet, at the same time, teams in the sadness condition showed comparatively weaker increases in speed in action with game progress relative to teams in the control condition. Hence, whereas sad teams acted generally quicker than teams in the remaining conditions, this discrepancy in speed emerged at an early stage of the TTT game and tended to decrease over time. Regarding fear, against our expectations, teams in the fear condition acted at speeds comparable to teams in the control condition. At the same time, teams in the fear condition increased their speed in action slightly less strongly over the course of the game than teams in the control condition. Thus, fear did not robustly affect speed in action in absolute terms, but with game progress, it led to a relative decrease in speed in action relative to the control condition.

4.2.3 Reliability in action

To test whether sadness and fear affected how functionally developed operating routines are, we followed Cohen and Bacdayan (1994) in analyzing reliability in action. To measure teams' reliability in action, we looked at the 'deviation in number of moves relative to the best team'.

We conducted an OLS regression analysis in which we regressed 'deviation in number of moves relative to the best team' on the hand index, on two dummy variables corresponding to our experimental manipulations of sadness and fear, and on terms that test for interactions between our experimental manipulations and the hand index. We present our findings in Table 4. Our regression analysis (Table 4) suggests negative main effects for the sadness ($b = -1.30$, $SE = 0.21$, $p < 0.001$, $R^2 = 0.046$) and fear manipulations ($b = -0.70$, $SE = 0.21$, $p = 0.001$) on the 'deviation in number of moves relative to the best team', relating to a relative increase in reliability with sadness and fear. To better understand differences in reliability in action between our experimental conditions, we additionally conducted

pairwise tests in which we aggregated teams' mean 'deviation in number of moves relative to the best team' over all hands. These tests revealed that teams in the sadness condition required, on average, only 1.46 more moves (SD = 0.37) to finish a hand than the, respectively, best performing team, which is significantly fewer moves than teams in the control condition ($M = 2.21$, SD = 1.64), $t(53) = 2.37$, $p = 0.021$, $d = 0.634$. Regarding the fear condition, the pairwise tests reveal no significant differences in reliability in action between the fear condition ($M = 1.86$, SD = 0.83) and the control condition, $t(53) = 1.01$, $p = 0.317$, $d = 0.271$. Teams in the sadness condition performed significantly more reliably than teams in the control and fear conditions, $t(54) = 2.33$, $p = 0.024$, $d = 0.623$. We thus observed medium positive effects of sadness on reliability in action and no robust effects for fear. Accordingly, teams in the sadness condition generally solved the TTT game in a more reliable fashion than teams in the remaining conditions.

TABLE 3 Speed in action: OLS regression analysis of average move time per hand.

	Coeff.	SE
Constant	7.581***	0.108
	(0.000)	
Hand index	−0.103***	0.005
	(0.000)	
Sadness condition (1 = yes vs. 0 = no)	−0.691***	0.151
	(0.000)	
Fear condition (1 = yes vs. 0 = no)	−0.225	0.151
	(0.137)	
Sadness condition × hand index	0.025***	0.007
	(0.000)	
Fear condition × hand index	0.012^{+}	0.007
	(0.086)	
Observations	3,296	
R^2	0.258	

Negative coefficients correspond to more speed in action. *P*-values in parentheses; $^{+}p < 0.1$, $^{***}p < 0.001$.

Whereas our regression analysis presented in Table 4 suggests that in all experimental conditions, the 'deviation in number of moves relative to the best team' decreased by an average of 0.06 moves (SE = 0.01, $p < 0.001$) with each hand of the game (and consequently, reliability in action increased), the regression yielded positive interaction coefficients for our emotional manipulation sadness and the hand index ($b = 0.03$, $SE = 0.01$, $p < 0.001$) and for fear and the hand index ($b = 0.02$, SE = 0.01, $p = 0.011$). These positive coefficients suggest that with game progress (i.e., with increases in the hand index), the 'deviation in number of moves relative to the best team' decreased less strongly in our sadness and fear conditions than in our control condition. Hence, we observed two distinct aspects of reliability in action, namely the rate of change in reliability and the relative level of reliability. On the one hand, when considering the entire duration of the game (i.e., rate of change in reliability), we found that over the course of the game, teams in the sadness and fear conditions could not increase their reliability in action to the same extent as teams in the control condition. Figure 3 presents this finding in a more comprehensible way. The graph illustrates how reliability in action in our experimental conditions increased with game progress. Whereas in the sadness and fear conditions the 'deviation in number of moves relative to the best team' decreased quickly in the early hands of the game, it took teams in the control condition longer (i.e., more hands) to perform reliably.

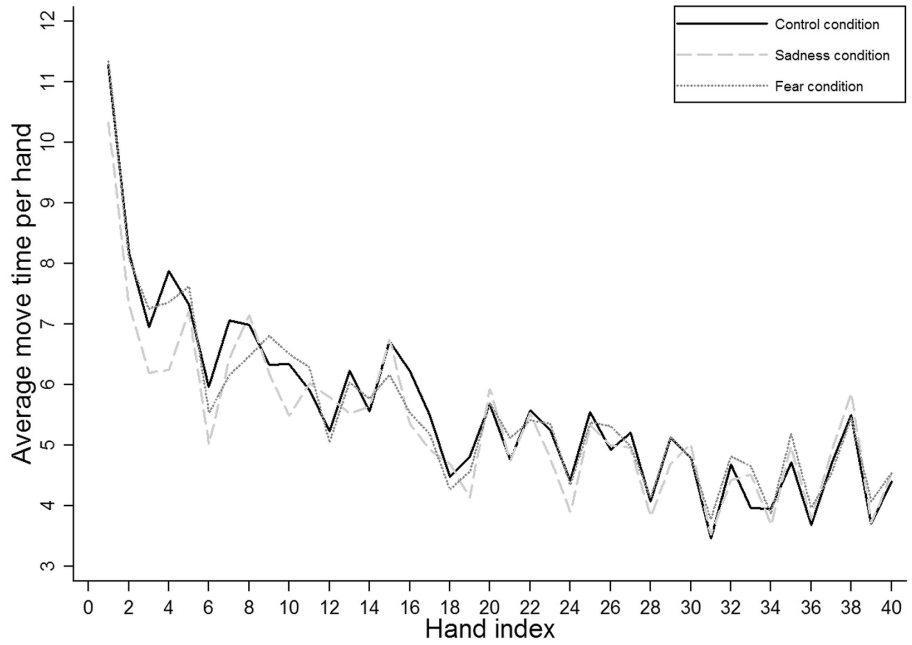


FIGURE 2
Speed in action: development of the average move time per hand with game progress.

TABLE 4 Reliability in action: OLS regression analysis of deviation in number of moves relative to best team.

	Coeff.	SE
Constant	3.234***	0.148
	(0.000)	
Hand index	−0.058***	0.007
	(0.000)	
Sadness condition (1 = yes vs. 0 = no)	−1.303***	0.207
	(0.000)	
Fear condition (1 = yes vs. 0 = no)	−0.700**	0.207
	(0.001)	
Sadness condition × hand index	0.034***	0.009
	(0.000)	
Fear condition × hand index	0.023*	0.009
	(0.011)	
Observations	3,296	
R^2	0.046	

Negative coefficients correspond to more reliability in action. *P*-values in parentheses; *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

However, over the course of the game, teams in the control condition showed a steady increase in reliability, and toward the end of the game, they achieved similar levels of reliability.

Thus, on the other hand, against our expectations, teams in the sadness condition developed generally more reliable operating routines than teams in the control and fear conditions, especially during the early stages of the game (i.e., relative level of reliability). These differences in reliability emerged at a very early stage of the TTT game, but they decreased over time. Unexpectedly, teams in the fear condition did not robustly differ from teams in the control condition in terms of their absolute reliability. Yet, with game progress, reliability in action in the fear condition increased comparatively less strongly than in the control condition.

Accordingly, we observed significant differences in the payouts, with teams in the control condition earning less than teams experiencing sadness and fear. It is crucial to acknowledge these differences and to emphasize that those variations are driven by the nuanced effects of speed and reliability in action.

4.2.4 Attentiveness in action

To understand the effects of sadness and fear on the modification of operating routines, we analyzed attentiveness in action. This dimension allows us to address the question of whether sadness and fear affect how effectively operating routines are modified to match the dynamics of their environment. We implemented three 'trap hands', i.e., 8, 15, and 38, which can be solved quite easily by teams that act attentively but result in suboptimal performance if teams rely on pre-established operating routines (Cohen and Bacdayan, 1994).

The 79 teams that managed to play all three hands were able to avoid, on average, 38.82 percent (SD = 0.32) of the three traps. We found significant differences in the 'percentage of traps avoided' between the sadness and fear conditions, $t(54) = 2.18$, $p = 0.033$, $d = 0.583$. The observed medium-sized effect is quite distinct. The average team in the sadness condition avoided only 29.76 percent (SD = 0.26) of the three 'traps', whereas teams in the fear condition avoided 47.62 percent of them (SD = 0.34).

4.2.5 Additional analyzes concerning the patterning dimension of routines

In addition to the analyzes that we conducted to shed light on the performative dimension of routines (i.e., on the actual actions), we performed analyzes with respect to the patterning dimension of routines (i.e., the sequences of action). Routine dynamics research suggests to consider routines as "emergent patterns that form in the actual performance" (Geiger, 2022: 2) and as a process of constant reproduction of actions across temporal and spatial boundaries (Feldman et al., 2016). In this context, we investigated the extent to which participants displayed routinized or flexible behavior. In particular, based on Egidi (1996), we analyzed the two minimal paths for solving the TTT game (i.e., 442 and 422 strategies).[3]

First, we identified Egidi's (1996) coordination patterns (i.e., 442 and 422) among all teams. To assess whether the teams displayed routinized or flexible behavior, we created a score from the 442 and 422 paths by dividing the number of uses of the 422 strategy by the total number of uses of either 442 or 422 strategies. As a result, we obtained values between 0.59 and 0.96; the closer the value is to 1.0, the more rigid is the routinized behavior of the teams. Second, we calculated the means for the scores in each condition and used t-tests to investigate whether there are any significant differences. We observed that participants in the sadness condition ($M = 0.71$, SD = 0.14) were significantly more flexible in their routines than participants in the control condition (M = 0.77, SD = 0.14, $p = 0.009$). The same is valid for participants in the fear condition ($M = 0.70$, SD = 0.12), who were significantly more flexible in their routines than participants in the control condition (M = 0.77, SD = 0.14, $p = 0.002$). We did not observe significant differences between participants in the sadness condition (M = 0.70, SD = 0.14) and the fear condition ($M = 0.70$, SD = 0.12, $p = 0.337$).

Third, we computed dummy variables for the experimental conditions to calculate a linear regression examining whether routinized behavior as a dependent variable could be explained by the induced emotions, namely sadness and fear. The negative coefficients suggest that teams perceiving sadness ($b = -0.039$, SE = 0.026, $p = 0.140$) and fear ($b = -0.068$, SE = 0.026, $p = 0.009$) tend to have comparatively more balanced paths and, accordingly, more flexible routines. Table 5 gives an overview.

3 In the TTT experiment, two distinct strategies, known as "442" and "422," can be employed to accomplish the objective (Egidi and Narduzzo, 1997). Following the 442 strategy means that the Numberkeeper initiates solving the card game. Specifically, the Numberkeeper searches for and places a specific card (e.g., 4♥) into the target position. Subsequently, the Colorkeeper follows suit by searching for and placing a different card (e.g., 2♥) into the target position. This sequence of actions results in a specific card sequence for the target position (e.g., 4♣-4♥-2♥), which explains the name of the relative strategy (i.e., 442). Accordingly, 422 strategy means that the Colorkeeper takes the lead by identifying and placing a specific card (e.g., 2♣) into the target position. Subsequently, the Numberkeeper takes their turn, searching for and placing a distinct card (e.g., 2♥) into the target position. Thus, the card sequence on the target position is, for example, 4♣-2♣-2♥ (i.e., 422 strategy).

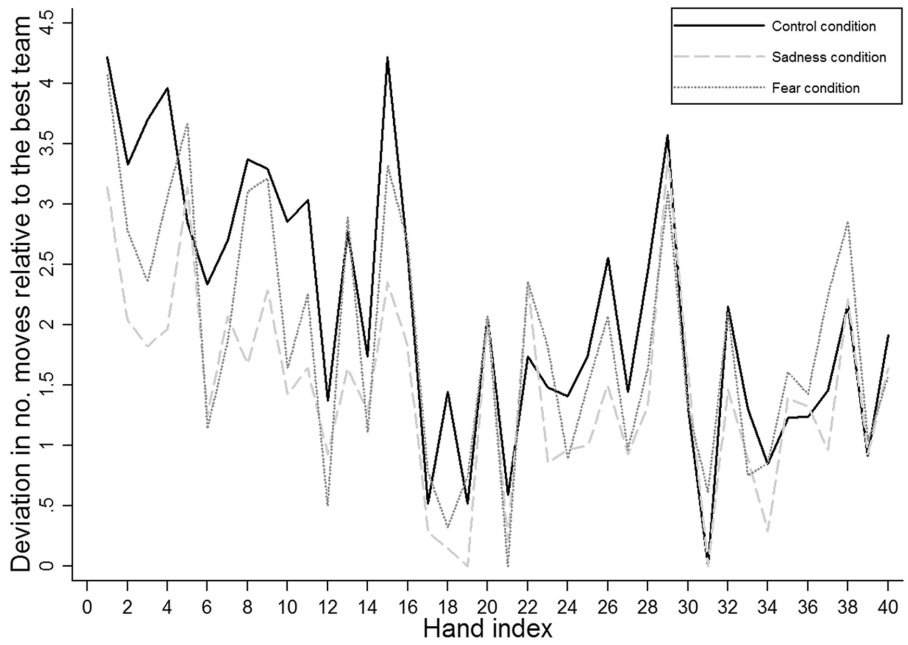


FIGURE 3
Reliability in action: development of the deviation in number of moves relative to the best team with game progress.

To examine the underlying routine performance of participants at an early and advanced stage of the experiment across all conditions, we further conducted descriptive statistics as an additional analysis. According to Cohen and Bacdayan (1994), we repeated the deck of cards from sequences 1–5 in sequences 26–30. Accordingly, the range and mean values indicate that the participants improved across all conditions in terms of sum of move durations divided by the number of moves in the specific hand, money that the group gained for the specific hand, and duration of the specific hand. Tables 6 and 7 provide an overview of the results.

TABLE 5 Coordination patterns: linear regression analysis of the influence of induced emotions on routinized behavior.

	Coeff.	SE
Constant	0.763***	0.019
	(0.000)	
Control condition (dummy variable)	0.069**	0.026
	(0.009)	
Sadness condition (dummy variable)	−0.039	0.026
	(0.140)	
Fear condition (dummy variable)	−0.068**	0.26
	(0.009)	

Negative coefficients correspond to comparatively more balanced paths. *P*-values; $^{+}p<0.1$, $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$.

5 Discussion

This study set out to explore the effects of distinct negative emotions on routine development. In the context of the Carnegie perspective, we thus address both the unintended consequences of negative stimuli induced by organizational change and the limitations of human rationality. We focused on sadness and fear due to their different natures–e.g., whereas sadness relates to uncertainty acceptance and risk taking, fear relates to uncertainty and risk avoidance (Raghunathan and Pham, 1999; Lerner and Keltner, 2001)–and due to their high relevance in change processes, in which sadness is related to certain states that are left behind, whereas fear is related to uncertain future states (Verduyn et al., 2009). Figure 4 summarizes the observed differences between our emotional manipulations. Our findings support our underlying assumption that distinct negative emotions differ in their effects on routine development.

Regarding repetitiveness in action, we find that sad teams repeated their operating routines more often than teams in the control condition. A potential explanation for this observation points to situational control (Smith and Ellsworth, 1985). Sadness may generally lead to a perceived shift from human control toward situational control (Smith and Ellsworth, 1985), which in turn may be countered by an increased reliance on repetitive and thus easily controllable actions (Nelson and Winter, 1982; Becker, 2004). Against our expectations, we observe no clear tendency toward more repetitiveness in action in the fear condition. Fear kept teams from developing stable, repetitive routines, potentially due to the fact that fear in our setting led to more conscious, deliberate actions that differed from task to task (*cf.* our findings for attentiveness in action). Our findings suggest that sadness leads to a stronger urge to restore control through repetitiveness in action. In contrast, teams in the fear conditions seem to have tried to restore control by acting more deliberately but less repetitively.

By analyzing speed in action, we explored to what extent sadness and fear affected the 'off-loading' of cognitive efforts onto automatized–and hence quickly executed–operating routines

TABLE 6 Comparison of routine performance of participants at early and advanced stages of the experiment.

Games 1–5	Condition	*N*	*Minimum*	*Maximum*	*M*	SD
Sum of move durations divided by the number of moves in the specific hand	Control	135	4.49	23.43	8.55	2.62
	Sadness	140	3.70	13.96	7.76	2.03
	Fear	140	3.89	29.26	8.65	3.09
Money that the group gained for the specific hand (in Cents)	Control	135	−100	30	6.22	31.08
	Sadness	140	−35	30	15.89	12.61
	Fear	140	−100	30	11.32	20.99
Duration of the specific hand (in seconds)	Control	135	19.03	238.41	67.01	43.76
	Sadness	140	16.53	198.51	52.06	29.09
	Fear	140	16.52	175.82	64.53	39.60
Games 26–30	**Condition**	**N**	**Minimum**	**Maximum**	**M**	**SD**
Sum of move durations divided by the number of moves in the specific hand	Control	133	3.46	9.33	5.51	1.31
	Sadness	140	3.20	10.52	5.35	1.20
	Fear	140	3.55	10.18	5.59	1.26
Money that the group gained for the specific hand (in Cents)	Control	133	−75	30	17.33	14.51
	Sadness	140	−5	30	20.21	8.52
	Fear	140	−35	30	19.54	11.01
Duration of the specific hand (in seconds)	Control	133	14.18	125.48	31.59	17.98
	Sadness	140	11.51	81.14	28.52	13.34
	Fear	140	12.02	96.16	29.67	14.24

TABLE 7 Overview of the results.

	Sadness	Fear
Repetitiveness in action	Medium-sized positive effect	No effect
Speed in action	Highly positive effect	Slightly positive effect
Reliability in action	Medium-sized positive effect	Medium-sized positive effect
Attentiveness in action	Medium-sized positive effect	Medium-sized positive effect

(Laureiro-Martinez, 2014). Unexpectedly, sadness also led to quicker actions than fear, whereas we observed no absolute differences in speed in action between the fear and control conditions. However, teams in the fear condition, increased their speed less strongly over the course of the task than teams in the control condition. Thus, teams subjected to sadness were comparatively quicker at cognitively 'off-loading' their actions into automatized, quickly executed action sequences. This 'head start' in routine development enabled them to act at comparatively higher speeds. However, relative to the control condition, this advantage in speed gradually decreased over time. Given that we observed very similar levels of speed among our experimental conditions toward the end of the experimental task, sadness-induced speed in action seems to have been a temporary phenomenon limited to early stages of routine development. Our finding is consistent with the notion of sadness-induced 'myopic misery' (Lerner et al., 2013), which relates to impatience and an increased demand for instant gratification (Lerner et al., 2013). In our setting, this demand was satisfied by quick routine development. With regard to fear, our findings do not suggest any association of fear with temporal myopia (Vuori and Huy, 2016). Thus, fear does not seem to foster routine development by increasing impatience. Moving beyond the results from our laboratory experiment, however, there are numerous internal and external factors to consider contributing to a sufficient contextualization of the phenomenon of temporal myopia. For instance, sadness may contribute to suppression and social isolation (Páez et al., 2013) and consequently slower response time, whereas fear may lead to suboptimal communication resulting in more myopic decisions. From a more general perspective on decision making processes, Opper and Burt (2021) grounded temporal myopia in the context of professional networks and social situations, indicating that managers in closed networks are more likely to be confronted with temporal myopia. Further, the experimental results of Worthy et al. (2012) suggest that increased working memory load tends to cause individuals to focus on the immediate consequences of their actions. Accordingly, previous research results indicate that various factors and their interaction foster the phenomenon of temporal myopia. For instance, it can be presumed that negative emotions, such as sadness or fear, affect working memory and amplify the effect of temporary myopia.

Reliability in action allowed us to test whether sadness and fear affected the functionality of the developed operating routines. Unexpectedly, sadness led to comparatively more-reliable operating routines. However, with game progress, this lead in reliability in the sadness condition became relatively smaller in comparison to the control condition. Against our expectations, fear was not robustly

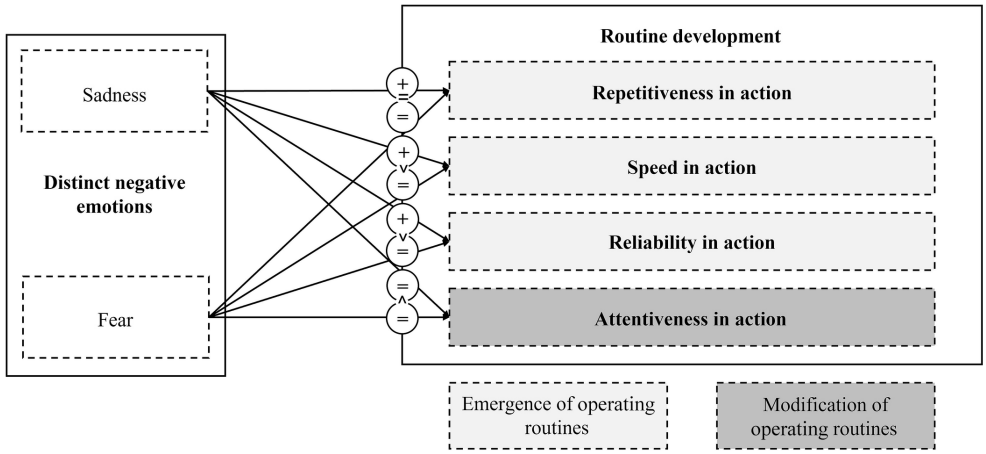


FIGURE 4
Measured effects of sadness and fear on different dimensions of routine development. The figure illustrates the expected effects of the distinct emotions sadness and fear on different dimensions of routine development. = denotes no effect; + denotes positive effect; – denotes negative effect; > denotes more positive effect when compared to other emotion rather than to control condition.

associated with an absolute increase in reliability in action. However, with game progress, we observed a decrease in reliability in action in the fear condition relative to the control condition. This finding is somewhat surprising given that sadness is often associated with uncertainty acceptance and risk taking, in contrast to fear, which is associated with uncertainty avoidance and less risk taking (Raghunathan and Pham, 1999). Accordingly, we would have expected a decreased demand for certain, riskless, and reliable actions with sadness and an increased demand for such actions with fear. If sadness in our setting actually caused a demand for less certainty, as previous literature would suggest, this demand was outweighed by sad teams' tendency to seek for speed by quickly repeating their predeveloped solutions without much consideration. However, in our setting, this behavior led to reliable outcomes. In contrast, it seems that fearful teams' demand for more certainty was offset by their tendency to act more attentively, slower, and less repetitively.

Regarding attentiveness in action, we found that sadness did not decrease and fear did not increase attentiveness in action relative to the control condition. However, in support of our expectations, sadness led to less attentiveness in action than fear. Hence, relative to the sadness condition, fear enabled teams to modify their operating routines attentively in order to avoid 'performance traps'. This finding suggests that the increases in repetitiveness in action, speed in action, and reliability in action that we observed with sadness came at the cost of less attentiveness in action. Apparently, the high degree of routinization associated with sadness led to 'myopic misery' (Lerner et al., 2013). Sad teams' attention was 'suboptimally' regulated by dynamic capabilities (Cohen and Bacdayan, 1994), whereas afraid teams, which relied on less-automatized operating routines, were comparatively better able to adjust their operating routines when necessary.

5.1 Theoretical implications

First, we show in light of the Carnegie perspective that distinct negative emotions as cognitive stimuli may have distinct effects on different dimensions of routine development, hence providing a better understanding of how emotions affect decision-making and change processes in organizations. With our finding of differential effects of distinct negative emotions, we enhance the growing body of work that demonstrates that operating routines and the dynamic capabilities through which they are regulated entail not only reason but also emotion (Hodgkinson and Healey, 2011, 2014; Døjbak Håkonsson et al., 2016; Parke and Myeong-Gu, 2017). We contribute to this research by showing that distinct negative emotions, such as sadness and fear, vary in their effects on routine development and by showing that these distinct emotions have differential effects on both performative and pattering dimensions of routine development (Egidi, 1996). Whereas sadness promotes the emergence of more repetitive, quicker, and reliable operating routines, fear enables teams to comparatively more attentively modify operating routines. Thus, whereas previous research finds that negative and positive emotions may generally affect the likelihood that teams adopt new routines (Døjbak Håkonsson et al., 2016), our findings suggest that in order to understand how negative emotions affect routines and their development, it is important, first, to differentiate between the distinct negative emotions that accompany routine development, and second, to follow Salvato and Rerup's (2011) suggestion of separating routines into their individual components and dynamics, which, as we find, may be subject to distinct emotional influences. Hence, our findings advise researchers who are responding to the repeated calls to explore the emotional foundations of organizations (Salvato and Rerup, 2011; Laureiro-Martinez, 2014; Ashkanasy et al., 2017) to not open only one black-box–organizational routines–while keeping emotions, as important antecedents of routines, in another black-box. Instead, our findings encourage researchers to explore the microfoundations of emotions and routines simultaneously in order to reveal their interrelations. Our study is the first to maintain emotion induction over a comparatively long period of time. This approach might be adapted by scholars in psychology and organizational research, as longer-term emotion induction allows for a nuanced examination of emotions and their influence on decision making in organizations, integrating both cognitive dynamics and impulses (Baldessarelli et al., 2022) and providing an important contribution for future research.

Second, we complement previous research emphasizing the importance of emotions in shaping the strategic decisions behind exploration and radical innovation in organizations, i.e., the decisions behind the abandonments of operating routines (Adler and Obstfeld, 2007). We reveal that (distinct negative) emotions may also guide less-radical forms of change in organizations–organizational evolution through routine development. Whereas routine development may generally engender as well as inhibit innovation (Hannan and Freeman, 1984; Feldman, 2000), our findings suggest that distinct negative emotions shift work teams' actions between stability and flexibility and thus influence whether and how organizations evolve. Whereas sadness leads organizations to 'off-load' cognitively demanding strategic decisions onto quickly applied and relatively static 'production rules' (Egidi, 1996) that only rigidly adapt to the dynamics of the environment, fear leads to comparatively more attentiveness in the enactment and development of operating routines. Thus, relative to sadness, fear is more likely to result in effective modifications of pre-established operating routines. Both sadness and fear may hence affect strategic decisions between stability and flexibility in organizations. Our results suggest that sadness fosters rather heuristic decision making, whereas fear fosters comparatively more-attentive team-level decision making. Interestingly, these results conflict with other recent research findings in the field of psychology. For example, Treffers et al. (2020) indicated that sadness among managers, especially under high time constraints, leads to improved original strategic decisions, which argues against rigid rule following. Furthermore, Yu et al. (2020) found in their study that fear is associated with lower cognitive flexibility and, as a result, an increased level of impulsivity, which seems to be inconsistent with high attention. Accordingly, our results contribute to the consolidation and contextualization of previous findings. For instance, (negative) emotions might have different effects on decision making among people with and without leadership responsibilities. Moreover, in the context of the Carnegie perspective, we extend previous research findings that suggest that organizational routines are commonly shaped by the management. For instance, the perception of threats (e.g., from changing market conditions) may reinforce routine rigidity. In this context, Gilbert (2005) found that the management centralizes control over decision making, reduces the level of experimentation, and focuses on existing resources when threats are perceived. Complementing these findings, Nigam et al. (2016) found that individuals with role-based authority in particular influence changes in organizational routines. However, our results indicate that negative emotions (induced by organizational changes) are also capable of influencing the development of organizational routines and are not necessarily driven by individuals with high levels of authority. From a more general perspective, we also contribute to the concept of implicit coordination within teams, providing a more nuanced view of dynamically evolving coordination and performance processes. According to Rico et al. (2008), routines within teams may develop in line with the socioemotional behavior of team members. In relation to our study, this may imply that fear and sadness have an impact on implicit, non-verbal interactions and, accordingly, may influence performance processes, apart from explicit working routines and organizational guidelines.

Third, we respond to more-general calls for more research on the (positive) effects of distinct negative emotions (Barsade and Gibson, 2007; Ashkanasy et al., 2017). This experimental study follows several previous studies that stress that negative emotions do not *per se* lead to negative outcomes (Lebel, 2017). We enhance these studies by providing evidence for further, previously unknown, and potentially positive effects of negative emotions. We find that two of the negative emotions that accompany change processes (Fugate et al., 2002), sadness and fear, are not necessarily harmful to routine development–an important component of change processes. Whereas sadness among team members leads to an 'off-loading' of cognitively demanding actions onto inattentive operating routines and therefore clears cognitive resources for alternative endeavors, fear enables teams to enact their routines comparatively more attentively (Gable and Harmon-Jones, 2010). Accordingly, we provide a differentiated understanding of how distinct negative emotions may be beneficial and how they may be harmful to organizations.

5.2 Practical implications

Our findings suggest that managers should not isolate sad or anxious employees in order to avoid emotional contagion of work teams (Barsade, 2002). Our findings reveal that negative emotions are not negative *per se* and that, in fact, in the right constellation, they may enable teams to better cope with the dynamics of their environment. Openly shared emotions may enable managers to identify the specific aspects of change processes that generate negative emotions and to intervene in order to harness the potentially beneficial effects of negative emotions. Such interventions require an in-depth understanding of the effects of distinct negative emotions. Our findings thus provide managers with a better understanding of when they should intervene (e.g., by inducing positive emotions) and when they should tolerate or even encourage negative emotions (e.g., by inviting organizational members to share their emotions).

For instance, in change processes, in which managers seek the quick development of reliable operating routines, managers might encourage employees to openly share their feelings of sadness; otherwise, they might avoid sadness (e.g., by generating positive experiences). Clearly, negative emotions such as sadness cannot easily be avoided in change contexts, yet managers might nevertheless have an influence on which distinct negative emotions dominate teams' feelings. For instance, sadness, which is related to the certain past, often follows fear, which is associated with uncertain future states (Verduyn et al., 2009). Accordingly, the timing of negative announcements might determine whether employees are afraid (e.g., of potentially losing a beloved colleague) or sad (e.g., about the certain departure of the colleague). Managers who focus on quickly restoring organizational efficiency might in some situations benefit from substituting fear with sadness, e.g., by creating certainty with regard to a negative event. From a more general attention-based perspective, our study further raises awareness that negative emotions might reduce attentional commitment toward change and, as a consequence, employees' exploratory behavior (Vuori, 2023). Accordingly, managers need to be vigilant about linking changes in routines to positive emotions that increase both the intensity and quality of attentional engagement.

5.3 Limitations and suggested paths for further research

Like all research, this study has some limitations. First, the different effect sizes for sadness vs. fear that we observed in our

manipulation check suggest that teams in the sadness condition might have experienced sadness to a greater extent than teams in the fear condition experienced fear. Accordingly, we do not know whether our comparatively weaker manipulations for fear in fact suggest that teams in the fear condition were less emotionalized than teams in the sadness condition. However, our finding of more repetitive, quicker, and more reliable routine development in the sadness condition in contrast to comparatively more attentiveness in action in the fear condition is not consistent with explanations that point to differences in the strength of our emotional manipulations. In fact, our findings become more meaningful when we consider that the emotional manipulations in our experimental setting are likely to be rather weak when compared to emotions that, for instance, are experienced in actual change processes. The levels of sadness and fear that we induced in the laboratory are very likely to be experienced as less intense than the levels of sadness and fear one could expect someone to feel who just lost or is going to lose his or her job. In this context, it is crucial to differentiate between induced emotions in a laboratory setting and the emotions experienced by individuals during real-world organizational change. Our study reveals insights into the effects of induced emotions (that are unrelated to the task) on routine development, whereas we cannot conclude anything concerning the effects of naturally occurring emotions in the context of organizational change. However, as naturally occurring emotions (independent of whether they are task-related or not) are often most presumably stronger than emotions induced in the laboratory. It appears reasonable to assume that our findings are attenuated rather than inflated. Future research may explore the effects of naturally occurring emotions in the context of organizational change to complement our findings, involving longitudinal studies, surveys, or qualitative interviews with individuals undergoing real organizational change. Regarding the data analyzes that we performed, we acknowledge that the substantial differences in payments between the conditions raise an interesting avenue for future research. More specifically, structural equation modeling might help to build and test complex models that capture the relationships between various variables, such as emotional states, action routines, and financial performance. Relying on structural equation modeling, future studies might shed more light on the mechanisms through which emotions influence both cognitive processes and economic outcomes, thereby broadening the scope of our research from routine development to other crucial dependent variables.

Second, one might argue that, in addition to the exogenous manipulation of the emotions that we implemented, endogenously generated emotions might have influenced our results. The reason for this argumentation is that emotions such as anger or sadness might be generated within the game as a result of coordination failures, when participants believe that their partner did not conduct the proper move.[4] To better understand further emotions that the participants felt during the game, we relied on survey data that we collected from our participants after the completion of the game. With respect to further negative emotions, in particular, we instructed our participants to indicate on a scale ranging from 0 to 10 to what degree they currently feel (1) guilty and (2) angry. Based on *t*-tests, we investigated whether there are significant differences with respect to these emotions among the teams that were among the lowest-performing 25% in terms of money gained. Concerning both, anger and guilt, we did not observe any significant differences between the experimental conditions. Thus, we feel confident that endogenously generated emotions did not influence our findings.

Third and finally, some findings of this study are bound by the methodological design and specifically by our experimental task. Specifically, our experimental setting might be limited in its explanatory power, as it isolates teams from the 'messiness' that typically characterizes work life. In our experimental setting, we replicated Cohen and Bacdayan's (1994) experimental setting, which did not feature any obvious form of authority and which prohibited participants from talking during the experimental session. Here, we decided to observe routine development isolated from direct authority and open communication to highlight a characteristic of routines that is often overlooked in empirical studies–the routine as an "organizational unconscious,' a body of largely inarticulate know-how that underpins so much of an organization's capabilities" (Cohen and Bacdayan, 1994, p. 566). In this context, the incentive scheme is relevant as well. For our study, adding a variable payment to the basic payment was reasonable, because the variable payment motivated participants to play quickly and carefully at the same time, which favors the development of routines. However, one should consider that other incentive schemes could have changed the results. For example, abandoning the variable payment and thus, relying on a fixed payment solely, would probably have had a negative impact on routine development. Similarly, paying a higher proportion of the money gained to the participant who placed the final card in the target area could have changed the results, because an unequal distribution of the money gained would have led to increased competition between the participants, influencing the action sequences and, accordingly, the dimensions of routine emergence and adaptation. Thus, for the purposes of our study, we feel confident that we relied on an established and suitable incentive scheme. However, future research might analyze the effect of changing the incentive scheme to address similar research questions. In this context, introducing competition–and thus creating a coopetition environment–to the game appears to be particularly promising. Our setting illustrates that in an experimental environment, teams may both develop stable operating routines and coordinate on modifications of these routines in situations where they would lead to undesirable performance. This coordination is enabled by implicit authority and hidden communication. Future research should nevertheless shed more light to the interplay of emotions, open communication and direct authority in routine development processes. Furthermore, relevant boundary conditions occur in relation to task duration and organizational routines: First, in terms of time sensitivity, in short-term tasks with tight timelines (as in our experimental design), teams have less time to adapt and change their routines in the long term in response to emotional experiences. Second, the low complexity of the card game may be more vulnerable to immediate effects of emotion, whereas complex, interdependent routines in organizations may require more time to adapt and may reveal emotional effects over a longer period of time. Third, task familiarity may influence emotional responses, as in well-established and familiar routines emotions have a different, potentially weaker impact. Fourth, an organization's culture may influence how emotions are handled. Organizations with a strong culture of adaptability and emotional intelligence may exhibit

4 We thank an anonymous reviewer for this valuable comment.

different patterns of routine development in response to emotions than organizations with a rigid or resistant culture. Fifth, it is crucial to acknowledge that the outcomes of emotions in the workplace can be complex and multifaceted. While our study sheds light on specific aspects of how negative emotions can influence routine development, it does not encompass the entirety of potential workplace outcomes. Negative emotions may have diverse effects on various monetary and non-monetary performance variables that extend beyond the scope of our investigation. For instance, creativity and innovativeness, team cohesion, and trust among employees are integral components of workplace performance and we do not know how fear or sadness influence these variables. Future research should consider these aspects in the context of field research or adapted experimental designs.

6 Conclusion

The present study represents an important step toward an understanding of the causal influence of sadness and fear on routine development, which represents a crucial mechanism behind organizational change processes. Using a laboratory experiment in which we induced distinct negative emotions in teams, we find that sadness and fear have distinct effects on routine development. Whereas sadness in teams leads to the development of comparatively more repetitive, quicker, and more reliable operating routines, fear enables teams to better recognize and react to 'performance traps', i.e., situations in which pre-established operating routines are ineffective. Thus, the study contributes to an increased understanding of how negative stimuli influence individual behavioral responses and subsequent heuristic decision-making. Furthermore, our findings enable researchers and practitioners to better understand and predict the effects of sadness and fear in change processes and contribute toward new theories and practices that will enable organizations to better harness the emotional capacities of their members (Hodgkinson and Healey, 2014).

Data availability statement

The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author.

Author contributions

JS-W developed the research question and the research design in collaboration with IW and MS. JS-W provided the experimental software used for this essay and conducted the lab experiment. PO and JS-W performed the statistical analyses and wrote the first draft of the manuscript. MR wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

Acknowledgments

The authors would like to express their sincere gratitude to the Bavarian Academy of Sciences and Humanities (Bayerische Akademie der Wissenschaften). By supporting JS-W as a member of their young scholars program, the Bavarian Academy of Sciences and Humanities enabled the conduction of this study. Further thanks go to the attendants of several conferences for their thoughtful and constructive comments. Additionally, the authors wish to thank the participants of the study and all persons involved in the project, such as the student assistants, who played a supporting role in collecting the data, and the programmer, Sebastian Bendeich. The data for the study were collected at experimenTUM, laboratory for experimental economics, Technische Universität München, Germany.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

Adler, P. S., and Obstfeld, D. (2007). The role of affect in creative projects and exploratory search. *Ind. Corp. Chang.* 16, 19–50. doi: 10.1093/icc/dtl032

Annosi, M. C., Martini, A., Brunetta, F., and Marchegiani, L. (2020). Learning in an agile setting: a multilevel research study on the evolution of organizational routines. *J. Bus. Res.* 110, 554–566. doi: 10.1016/j.jbusres.2018.05.011

Appelbaum, S. H., Gandell, J., Yortis, H., Proper, S., and Jobin, F. (2000). Anatomy of a merger: behavior of organizational factors processes throughout the pre-during-post-stages (part 1). *Manag. Decis.* 38, 649–662. doi: 10.1108/00251740010357267

Ashkanasy, N. M., Humphrey, R. H., and Quy Nguyen, H. U. Y. (2017). Integrating emotions and affect in theories of management. *Acad. Manag. Rev.* 42, 175–189. doi: 10.5465/amr.2016.0474

Baldessarelli, G., Lazaric, N., and Pezzoni, M. (2022). Organizational routines: evolution in the research landscape of two core communities. *J. Evol. Econ.* 32, 1119–1154. doi: 10.1007/s00191-022-00779-2

Barsade, S. G. (2002). The ripple effect: emotional contagion and its influence on group behavior. *Adm. Sci. Q.* 47, 644–675. doi: 10.2307/3094912

Barsade, S. G., and Gibson, D. E. (2007). Why does affect matter in organizations? *Acad. Manag. Perspect.* 21, 36–59. doi: 10.5465/amp.2007.24286163

Bartel, C. A., and Saavedra, R. (2000). The collective construction of work group moods. *Adm. Sci. Q.* 45, 197–231. doi: 10.2307/2667070

Basch, J., and Fisher, C. D. (2000). "Affective events-emotions matrix: a classification of work events and associated emotions" in *Emotions in the workplace: Research, theory, and practice quorum books*. eds. N. M. Ashkanasy, C. E. J. Härtel and W. J. Zerbe (Westport, CT: Quorum Books), 36–48.

Baumgartner, T., Esslen, M., and Jäncke, L. (2006a). From emotion perception to emotion experience: emotions evoked by pictures and classical music. *Int. J. Psychophysiol.* 60, 34–43. doi: 10.1016/j.ijpsycho.2005.04.007

Baumgartner, T., Lutz, K., Schmidt, C. F., and Jäncke, L. (2006b). The emotional power of music: how music enhances the feeling of affective pictures. *Brain Res.* 1075, 151–164. doi: 10.1016/j.brainres.2005.12.065

Becker, M. C. (2004). Organizational routines: a review of the literature. *Ind. Corp. Chang.* 13, 643–678. doi: 10.1093/icc/dth026

Becker, M. C. (2005). A framework for applying organizational routines in empirical research: linking antecedents, characteristics and performance outcomes of recurrent interaction patterns. *Ind. Corp. Chang.* 14, 817–846. doi: 10.1093/icc/dth072

Blume, A., Franco, A. M., and Heidhues, P. (2021). Dynamic coordination via organizational routines. *Economic Theory* 72, 1001–1047. doi: 10.1007/s00199-020-01261-5

Cohen, M. D., and Bacdayan, P. (1994). Organizational routines are stored as procedural memory: evidence from a laboratory study. *Organ. Sci.* 5, 554–568. doi: 10.1287/orsc.5.4.554

Cyert, R. M., and March, J. G. (1963). *A behavioral theory of the firm*. New Jersey: Prentice-Hall.

De Boer, E. A., and Zandberg, T. (2012). Decision-making by organizational routines: the influence of agency and personality traits on deviating from formal organizational routines. *J. Qual. Assur. Hosp. Tour.* 13, 316–325. doi: 10.1080/1528008X.2012.692287

Delgado-García, J. B., de la Fuente-Sabat, J. M., and de Quevedo-Puente, E. (2010). Too negative to take risks? The effect of the CEO's emotional traits on firm risk. *Br. J. Manag.* 21, 313–326. doi: 10.1111/j.1467-8551.2008.00625.x

Dewey, J. (1922). *Human nature and conduct*. New York: Henry Hold and Company.

Døjbak Håkonsson, D., Eskildsen, J. K., Argote, L., Mønster, D., Burton, R. M., and Obel, B. (2016). Exploration versus exploitation: emotions and performance as antecedents and consequences of team decisions. *Strateg. Manag. J.* 37, 985–1001. doi: 10.1002/smj.2380

Drace, S., Desrichard, O., Shepperd, J. A., and Hoorens, V. (2009). Does mood really influence comparative optimism? Tracking an elusive effect. *Br. J. Soc. Psychol.* 48, 579–599. doi: 10.1348/014466608X387098

Egidi, M. (1996). "Routines, hierarchies of problems, procedural behaviour: some evidence from experiments" in *The rational foundations of economic behaviour*. eds. K. J. Arrow, M. Perlman and C. Schmidt (London, UK: Palgrave Macmillan), 303–333.

Egidi, M., and Narduzzo, A. (1997). The emergence of path-dependent behaviors in cooperative contexts. *Int. J. Ind. Organ.* 15, 677–709. doi: 10.1016/S0167-7187(97)00007-6

Etzel, J. A., Johnsen, E. L., Dickerson, J., Tranel, D., and Adolphs, R. (2006). Cardiovascular and respiratory responses during musical mood induction. *Int. J. Psychophysiol.* 61, 57–69. doi: 10.1016/j.ijpsycho.2005.10.025

Feldman, M. S. (2000). Organizational routines as a source of continuous change. *Organ. Sci.* 11, 611–629. doi: 10.1287/orsc.11.6.611.12529

Feldman, M. S., and Pentland, B. T. (2003). Reconceptualizing organizational routines as a source of flexibility and change. *Adm. Sci. Q.* 48, 94–118. doi: 10.2307/3556620

Feldman, M. S., Pentland, B. T., D'Adderio, L., and Lazaric, N. (2016). Beyond routines as things: introduction to the special issue on routine dynamics. *Organ. Sci.* 27, 505–513. doi: 10.1287/orsc.2016.1070

Felin, T., Foss, N. J., Heimeriks, K. H., and Madsen, T. L. (2012). Microfoundations of routines and capabilities: individuals, processes, and structure. *J. Manag. Stud.* 49 forthcoming, 1351–1374. doi: 10.1111/j.1467-6486.2012.01052.x

Fugate, M., Kinicki, A. J., and Scheck, C. L. (2002). Coping with an organizational merger over four stages. *Pers. Psychol.* 55, 905–928. doi: 10.1111/j.1744-6570.2002.tb00134.x

Gable, P., and Harmon-Jones, E. (2010). The blues broaden, but the nasty narrows: attentional consequences of negative affects low and high in motivational intensity. *Psychol. Sci.* 21, 211–215. doi: 10.1177/0956797609359622

Gavetti, G., Levinthal, D., and William, O. (2007). Perspective–neo-Carnegie: the Carnegie School's past, present, and reconstructing for the future. *Organ. Sci.* 18, 523–536. doi: 10.1287/orsc.1070.0277

Geiger, D. (2022). Routine dynamics and paradox: a revised research agenda. *Scand. J. Manag.* 38:101244. doi: 10.1016/j.scaman.2022.101244

Gilbert, C. G. (2005). Unbundling the structure of inertia: resource versus routine rigidity. *Acad. Manag. J.* 48, 741–763. doi: 10.5465/amj.2005.18803920

Gill, M. J., and Burrow, R. (2018). The function of fear in institutional maintenance: feeling frightened as an essential ingredient in haute cuisine. *Organ. Stud.* 39, 445–465. doi: 10.1177/0170840617709306

Greiner, B. (2004). "An online recruitment system for economic experiments" in *Forschung und wissenschaftliches Rechnen 2003. GWDG Bericht 63*. eds. K. Kremer and V. Macho (Göttingen: Ges. für Wiss. Datenverarbeitung), 79–93.

Haase, C. M., and Silbereisen, R. K. (2011). Effects of positive affect on risk perceptions in adolescence and young adulthood. *J. Adolesc.* 34, 29–37. doi: 10.1016/j.adolescence.2010.03.004

Hannan, M. T., and Freeman, J. (1984). Structural inertia and organizational change. *Am. Sociol. Rev.* 49, 149–164. doi: 10.2307/2095567

Healey, M. P., Vuori, T., and Hodgkinson, G. P. (2015). When teams agree while disagreeing: Reflexion and reflection in shared cognition. *Acad. Manag. Rev.* 40, 399–422. doi: 10.5465/amr.2013.0154

Hodgkinson, G. P., and Healey, M. P. (2011). Psychological foundations of dynamic capabilities: Reflexion and reflection in strategic management. *Strateg. Manag. J.* 32, 1500–1516. doi: 10.1002/smj.964

Hodgkinson, G. P., and Healey, M. P. (2014). Coming in from the cold: the psychological foundations of radical innovation revisited. *Ind. Mark. Manag.* 43, 1306–1313. doi: 10.1016/j.indmarman.2014.08.012

Kabanoff, B., Waldersee, R., and Cohen, M. (1995). Espoused values and organizational change themes. *Acad. Manag. J.* 38, 1075–1104. doi: 10.2307/256621

Krisberga-Sinigoi, S., Reinmoeller, P., and Tobias, J. (2019). Insufficient change: a systematic review of the relationship between emotions, change and routines. *Acad. Manag. Proc.* 2019:18510. doi: 10.5465/AMBPP.2019.18510abstract

Krumhansl, C. L. (1997). An exploratory study of musical emotions and psychophysiology. *Can. J. Exp. Psychol.* 51, 336–353. doi: 10.1037/1196-1961.51.4.336

Laureiro-Martinez, D. (2014). Cognitive control capabilities, routinization propensity, and decision-making performance. *Organ. Sci.* 25, 1111–1133. doi: 10.1287/orsc.2014.0899

Laureiro-Martínez, D., Brusoni, S., Canessa, N., and Zollo, M. (2015). Understanding the exploration-exploitation dilemma: an fMRI study of attention control and decision-making performance. *Strateg. Manag. J.* 36, 319–338. doi: 10.1002/smj.2221

Lazarus, R. S. (1991). *Emotion and adaption*. New York: Oxford University Press.

Lebel, R. D. (2017). Moving beyond fight and flight: a contingent model of how the emotional regulation of anger and fear sparks proactivity. *Acad. Manag. Rev.* 42, 190–206. doi: 10.5465/amr.2014.0368

Lench, H. C., Flores, S. A., and Bench, S. W. (2011). Discrete emotions predict changes in cognition, judgment, experience, behavior, and physiology: a meta-analysis of experimental emotion elicitations. *Psychol. Bull.* 137, 834–855. doi: 10.1037/a0024244

Lerner, J. S., and Keltner, D. (2001). Fear, anger, and risk. *J. Pers. Soc. Psychol.* 81, 146–159. doi: 10.1037/0022-3514.81.1.146

Lerner, J. S., Li, Y., and Weber, E. U. (2013). The financial costs of sadness. *Psychol. Sci.* 24, 72–79. doi: 10.1177/0956797612450302

Levinthal, D., and Rerup, C. (2006). Crossing an apparent chasm: bridging mindful and less-mindful perspectives on organizational learning. *Organ. Sci.* 17, 502–513. doi: 10.1287/orsc.1060.0197

Liu, Y., and Perrewe, P. L. (2005). Another look at the role of emotion in the organizational change: a process model. *Hum. Resour. Manag. Rev.* 15, 263–280. doi: 10.1016/j.hrmr.2005.12.001

March, J. G., and Simon, H. A.. (1958). *Organizations*. New York: Wiley.

Mayer, J. D., Allen, J. P., and Beauregard, K. (1995). Mood inductions for four specific moods: a procedure employing guided imagery vignettes with music. *J. Ment. Imag.* 19, 133–150.

Nelissen, R. M. A., Leliveld, M. C., van Dijk, E., and Zeelenberg, M. (2011). Fear and guilt in proposers: using emotions to explain offers in ultimatum bargaining. *Eur. J. Soc. Psychol.* 41, 78–85. doi: 10.1002/ejsp.735

Nelson, R. R., and Winter, S. G. (1982). *An evolutionary theory of economic change*. Cambridge, UK: Harvard University Press.

Niedenthal, P. M., Brauer, M., Halberstadt, J. B., and Innes-Ker, Å. H. (2001). When did her smile drop? Facial mimicry and the influences of emotional state on the detection of change in emotional expression. *Cognit. Emot.* 15, 853–864. doi: 10.1080/02699930143000194

Nigam, A., Huising, R., and Golden, B. (2016). Explaining the selection of routines for change during organizational search. *Adm. Sci. Q.* 61, 551–583. doi: 10.1177/0001839216653712

Oehler, P., Stumpf-Wollersheim, J., and Welpe, I. M. (2019). Never change a winning routine? How performance feedback affects routine change. *Ind. Corp. Chang.* 28, 1101–1124. doi: 10.1093/icc/dty049

Oh, J. K., and Farh, C. I. (2017). An emotional process theory of how subordinates appraise, experience, and respond to abusive supervision over time. *Acad. Manag. Rev.* 42, 207–232. doi: 10.5465/amr.2014.0347

Öhman, A. (2008). "Fear and anxiety" in *Handbook of emotions*. eds. M. Lewin, J. M. Haviland-Jones and L. Feldman Barrett. *3rd* ed (New York: The Guilford Press), 709–729.

Opper, S., and Burt, R. S. (2021). Social network and temporal myopia. *Acad. Manag. J.* 64, 741–771. doi: 10.5465/amj.2019.1026

Páez, D., Martínez-Sánchez, F., Mendiburo, A., Bobowik, M., and Sevillano, V. (2013). Affect regulation strategies and perceived emotional adjustment for negative and positive affect: a study on anger, sadness and joy. *J. Posit. Psychol.* 8, 249–262. doi: 10.1080/17439760.2013.786751

Parke, M. R., and Myeong-Gu, S. E. O. (2017). The role of affect climate in organizational effectiveness. *Acad. Manag. Rev.* 42, 334–360. doi: 10.5465/amr.2014.0424

Parmigiani, A., and Howard-Grenville, J. (2011). Routines revisited: exploring the capabilities and practice perspectives. *Acad. Manag. Ann.* 5, 413–453. doi: 10.5465/19416520.2011.589143

Pentland, B. T. (2003a). Conceptualizing and measuring variety in the execution of organizational work processes. *Manag. Sci.* 49, 857–870. doi: 10.1287/mnsc.49.7.857.16382

Pentland, B. T. (2003b). Sequential variety in work processes. *Organ. Sci.* 14, 528–540. doi: 10.1287/orsc.14.5.528.16760

Pentland, B. T., and Hærem, T. (2015). Organizational routines as patterns of action: implication for organizational behavior. *Annu. Rev. Organ. Psych. Organ. Behav.* 2, 465–487. doi: 10.1146/annurev-orgpsych-032414-111412

Raghunathan, R., and Pham, M. T. (1999). All negative moods are not equal: motivational influences of anxiety and sadness on decision making. *Organ. Behav. Hum. Decis. Process.* 79, 56–77. doi: 10.1006/obhd.1999.2838

Rico, R., Sánchez-Manzanares, M., and Gil, F. (2008). Team implicit coordination processes: a team knowledge–based approach. *Acad. Manag. Rev.* 33, 163–184. doi: 10.5465/amr.2008.27751276

Salvato, C., and Rerup, C. (2011). Beyond collective entities: multilevel research on organizational routines and capabilities. *J. Manag.* 37, 468–490. doi: 10.1177/0149206310371691

Selye, H. (1956). *The stress of life*. New York: McGraw-Hill.

Siedlecka, E., and Denson, T. F. (2019). Experimental Methods for Inducing Basic Emotions: A Qualitative Review. *Emot. Rev.* 11, 87–97. doi: 10.1177/1754073917749016

Simon, H. A. (1947). *Administrative behavior: A study of decision-making processes in administrative organization*. New York: Macmillan.

Smith, C. A., and Ellsworth, P. C. (1985). Patterns of cognitive appraisal in emotion. *J. Pers. Soc. Psychol.* 48, 813–838. doi: 10.1037/0022-3514.48.4.813

Soderstrom, S. B., and Weber, K. (2020). Organizational structure from interaction: evidence from corporate sustainability efforts. *Adm. Sci. Q.* 65, 226–271. doi: 10.1177/0001839219836670

Soussignan, R., Jiang, T., Rigaud, D., Royet, J. P., and Schaal, B. (2010). Subliminal fear priming potentiates negative facial reactions to food pictures in women with anorexia nervosa. *Psychol. Med.* 40, 503–514. doi: 10.1017/S0033291709990377

Staw, B. M., Sandelands, L. E., and Dutton, J. E. (1981). Threat-rigidity effects in organizational behavior: a multilevel analysis. *Adm. Sci. Q.* 26, 501–524. doi: 10.2307/2392337

Stephens, C. L., Christie, I. C., and Friedman, B. H. (2010). Autonomic specificity of basic emotions: evidence from pattern classification and cluster analysis. *Biol. Psychol.* 84, 463–473. doi: 10.1016/j.biopsycho.2010.03.014

Tosi, H. L. (2008). James March and Herbert Simon, organizations. *Theories Organ.* 1, 93–102.

Treffers, T., Klarner, P., and Huy, Q. N. (2020). Emotions, time, and strategy: the effects of happiness and sadness on strategic decision-making under time constraints. *Long Range Plan.* 53:101954. doi: 10.1016/j.lrp.2019.101954

Verduyn, P., Delvaux, E., Van Coillie, H., Tuerlinckx, F., and Van Mechelen, I. (2009). Predicting the duration of emotional experience: two experience sampling studies. *Emotion* 9, 83–91. doi: 10.1037/a0014610

Vuori, T. O. (2023). Emotions and attentional engagement in the attention-based view of the firm. *Strateg. Organ.* 1–22. doi: 10.1177/14761270231165356

Vuori, T. O., and Huy, Q. N. (2016). Distributed attention and shared emotions in the innovation process. *Adm. Sci. Q.* 61, 9–51. doi: 10.1177/0001839215606951

Weick, K. E., and Sutcliffe, K. M. (2006). Mindfulness and the quality of organizational attention. *Organ. Sci.* 17, 514–524. doi: 10.1287/orsc.1060.0196

Wollersheim, J., and Heimeriks, K. H. (2016). Dynamic capabilities and their characteristic qualities: insights from a lab experiment. *Organ. Sci.* 27, 233–248. doi: 10.1287/orsc.2016.1053

Worthy, D. A., Otto, A. R., and Maddox, W. T. (2012). Working-memory load and temporal myopia in dynamic decision making. *J. Exp. Psychol. Learn. Mem. Cogn.* 38, 1640–1658. doi: 10.1037/a0028146

Yu, Y., Yu, Y., and Lin, Y. (2020). Anxiety and depression aggravate impulsiveness: the mediating and moderating role of cognitive flexibility. *Psychol. Health Med.* 25, 25–36. doi: 10.1080/13548506.2019.1601748

Zietsma, C., Toubiana, M., Voronov, M., and Roberts, A.. (2019). *Emotions in organization theory*. Cambridge, UK: Cambridge University Press.

Zollo, M., and Winter, S. G. (2002). Deliberate learning and the evolution of dynamic capabilities. *Organ. Sci.* 13, 339–351. doi: 10.1287/orsc.13.3.339.2780

frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 22 December 2023
DOI 10.3389/fpsyg.2023.1167135

OPEN ACCESS

EDITED BY
Giovanni Gavetti,
Dartmouth College, United States

REVIEWED BY
Luigi Marengo,
Guido Carli Free International University for Social Studies, Italy
Daniel Keum,
Columbia University, United States

*CORRESPONDENCE
Daniella Laureiro-Martínez
✉ dlaureiro@ethz.ch

RECEIVED 16 February 2023
ACCEPTED 03 October 2023
PUBLISHED 22 December 2023

CITATION
Richner J, Zagorac-Uremović Z and Laureiro-Martínez D (2023) Individual and context-evoked antecedents of exploration-exploitation performance.
Front. Psychol. 14:1167135.
doi: 10.3389/fpsyg.2023.1167135

Individual and context-evoked antecedents of exploration-exploitation performance

Jan Richner, Zorica Zagorac-Uremović and Daniella Laureiro-Martínez*

Chair of Technology and Innovation Management, Department of Management, Technology and Economics, ETH Zürich, Zürich, Switzerland

A central issue within the Carnegie approach is the exploration-exploitation tension that lies behind organizational adaptation. After decades of research, there is still little understanding of how the combination of individual and context-evoked differences affects exploration-exploitation performance. To address that issue, we build on recent psychological and neuroscientific studies to develop and test an integrative model. The model considers two individual antecedents (personality and cognitive flexibility) and three context-evoked antecedents that take place along different time horizons (recent stress, present emotional states, and present task motivation). We rely on a lab-in-the-field study of 282 leaders within the Swiss Armed Forces—an organization that exhibits the exploration-exploitation tension in an accentuated form. Using structural equation modeling, we conduct a multiple-mediation path analysis aimed at testing complex interactions between multiple variables. Our findings highlight the need to take an integrative approach; cognitive flexibility mediates the positive effect of the personality trait of emotional stability on exploration-exploitation performance, however, both cognitive flexibility and emotional stability play unique, underlying roles in explaining how organizational leaders interpret the context. Emotional stability decreases the negative effect of recent stress on a leader's cognitive flexibility. Cognitive flexibility, in turn, mediates the effect of the present positive affective signals of task motivation on exploration-exploitation performance. These findings shed new light on our understanding of how adaptive leaders leverage positive and negative context-evoked antecedents that, in turn, affect cognitive flexibility and exploration-exploitation.

KEYWORDS

exploration and exploitation, cognitive flexibility, executive functions, emotions, leadership, Carnegie, microfoundations

Introduction

The Carnegie approach places a strong emphasis on the study of issues that affect daily organizational life. Among those, a central issue relates to the fundamental tension that lies behind adaptive behavior and emerges when making decisions that balance exploratory and exploitative behaviors. Organizations must constantly explore new options, but they often fail as they focus on exploiting known options to sustain efficiency and fall prey to organizational inertia (Tripsas and Gavetti, 2000). This is particularly likely when organizations are currently

experiencing success—something the Carnegie approach has studied as the myopia of learning (Levinthal and March, 1993)—or when they operate in regulated ways following standard operating procedures that bring short-term efficiency advantages at the expense of flexibility (Cyert and March, 1963). To overcome myopia and rigidity, organizations must rely on leaders who manage exploration and exploitation dynamically by making adaptive decisions appropriate to a given context at any moment in time. While the Carnegie approach emphasizes the importance of both context and individual differences in human behavior (e.g., Simon, 1997; O'Reilly and Tushman, 2004), a model that integrates the combined effects of different antecedents on exploration-exploitation performance is lacking (Gavetti et al., 2007). Our goal is to combine psychology and neurosciences (e.g., Lerner et al., 2015; Pessoa, 2017) to propose and test a model that studies the interplay between fundamental psychological categories that are considered antecedents of human behavior: individual antecedents (categorized under personality traits and cognitive flexibility) and context-evoked antecedents (categorized as affective signals pertaining to different time horizons such as recent stress, present emotional states, and task motivation). We contribute to the Carnegie approach by revealing how individual and context-evoked antecedents influence each other and, in turn, jointly affect exploration-exploitation performance.

We build on Herbert Simon's (1967, 1997) and March and Simon's (1958, 2004) ideas that emotions and motivations (i.e., affective signals) are central antecedents at the intersection between organizational context and individual organizational leaders. Affective signals describe how environmental signals evoke individual responses by attracting their attention through a "complex interweaving of affective and cognitive processes" (March and Simon, 1958, 2004, p. 151). In line with the state-of-the-art understanding of affective signals (e.g., Zadra and Clore, 2011), we propose that the organizational context is likely to indirectly affect leaders' exploration-exploitation performance through the context-evoked antecedents of recent situational stress, present emotional states, and task motivation. While these context-evoked affective signals reflect how the context influences leaders, the perceived intensity of these affective signals can vary from individual to individual (e.g., Sherman et al., 2012), which, in turn, might have an effect on exploration-exploitation performance.

We investigate the interplay between individual antecedents (i.e., personality traits and cognitive flexibility) and context-evoked antecedents (i.e., recent stress, present emotional states, and task motivation). Figure 1 provides an overview of the antecedents of exploration-exploitation that we study at different levels (individual and context-evoked) and the interactions between them (e.g., how the organizational context evokes some antecedents that interact with individual antecedents). The theory section will develop arguments for each of the variables and outline the directionality of the different interactions between them.

The study of such interactions requires a method that will allow for controlled measurements in the field and an analysis of multiple interactions. Thus, we rely on a lab-in-the-field study and collect rich individual and context-evoked data from a sample of 282 leaders training and practicing leadership skills within the Swiss Armed Forces. We analyze the data by means of structural equation modeling, which allows us to examine complex interactions between individual and context-evoked antecedents (Zyphur et al., 2023) in an organization often characterized by rigidity. In fact, the Swiss Armed Forces exhibit the tension between exploration-exploitation in an accentuated form: the organization is large and heavily regulated and, at the same time, must continuously prepare to operate under unknown conditions. To test our model, we draw parallels between typical war simulation exercises and a task paradigm that captures the essence of dynamic exploration-exploitation decisions under conditions in which organizational leaders must make multiple, adaptive decisions over a period of time. Although war is a rare event, it is the *raison d'ĕtre* for military organizations and, therefore, forms the core of military leadership education programs (Hirst, 2022). In fact, most of everyday organizational life in the military centers on training that focuses precisely on the exploration-exploitation tension using a variety of war simulation exercises. Thanks to continuous training, organizational members learn the standard procedures that allow for efficiency and coordinated action while also practicing how to select, recombine, or redeploy some of those standard procedures in different ways should the context change and decisions need to be made under greater time pressure and/or resource scarcity (Cyert and March, 1963).

Our study identifies key antecedents that enable or hinder leaders' ability to deal with exploration-exploitation decisions. First, we identified cognitive flexibility with its core components—vigilance, working memory, and switching—as a central individual antecedent behind exploration-exploitation. Cognitive flexibility not only positively and directly affects exploration-exploitation performance but also mediates the positive effect that the personality trait of emotional stability has on it. Second, we found that emotional stability mediates the negative effect of recent stress on cognitive flexibility. Thus, this personality antecedent plays an additional role as a protective shield for organizational leaders' cognitive flexibility and allows them to cope with potentially negative context signals when they must make exploration-exploitation trade-off decisions. Third, and in line with both received theory (e.g., Dolan, 2002; Phelps et al., 2014; Lerner et al., 2015; Pessoa, 2017) and our model, we find that cognitive flexibility mediates the effect of present task motivation on exploration-exploitation performance. This finding indicates that contextual, affective signals can inform and interact with—and not just bias—cognition. Taken together, the results provide empirical evidence that leaders make exploration-exploitation decisions in a truly situated manner: they interact with the context by leveraging cognitive flexibility and specific personality antecedents to process helpful and potentially harmful contextual cues to achieve higher exploration-exploitation performance.

The current study's findings contribute to our understanding of the antecedents of adaptive exploration-exploitation decisions in organizational leaders in two main ways. First, while not claiming causality, our study contributes to Carnegie literature by putting forward and testing a microfoundational model that studies the complex interactions of individual and context-evoked antecedents that affect exploration-exploitation performance. Second, by attending to both individual and context-evoked antecedents of behavior, our study "exports" to psychology an organizationally situated understanding of exploration-exploitation—a central tenet of the Carnegie approach—and proposes that, in addition to individual antecedents, it is important to study a category of variables that considers how individuals' affective signals capture elements of the context over different time horizons. This is difficult in a pure lab study, but the lab-in-the-field approach of our study allows us to

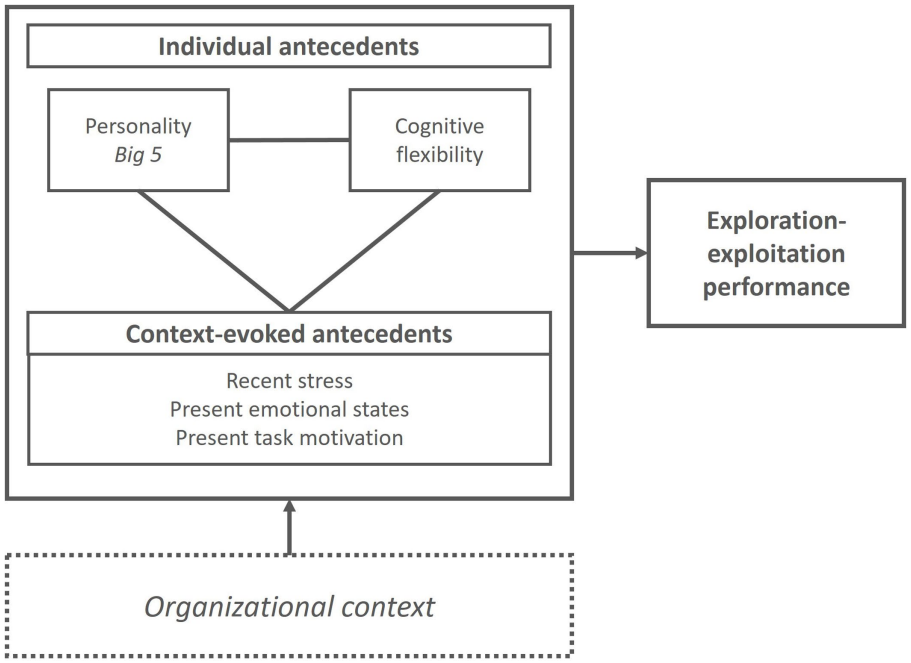


FIGURE 1
Basic conceptual framework.

capture context-evoked antecedents. Specifically, we consider how the context affects the individual via three context-evoked variables: recent stress, present emotional state, and present task motivation. Additionally, the study allows us to draw parallels between empirical and practical task paradigms—here, between the four-armed bandit task and war simulation exercises, which are fundamental activities for leadership development in the context of our study (Augier et al., 2018). The stringent mode of aligning a lab task to an organizational task enables us to increase the external validity of constrained laboratory tasks without losing the advantages of the internal validity associated with these tasks.

Adaptive exploration-exploitation decisions

The tension between exploration and exploitation is pervasive and involves issues that can take place in different timeframes and at different levels. At its core, it is a tension involving choices that "must be made between gaining new information about alternatives and thus improving future returns (which suggests allocating part of the investment to searching among uncertain alternatives) and using the information currently available to improve present returns (which suggests concentrating the investment on the apparently best alternative)" (March, 1994, p. 237). Exploration-exploitation choices are faced by everyone from entire armies at war (should a troop focus intensively on a known site or explore new battlegrounds?) to CEOs (should the company invest in its current market or explore new ones?).

Organizations must rely on their adaptive leaders' ability to manage the exploration-exploitation tradeoff. An adaptive leader is one who can decide for themselves and for others, when to stick to a well-known option and when to try out an alternative one—i.e., when to stay and when to go (Laureiro-Martínez et al., 2015). Thus, the adaptive leader can identify when to switch between exploratory and exploitative behaviors; high exploration-exploitation performance is not achieved by switching between exploration and exploitation per se but by doing so at the right moment—for instance, in reference to the perceived level of uncertainty in a situation (Mehlhorn et al., 2015) or in response to performance feedback related to a preceding decision (Levinthal and March, 1993).

There is agreement in the management literature that "the ability to dynamically balance exploration and exploitation" (Luger et al., 2018, p. 450) provides an adaptive solution to the tension between the two and leads to better outcomes (O'Reilly and Tushman, 2004). However, not everyone has the same dynamic balancing ability (Raisch et al., 2009). Various studies have aimed to understand the antecedents that lead to appropriate switching between exploration and exploitation. Some studies have focused on individual variables, while others have focused on variables that capture particular aspects of the context. Simon (1997) proposed two main sets of mechanisms that affect behavior: those that are for the most part internal ("their situs is in the human mind") and those that are "largely external to the individual, although they usually imply his [*sic*] sensitivity to particular stimuli. Being external, they can be interpersonal—they can be invoked by someone other than the person they are intended to influence, and consequently, they play a central role in administrative organization" (p. 105).

A recent review on the microfoundations of the exploration-exploitation tension (Pertusa-Ortega et al., 2021) outlines numerous antecedents which it categorizes as either individual antecedents (such as cognitive and social capabilities, risk propensity, or self-efficacy) or context-evoked antecedents perceived by organizational leaders (such as motivation and handling work stress). Our study aims to empirically

test the combined effects of specific individual and context-evoked antecedents on performance in tasks that require dynamic switching between exploration and exploitation decisions.

The next two subsections of this article present an overview of key antecedents that could help explain the ability to dynamically switch between exploration and exploitation. The first subsection focuses on the individual level, and the next on the context-evoked variables—i.e., those variables that capture how an individual interacts with a context.

Individual antecedents of exploration and exploitation

Personality

While people behave in reference to a specific situation, they still display considerable rank-order stability in personality traits when compared to their cohort (Bleidorn et al., 2022).

To develop our theoretical arguments, we build on the Big Five traits as outlined by McCrae and Costa (1987). This view of personality has been widely used in psychology (e.g., Soldz and Vaillant, 1999; Leutner et al., 2014) and management (e.g., Herrmann and Nadkarni, 2014; Judge and Zapata, 2015). The Big Five personality traits are defined as follows: *Conscientiousness* is the disposition "to control one's impulses, be detail oriented and careful, and to prefer order to disorder" (Feist, 2019, p. 31). *Emotional stability* is defined as the "ability of individuals to adjust their emotional state to varied situational demands and to remain calm, levelheaded, and self-confident in stressful situations" (Herrmann and Nadkarni, 2014, p. 1,323). *Agreeableness* is the tendency "to be warm, caring, and empathetic in social relationships" (Feist, 2019, p. 31). *Openness to experience* is the disposition "to be curious and open to new experiences and ideas, and to be flexible in both behavior and thought" (Feist, 2019, p. 31). Finally, *extraversion* describes the "tendency to enjoy stimulating social activities, seek out stimulating experiences, and to be confident and leader-oriented in group settings" (Feist, 2019, p. 31). Recent evidence has shown that consciousness and openness to experience moderate the relationship between switching between exploration and exploitation and cognitive strain (Keller and Weibler, 2014). In addition, a longitudinal experiment tracking the movement of 850 individuals for a two-year period found that the Big Five personality traits partly explain exploration and exploitation in the social and spatial sphere. Extraverted individuals showed more explorative behavior and diverse routines. Openness to experience was associated with routine instability and emotional stability with routine stability (Alessandretti et al., 2018).

Cognitive flexibility

Cognitive flexibility—defined as the ability to appropriately adjust one's behavior according to a changing context (Dajani and Uddin, 2015)—has been proposed as the critical cognitive ability at the organizational (Kiss et al., 2020) and individual levels (Furr, 2009; Laureiro-Martínez and Brusoni, 2018).

Management studies have investigated the cognitive antecedents of managing the switch between exploration and exploitation well. Behavioral lab studies (Laureiro-Martínez and Brusoni, 2018) and studies using fMRI (Laureiro-Martínez et al., 2015) have found that exploration and exploitation involve different cognitive processes, and leaders who recognize when to switch—and, therefore, achieve better performance—engage more brain areas and the cognitive abilities related to cognitive flexibility. In particular, the switch between exploitation and exploration relies heavily on the activation of the attention control circuitries and, therefore, higher levels of involvement of the brain's executive functions.

In psychology, cognitive flexibility is often described as being synonymous with set- or attention-shifting. Cognitive flexibility "emerges from a complex interaction of several mechanisms" (Ionescu, 2012, p. 196). Dajani and Uddin's (2015) conceptualization of cognitive flexibility considers multiple components, or executive functions, to provide a complete account of the mechanisms that interact and allow for cognitive flexibility to emerge. This emphasis on executive functions aligns with very recent research supporting the notion that executive functions like sustained attention (or vigilance) and working memory are the cognitive abilities that might best explain human behavior in organizations (Bergenholtz et al., 2023). We rely on Dajani and Uddin's (2015) conceptualization of cognitive flexibility, considering salience detection, vigilance, working memory, inhibition, and switching as the central components of cognitive flexibility and, therefore, exploration-exploitation performance.

Salience detection has been described as the first step in adjusting one's thinking to changes in the environment. Only salient stimuli attract attention, allowing us to process them further (Dajani and Uddin, 2015). The term "salient" describes "a stimulus or an aspect of a stimulus that stands out or that is set apart from others" (Uddin, 2015, p. 1). Perception and response to salient stimuli rely on the combination of sensory, visceral, autonomic, and attention systems in the brain (Uddin, 2015). Consequently, if a salient stimulus is not detected, arguably it cannot trigger a change in thinking, which would undermine adequate switching between exploration and exploitation.

Once a salient stimulus is detected, attention is allocated accordingly (Dajani and Uddin, 2015). In line with a managerial understanding of attention, vigilance and attention-switching are complementary in attentional engagement, without which effective decision-making in organizations is highly unlikely. Accordingly, vigilance stands for "attachment" to a stimulus, and executive attention for "detachment" from a stimulus (Ocasio, 2011). From a neuropsychological point of view, the term "vigilance" describes the "processes that enable sustained performance on tasks over extended periods of time" (Cohen, 2011, p. 2,440), making it a central component in most models of attention. Consequently, vigilance is a precondition for flexible thought and action in the sense that it allows one to stay focused on a task for a certain period, even if it requires switching attention between exploration-exploitation decisions.

An additional and frequently cited precondition for flexible thought and action is working memory, meaning "the short-term storage of information and its 'online' maintenance and manipulation" (Dajani and Uddin, 2015, p. 571). This short-term storage or updating of information enables an individual to cognitively represent multiple aspects of a complex situation, thus allowing them to select those behavioral responses that are most promising in any given situation (Kashdan and Rottenberg, 2010). Cognitive flexibility is about switching between different mental sets, and working memory provides the information processing power to uphold the information

associated with different mental sets in the mind (Dajani and Uddin, 2015).

In the face of a changing environment, cognitive and behavioral responses that are no longer adequate require inhibition, making it a central component of cognitive flexibility. Hence, inhibition is a precondition for subsequent switching (Kashdan and Rottenberg, 2010; Dajani and Uddin, 2015). Inhibition is the "ability to control one's attention, behavior, or thoughts to override competing cognitions" (Dajani and Uddin, 2015, p. 571). This ability is particularly relevant in tasks requiring frequent changes in responses and, therefore, the inhibition of previously implemented responses. That ability may be especially significant given "exploitation tends to drive out exploration" (Levinthal and March, 1993, p. 107). Therefore, we argue that inhibition is particularly important for stopping automatized exploitative behaviors and initiating explorative ones.

The final step in the process of cognitive flexibility is switching, which "involves the disengagement of an irrelevant task set and the subsequent active engagement of a relevant task set" (Miyake et al., 2000, p. 55). Switching relates to the previous antecedents in that salient internal and external stimuli attract attention, are manipulated, and indicate the cessation of a current thought or behavior, after which a shift in thought or behavior occurs (Dajani and Uddin, 2015). These explanations align with the finding that attentional switching is a fundamental mechanism for balancing exploration and exploitation (Laureiro-Martínez et al., 2015).

Context-evoked antecedents of exploration and exploitation

An important tenet of the Carnegie approach is the understanding that decision-making is situated within an organizational context (Gavetti et al., 2007). That context is defined by specific rules and routines and conflicting goals, values, and identities; taking it into consideration when understanding a decision can limit the generalizability of scientific insights generated by studying that context but also increase their accuracy. In an overview of the past, present, and future of the Carnegie approach, Gavetti et al. (2007) stressed the importance of better understanding the impact that situational context has on organizational leaders.

In order to understand how the context affects the individual leader, we draw on Simon's (1997) idea that environmental stimuli evoke responses if they attract attention and that we need to study the "mechanisms that allow us to allocate attention to tasks and to shift attention rapidly when a task presents itself with real-time urgency […] Motivation and emotion are the mechanisms responsible for this allocation of attention" (p. 90). We build on this idea and argue that context itself does not directly affect human behavior but does indirectly affect it through humans' affective signals, which involve emotions and motivations. Our argument is grounded in bounded rationality, according to which context is not an objective entity as it must be perceived and defined by the individual, whereby "the steps that lead, for an actor, to his [*sic*] defining the situation in a particular way involve a complex interweaving of affective and cognitive processes" (March and Simon, 1958, 2004, p. 151). This seminal notion is in line with the state-of-the-art understanding of the "affect-as-information"-view, according to which one's affective signals are integrated into perceptions of the environment (Schwarz and Clore, 1983; Zadra and Clore, 2011). Given that humans sense and feel contextual information before they deliberately process it, affective signals capture features from the environment that are relevant for the individual situated in it. For example, it has been found that a positive emotional state indicates that the environment is relatively harmless and that others in the social setting are allies rather than enemies (Rhoades et al., 2001).

Recent neuroscientific works on cognitive control (Krebs and Woldorff, 2017; Pessoa, 2017) and decision-making (Lerner et al., 2015) provide further support for the affect-as-information-view and add that emotional states and motivation affect cognition during decision-making through interactions with other variables, such as personality, in complex ways that are not yet fully understood (Dolan, 2002; Phelps et al., 2014; Lerner et al., 2015; Pessoa, 2017). Furthermore, and aligned with Simon's (1967, 1997) emphasis on human adaptation, work in the cognitive sciences shows that stress is also a fundamental affective signal preparing humans to cope with challenging situations, such as difficult tasks in uncertain environments (Fink, 2016).

Thus, we treat organizational leaders' affective signals as context-evoked antecedents that capture behaviorally relevant information from the organizational context. Specifically, we suggest *stress, emotional states,* and *task motivation* as powerful context-evoked antecedents allowing organizational leaders to direct goal-driven cognition by holding their attention on important environmental stimuli. Importantly, we consider different time horizons. Stress is an affective signal that arises as part of the context over a period that lasts beyond the task but that is nonetheless recalled in the moment of performing the decision-making task itself. Emotional states, in contrast, are felt at the moment of the task but are not directly related to it as they result from different contextual cues. Task motivation, on the other hand, captures the present affective signal driven by the immediate task environment.

Stress

Stress is defined as a "state of worry or mental tension caused by a difficult situation" (WHO, 2023). The purpose of this stress reaction is to prepare the human organism for either fighting a stressor or fleeing from it (Allen et al., 2014). The organizational setting rarely evokes reasons for an acute fight-or-flight response but rather results in reactions (i.e., negative feelings and thoughts) to stressful situations, such as high workload and uncertainty, that occur over a period of time, for example during a month (Sherman et al., 2012).

Under stress, cognition is impaired (Diamond, 2013). A meta-analysis conducted by Shields et al. (2016) showed that stress generally lowers switching, working memory, and cognitive inhibition, defined as selectively attending or ignoring stimuli. However, stress seems to have no negative effect on response inhibition, meaning the suppression of the dominant response. Stress also reduces cognitive flexibility by forcing attention toward highly salient stimuli related to the stressor while undermining a more top-down selection of stimulus. Stress, while decreasing cognitive control processes and increasing automatic processing, directs mental and energetical resources toward the motor control of actions (Shields et al., 2016).

The level of maturity of this stream of literature stands in contrast with the literature on the microfoundations of exploration and exploitation behavior in management, which has so far overlooked the topic of stress (see Tarba et al., 2020; Pertusa-Ortega et al., 2021). Still, there is some evidence that stress disrupts the connectivity of the frontoparietal network, temporarily undermining attention control (Liston et al., 2009), which represents the basic mechanism for exploring alternative courses of action under changing environmental circumstances (Laureiro-Martínez et al., 2015), and continuous stress at an early age can lead to an excessively exploitative decision-making approach (Humphreys et al., 2015).

Emotional states

Scholarly work linking emotional states to decision-making has proliferated exponentially in recent decades, increasing from practically no articles at all in 1970 to roughly 500 per year today. Nowadays, emotional states are understood as the "dominant driver" of most life-changing decisions, shaping both the content of thought and its depth (Lerner et al., 2015). We define emotional states as "complex reaction pattern[s], involving experiential, behavioral, and physiological elements, by which an individual attempts to deal with a personally significant matter or event" (American Psychological Association Dictionary of Psychology, 2023). Emotional states reflect the aggregated emotions experienced at the present moment. Importantly, while the emotions are felt in the moment, their underlying contextual stimuli may have accumulated over hours or even days (Forgas, 1995).

Overall, positive emotional states seem to favor cognitive flexibility. Several studies have found that positive emotional states decrease switching costs (e.g., Lin et al., 2013; Wang et al., 2017) while increasing working memory capacity (Levens and Phelps, 2008; Yang et al., 2013), thus favoring cognitive flexibility. Regarding inhibition, negative emotional states seem to have an effect in terms of decreasing performance (Derakshan and Eysenck, 2010). However, when considering the cognitive process of vigilance, it appears that it is not positive but rather negative emotional states that improve performance (Schwarz and Bless, 2020).

Considering the effect of emotional states on decisions about exploration and exploitation, research on the team level has shown that neither positive nor negative emotional states before taking a decision about the exploration of new routines have any effect on that decision. However, a decrease in team performance, which presumably leads to negative emotional states, before taking a decision about the adoption of a certain routine does favor exploration (Håkonsson et al., 2016). Still, on the individual level, negative emotional states seem to hinder exploration (Brusoni et al., 2020). Both our work and broader literature reviews by other authors (see Tarba et al., 2020; Pertusa-Ortega et al., 2021) indicate the need to further investigate the link between emotional states and exploration and exploitation.

Task motivation

Motivation, as a context-evoked antecedent, is indispensable for explaining decision-making performance (Kanfer and Ackerman, 1989). Motivation is defined as an "unobservable force that directs, energizes, and sustains behavior" (Diefendorff and Chandler, 2011, p. 66) and as "the joy of solving a task" in relation to expected rewards (Krebs and Waldorff, 2017, p. 422). Motivation affects decision-making performance by influencing the direction, intensity, and persistence of effort (Campbell, 1990). Most importantly, state-like measures of motivation, which capture immediate and transient motivation for a concrete task in a concrete setting, predict decision-making performance better than trait-like measures such as general achievement motivation (Van Iddekinge et al., 2018). Accordingly, task motivation predicts performance in a wide variety of organizations (Piccolo and Colquitt, 2006) and tasks (Freund et al., 2011).

While the association between task motivation and general decision-making performance is well established, knowledge about the role of motivation in exploration-exploitation tasks is scarce. For example, recent reviews or empirical articles related to cognitive flexibility have not considered task motivation as a factor (e.g., Ionescu, 2012; Laureiro-Martínez and Brusoni, 2018; Zmigrod et al., 2020; Howlett et al., 2021; Uddin, 2021). While the antecedent of task motivation is overlooked in much of the literature on the microfoundations of exploration and exploitation behavior (see Pertusa-Ortega et al., 2021), initial research has found that task motivation improves the dynamic switching between exploration and exploitation, presumably by increasing one's sense of self-control and willingness to change one's behavior in the face of a shifting environment (Mom et al., 2019). However, despite these initial findings, more evidence on the relevance of task motivation for switching between exploration and exploitation is needed, particularly in combination with cognition and personality (Tarba et al., 2020).

Table 1 provides an overview of the just-described constructs and their associations with exploration-exploitation performance.

To date, the important antecedents of exploration-exploitation have been studied separately from each other. We propose a microfoundational model that consolidates multiple antecedents to provide a more comprehensive explanation of what precedes adaptive exploration-exploitation decisions. Our model integrates the three psychological antecedents—personality, cognitive flexibility, and context-evoked antecedents—that jointly affect exploration-exploitation performance. Before turning to the integrative path model, we explain each of the three mediations in more detail.

The relationship between personality, cognitive flexibility, and exploration-exploitation performance

Given the evidence about the effects of both personality and cognitive flexibility on exploration-exploitation (as described in previous sections), we theorize that both categories of antecedents are likely to affect exploration-exploitation performance. Importantly, we propose that cognitive flexibility represents the most direct influence on exploration-exploitation decisions due to the mental control efforts needed to allocate attention and process information for such tasks (Laureiro-Martínez et al., 2015). Personality antecedents, on the other hand, contribute less directly to the outcome, as they likely interact with individuals' cognitive flexibility (Unsworth et al., 2009). In fact, personality is found to correlate with some of the components of cognitive flexibility that are critical for exploration-exploitation decisions. For example, emotional stability is associated with improved working memory, inhibition, and switching ability (Murdock et al., 2013). Openness to experience is positively associated

TABLE 1 Overview of antecedents and their associations with exploration-exploitation performance.

Antecedent	Association with exploration-exploitation performance
Personality	
Conscientiousness is the disposition "to control one's impulses, be detail oriented and careful, and to prefer order to disorder" (Feist, 2019, p. 31).	Personality traits, such as the Big Five (conscientiousness, emotional stability, etc.) might predict exploration and exploitation (Keller and Weibler, 2014; Alessandretti et al., 2018).
Using the term **emotional stability**, instead of neuroticism or emotional instability, we define this trait as the "ability of individuals to adjust their emotional state to varied situational demands and to remain calm, levelheaded, and self-confident in stressful situations" (Herrmann and Nadkarni, 2014, p. 1,323).	
Agreeableness is the tendency "to be warm, caring, and empathetic in social relationships" (Feist, 2019, p. 31).	
Openness to experience is the disposition "to be curious and open to new experiences and ideas, and to be flexible in both behavior and thought" (Feist, 2019, p. 31).	
Extraversion describes the "tendency to enjoy stimulating social activities, seek out stimulating experiences, and to be confident and leader-oriented in group settings" (Feist, 2019, p. 31).	
Components of cognitive flexibility	
Salience detection: Identification of "a stimulus or an aspect of a stimulus that stands out or that is set apart from others" (Uddin, 2015, p. 1).	The detection of salient stimuli allows a decision-maker to notice changes in the environment (Uddin, 2015) that might require them to switch between exploration and exploitation.
Vigilance: "Processes that enable sustained performance on tasks over extended periods of time" (Cohen, 2011, p. 2,440).	Vigilance allows a decision-maker to attach their attention to a stimulus (Ocasio, 2011) that might require them to switch between exploration and exploitation.
Working memory:"The short-term storage of information and its 'online' maintenance and manipulation" (Dajani and Uddin, 2015, p. 571).	Working memory allows a decision-maker to process relevant information (Dajani and Uddin, 2015) that might require them to switch between exploration and exploitation.
Inhibition: "Ability to control one's attention, behavior, or thoughts to override competing cognitions" (Dajani and Uddin, 2015, p. 571).	Inhibition allows a decision-maker to stop implementing a response that is no longer adequate in a situation (Dajani and Uddin, 2015) and thus to switch between exploration and exploitation.
Switching:"Disengagement of an irrelevant task set and the subsequent active engagement of a relevant task set" (Miyake et al., 2000, p. 55).	Switching represents the core cognitive mechanism that allows a decision-maker to stop exploiting and start exploring or vice versa.
Context-evoked antecedents	
Stress:"State of worry or mental tension caused by a difficult situation" (WHO, 2023).	Stress undermines attention control (Liston et al., 2009), representing the basic mechanism for exploring alternative courses of action under changing environmental circumstances (Laureiro-Martínez et al., 2015).
Emotional states: "Complex reaction pattern[s], involving experiential, behavioral, and physiological elements, by which an individual attempts to deal with a personally significant matter or event" (American Psychological Association Dictionary of Psychology, 2023).	Emotional states might affect a decision-maker's tendency to explore or exploit in a given situation (Brusoni et al., 2020).
Task motivation: "Unobservable force that directs, energizes, and sustains behavior" (Diefendorff and Chandler, 2011, p. 66) in a task.	Motivation affects the direction, intensity, and persistence of effort (Campbell, 1990) in tasks that might require a decision-maker to switch between exploration and exploitation.

with working memory (DeYoung et al., 2005) and switching ability (Unsworth et al., 2009; Murdock et al., 2013). Agreeableness, conscientiousness, and extraversion yield inconsistent findings (Murdock et al., 2013). In sum, some specific personality antecedents are correlated with some, but not all, components of cognitive flexibility. Given the immediate role of cognition in task performance, we propose that cognitive flexibility is likely to mediate the effect of some of the personality antecedents on exploration-exploitation performance. We do not hypothesize which specific personality antecedents or components of cognitive flexibility will have an effect

but rather explore the relation summarized in this proposition (see Figure 2):

> **Proposition 1 (P1):** Cognitive flexibility mediates the effect of personality antecedents on exploration-exploitation performance.

The relationship between recent stress, cognitive flexibility, and personality

We posit that recent stress represents a context-evoked antecedent that captures challenging organizational states that occur over a period of time. Some organizational states, such as high workload, a number of difficult tasks, and high uncertainty related to future organizational states, can evoke affective signals in the form of stress if they persist for some time. As described in the previous section, enduring stress is mostly associated with impaired cognitive flexibility. In line with these findings, we would expect to find a negative effect of recent stress on cognitive flexibility.

Importantly, however, some personality effects seem to influence the effect of recent stress. Personality, as a rather stable category of antecedents, can filter how individuals react to the influence of different contextual cues. For example, a number of studies have shown that emotional stability is associated with a lower level of experienced stress in individuals, even if potentially stressful situations endure for some time (e.g., Bibbey et al., 2013; Xin et al., 2017). Surprisingly, and in contrast to studies that only assess the direct effect of stress on decision-making performance (see previous paragraphs), it has been shown that leaders experience a lower level of stress compared to non-leaders in situations of uncertainty (Sherman et al., 2012). This finding points toward a view that leaders possess personality traits, such as emotional stability, that make them less reactive to stress in times that evoke considerable stress and negative emotions in others. In contexts that involve high uncertainty and impose cognitive load, such as the exploration-exploitation dilemma, personality antecedents such as emotional stability are, therefore, likely to filter the kind or scope of potentially detrimental affective signals evoked by the context.

Thus, personality antecedents such as emotional stability are likely to influence the level of activation of negative and sustained stress by filtering the interpretation of contextual cues—an effect that is captured by the perceived level of (sustained) stress. As with Proposition 1, we do not hypothesize ex-ante which specific Big Five personality antecedents act as mediators but will empirically test this. Taken together, we postulate an indirect relationship summarized in this proposition (see Figure 3):

> **Proposition 2 (P2):** Personality antecedents mediate the effect of recent stress on cognitive flexibility.

The relationship between present context antecedents, cognitive flexibility, and exploration-exploitation performance

Neuroscientific studies have found evidence that affective signals do not necessarily lead to flawed cognition and biased decisions but favor awareness of important contextual cues—in contrast to what has been posited in traditional philosophy and economic theories of rationality

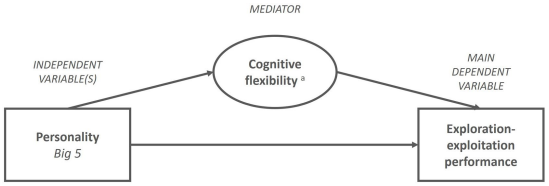


FIGURE 2
Proposed sub-model of exploration-exploitation performance in organizational leaders. P1: Cognitive flexibility mediates the effect of personality antecedents on exploration-exploitation performance. [a]Five components of cognitive flexibility: Salience detection, vigilance, working memory, inhibition, switching.

(Dolan, 2002). Lerner et al. (2015) proposed that context antecedents, such as emotions, that have motivational quality can indirectly influence decision-making outcomes by influencing, for example, the type of cognitive processes used (e.g., analytic vs. heuristic thinking). Pessoa (2017), using motivation as an example of an affective signal, summarized three options relevant for tasks that require cognitive flexibility: (1) affective signals and cognition could co-evolve in parallel during an event but still contribute separately to the outcome (model "parallel"); (2) cognition could mediate affective signals so that it changes the effect of the affective signals on the outcome (model "mediation"); and (3) affective signals and cognition are truly integrative, in that they are not separable (model "integration").

Given that cognitive flexibility is expected to affect exploration-exploitation most directly, we propose a mediation effect between present context antecedents and cognitive flexibility. To give an illustrative example: Positive emotional states and task motivation typically have a positive effect on task outcomes (Van Iddekinge et al., 2018). In addition, as outlined in our model, it has been argued that affective signals (i.e., emotional states and task motivation) also influence cognitive flexibility, which, in turn, might change and mediate the effect of positive affective signals on task performance by engaging the same set of cognitive functions (see Pessoa, 2017). We expect positive emotional states and task motivation to have positive indirect effects on exploration-exploitation and negative emotional states to have negative indirect effects. In both cases, we assume the same kind of indirect relationship. In line with our argumentation, we make the following propositions (see Figure 4):

> **Proposition 3a (P3a):** Cognitive flexibility mediates the effect of the present emotional state on exploration-exploitation performance.

> **Proposition 3b (P3b):** Cognitive flexibility mediates the effect of present task motivation on exploration-exploitation performance.

Based on our propositions, we present a model (see Figure 5) of exploration-exploitation performance that includes three connected mediations with different types of antecedents. The model takes into account two levels of antecedents (i.e., individual and context-evoked antecedents) and different time horizons (i.e., recent and present). In order to include all three mediations into one model, we slightly changed the arrangement of the three mediation effects.

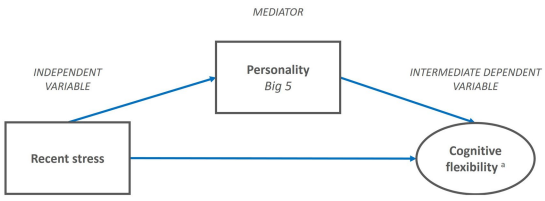


FIGURE 3
Proposed sub-model of exploration-exploitation performance in organizational leaders. P2: Personality antecedents mediate the effect of recent stress on cognitive flexibility. [a]Five components of cognitive flexibility: Salience detection, vigilance, working memory, inhibition, switching.

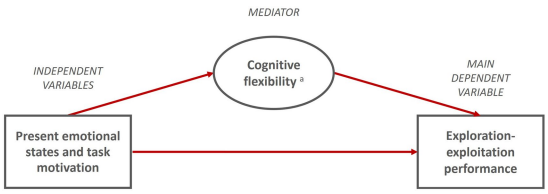


FIGURE 4
Proposed sub-model of exploration-exploitation performance in organizational leaders. P3a-b: Cognitive flexibility mediates the effect of present emotional states (3a) and task motivation (3b) on exploration-exploitation performance. [a]Five components of cognitive flexibility: Salience detection, vigilance, working memory, inhibition, switching.

Materials and methods

Sample and data collection

We examined the propositions described above with a lab-in-the-field approach conducted in officer schools of the Swiss Armed Forces. This means that we employed laboratory equipment to collect our data in the study participants' working environment, favoring the external validity of our findings (Gneezy and Imas, 2017). Data collection took place in the facilities of each of the participating officer schools between August 2021 and September 2022. The participants used their personal laptops provided by the officer school to access the experimental online platform Gorilla.sc. This approach of collecting data in the cadets' own facilities, where they were surrounded by their colleagues and submitted their responses via the laptops they used in daily organizational life, allowed us to better capture context-evoked variables that unfold in a situated manner and over different periods of time. This favors the external validity of our findings (Gneezy and Imas, 2017). Participants answered our questions, conducted tests, and made decisions in sessions of around two hours each. To reflect our theoretical model subdividing context-evoked antecedents into recent past (i.e., stress occurring over a month) and present (i.e., present emotional states and task motivation) variables, participants first answered the questions regarding their emotional states and perceived stress around one hour before taking the exploration-exploitation decisions, followed by questions related to their task motivation around 10 min before that. The individual antecedents were measured between (components of cognitive flexibility) stress and task motivation and after (personality) exploration-exploitation performance. The data on the two control variables, gender and age, were collected and transmitted by the officer schools around one month before our data collection.

The sample consisted of 282 officer cadets undergoing a 15-week officer training program. Officer schools prepare cadets to act as leaders of groups of 30 soldiers and five sergeants in often uncertain and hostile environments. The training includes the acquisition of competencies such as tactical leadership, team management, medical first aid, and survival (Eidgenössisches Department für Verteidigung, Bevölkerungsschutz und Sport, 2023). About 93% of our study participants were male, and their average age was 24. All had undergone basic military training in the Swiss Armed Forces as well as an extensive selection process before becoming officer cadets. They had also all either finished vocational training or achieved the general qualifications for university entrance before starting basic military training. The participants' superior officers (their "commanders") requested that participants join our study information session. In this session, we incentivized participants to perform at their best by emphasizing that the results would help to improve officer selection in the Swiss Armed Forces and that the usefulness of the data collection depended on their effort in the behavioral tasks and their willingness to provide self-reports that reflected their genuinely honest self-assessment. Confidentiality was assured and participation was voluntary. Over 95% of all addressed officer cadets chose to take part in the study. We excluded 20 participants from the data set, reducing the sample from 302 to 282 (7% of total participants), as their results indicated low motivation for taking part in the data collection. Apart from these twenty participants, behavior during and immediately after data collection (e.g., asking questions afterward and staying longer than planned to finish data collection), as well as the consistency of the results across similar variables, indicates that the sample was, on average, highly motivated to provide data that reflected their "true" level of ability and self-assessment.

Measures

Personality

We used the German version of the *Big Five Inventory 2* (BFI-2; Soto and John, 2017) to measure personality, meaning the Big Five personality traits. Exemplary items were as follows: "I am someone who is…" "…dependable, steady" (*conscientiousness*), "…relaxed, handles stress well" (*emotional stability*), "…compassionate, has a soft heart" (*agreeableness*), "…curious about many different things" (*openness to experience*), or "…outgoing, sociable" (*extraversion*). The items were scored on a five-point Likert scale. Cronbach's Alpha for the different subscales were 0.85 for *conscientiousness*, 0.85 for *emotional stability*, 0.80 for *agreeableness*, 0.80 for *openness to experience*, and 0.84 for *extraversion*.

Cognitive flexibility

We relied on Dajani and Uddin's (2015) conceptualization of cognitive flexibility and measured five executive functions as the central components of cognitive flexibility.

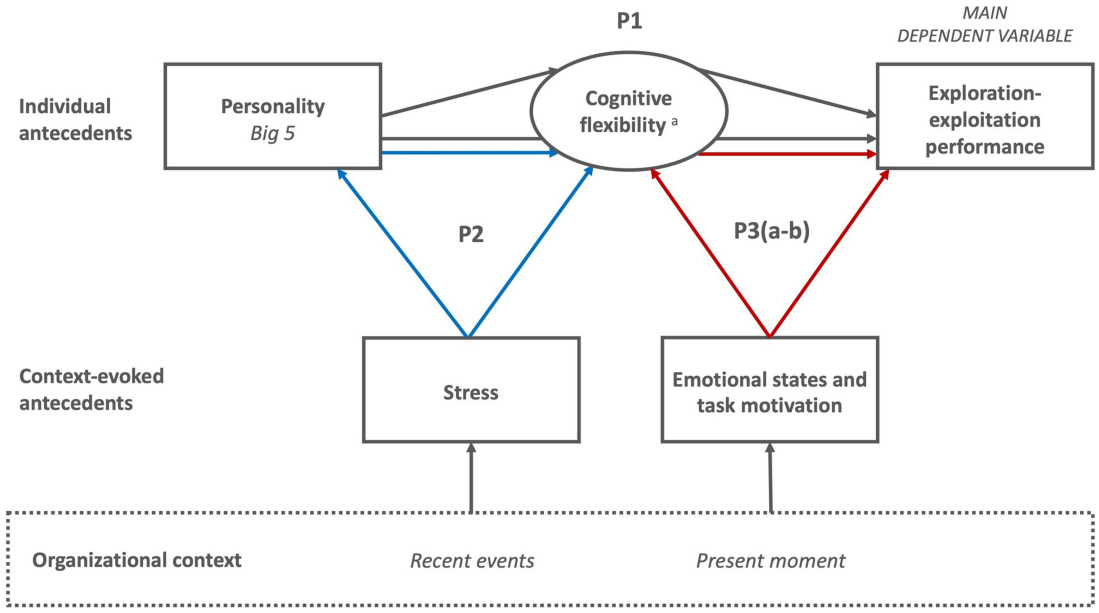


FIGURE 5
Proposed integrative path-model of exploration-exploitation performance including all three mediations. [a]Five components of cognitive flexibility: Salience detection, vigilance, working memory, inhibition, switching.

Salience detection

We measured salience detection through the *visual search task* (Stoet, 2011; Mallik et al., 2020). This task included 50 trials in which participants were asked to respond if the target stimulus, an upright orange letter T, was shown on the screen and not to respond if it was not. After four seconds without a response, the trial was terminated as "no response." Distracting stimuli were blue Ts presented in various orientations and orange Ts in opposing orientations. There were conditions with five, 10, 15, or 20 distractor stimuli, and half of the trials did not include the target stimulus. Erroneous responses were indicated with a red cross shown for two seconds. The outcome variables of the task were *accuracy*, *average reaction time*, *average reaction time with 5, 10, 15, or 20 distractors on the screen*, and *slope*, calculated through a linear regression with the set size of distractors as the independent variable. We used the task variable *slope* for our statistical analyses.

Vigilance

We measured vigilance through the *Mackworth clock test* (Mackworth, 1948; Vujic, 2017), a typical task for assessing vigilance. For around five minutes, participants watched a clock hand ticking around a dial. When the hand jumped forward two increments instead of the usual one, participants had to immediately press the space bar; otherwise, they were instructed to do nothing. If they were correct, a green light was shown; when incorrect, a red light was shown. Each of the five circuits dial consisted of 60 ticks, with 15 two-step jumps to identify and report. The outcome variables of the task were *number of correct answers*, *false alarms*, *actual misses*, *all misses*, and *reaction time for correct answers*. We used the task variable *number of correct answers* for our statistical analyses.

Working memory

We measured working memory through the *n-back task* (Kirchner, 1958; Laureiro-Martínez, 2014). In this task, participants need to indicate by pressing two different keys whether they have seen a given letter two positions earlier in a sequence. The letter could be written in lower or upper case. The n-back task included 35 trials. The outcome variables of the task were *number of correct answers*, *mistakes*, *misses*, *reaction time for mistakes*, and *reaction time for correct answers*. We used the task variable *number of correct answers* for our statistical analyses.

Inhibition

We measured inhibition through the *Stroop task* (Miyake et al., 2000; Moore and Malinowski, 2009). In this task, participants were shown the names of colors printed in a congruent color (e.g., the word "blue" in blue text) and an incongruent color (e.g., the word "blue" written in red), and they had to resist the automatized response to indicate the meaning of the word rather than the color of the text. The control condition included a string of five asterisks in place of a word. After 24 practice trials, the main task consisted of 72 trials with a five-asterisk string printed in one of four colors (red, green, blue, or purple), 60 trials in the incongruent condition, and 12 trials in the congruent condition. The outcome variables of the task were *number of errors*, *anticipations*, *reaction time incongruent condition*, *reaction time asterisks*, and *reaction time difference*. *Reaction time difference* was calculated through the difference

between the incongruent and asterisks conditions. We used the task variable *reaction time difference* for our statistical analyses.

Switching

We measured switching through the *number-letter task*. In this task, a number-letter pair (e.g., "4 K") is shown in one of four quadrants (Miyake et al., 2000). The participants were asked to indicate whether the number was odd or even when the number-letter pair was shown in one of the upper two quadrants. When the number-letter pair was shown in one of the lower two quadrants, participants had to indicate whether the letter was a consonant or a vowel. The first two blocks included 32 trials each. In a subsequent third block of 128 trials, the number-letter pair rotated in a clockwise manner around all four quadrants. Hence, the trials in the first two blocks did not require participants to switch between tasks ("single trials"), but in half of the trials in the third block, they had to conduct these two different types of categorization operations quickly and correctly ("mixed trials"). The outcome variables of the task were *number of correct answers in single trials*, *total number of correct answers in mixed trials*, *number of correct answers in mixed trials with a switch*, and *number of correct answers in mixed trials without a switch*. All these variables were also calculated based on reaction time. We used the task variable *number of correct answers in mixed trials with a switch* for our statistical analyses.

Context-evoked antecedents

Stress

We used the German version (Schneider et al., 2020) of the *perceived stress scales* to measure context-evoked stress. The 10-item scale includes the subscales of helplessness and self-efficacy. They capture perceived stress over the past month, i.e., the recent past. Exemplar items were "In the last month, how often have you felt that things were going your way?" (self-efficacy) and "In the last month, how often have you felt that you were unable to control the important things in your life? (helplessness). The items were scored on a five-point Likert scale. Cronbach's Alpha for this study was 0.83.

Emotional states

We measured context-evoked emotional states through the German version of the *positive and negative affect schedule* (PANAS). The 20 items are subdivided into 10 positive and 10 negative affect items, which are scored on a five-point Likert scale (Breyer and Bluemke, 2016). They capture the emotional states of the participants "in the moment," meaning the present. Exemplar items were "active," "interested," "excited" (positive affect), "distressed," "guilty," or "scared" (negative affect). Cronbach's Alpha for *positive affect* was 0.86 and for *negative affect* it was 0.72.

Task motivation

We measured task motivation through the *current achievement motivation questionnaire*, including 18 items representing the four factors of anxiety, challenge, interest, and probability of success. They capture the motivation perceived about a task right before performing it. Exemplar items were "I feel under pressure to do this task well" (anxiety), "I am really going to try as hard as I can on this task" (challenge), "I would work on this task even in my free time" (interest), and "I think I am up to the difficulty of this task" (probability of success). The items were scored on a seven-point Likert scale (Freund et al., 2011). Cronbach's Alpha for this study was 0.75.

Exploration-exploitation performance

We used the *four-armed bandit task* to measure exploration-exploitation performance, which is a standard task in strategic management literature used to measure dynamic switching between exploration and exploitation (Laureiro-Martínez et al., 2015). In the four-armed bandit task, the subject sees four differently colored slot machines, with each slot representing unknown payoff probabilities. The participant's objective is to achieve the highest final payout possible. During the task, the slots' payoff probabilities continually change, and the subjects must choose whether they want to continue playing on the current slot or switch to another one. The choices made by subjects imply trade-offs between gleaning more information about the payout of each slot (exploration) and using available information to collect a payout (exploitation)—known as a "sequential choice problem" (Posen and Levinthal, 2012). The task consists of 150 trials subdivided into two blocks of 75 trials each. In line with the literature (see above), *total payout* is the main outcome variable of this task and represents exploration-exploitation performance.

The rationale for choosing such a task in our lab-in-the-field study within the Swiss Armed Forces was its comparability to their central activity: preparing for the unlikely event of war. War simulations such as war gaming and urban warfare reconstructions are considered a central training activity in military leadership education (Hirst, 2022). Such simulations allow leaders to generate and test strategic decisions in the form of collective search processes and have been described as not only the best but also the *only* form of training (Augier et al., 2018). According to Robert Work, a former U.S. Deputy Secretary of Defense, war simulations "provide structured, measured, rigorous […] environments to help us explore what works (winning) and what doesn't (losing) across all dimensions of warfighting" (Hirst, 2022, p. 5).

"Memoir 44" is an exemplary board game for war simulation that some of the officer schools participating in our study used to train tactical decision-making in their cadets. It thematizes the battles of World War II, is played on a hexagon-gridded board (the "battlefield"), and relies on the successful use of military principles and procedures ("options") to defeat the opponent (Borg, 2004). Memoir 44 captures exploration-exploitation performance as it requires its players to execute standardized tactical options and to stick to them if they serve the given military objective (i.e., exploitation) and to change or creatively combine tactical options when they do not (i.e., exploration). In addition to Memoir 44, we observed how some officer schools simulate urban warfare exercises. The reconstruction and usage of a realistic environment and equipment intensify the dynamic interaction between the different actors and evoke affective signals that are included in decision-making. Especially under such realistic situations, decision-makers need to dynamically shift between the exploitation of given options and the exploration of new ones.

The four-armed bandit task is well suited to capturing the essence of the underlying tension between the exploration and exploitation behaviors that occur in war simulations. Furthermore, in both tasks, learning reduces uncertainty and increases the decision-maker's probability of success. While the two task paradigms differ in some respects—e.g., the war simulations feature more behavioral options

and require more previous knowledge than the four-armed bandit task—they both allow for observation of exploration-exploitation performance. As such, the four-armed bandit task captures our dependent variable well. Table 2 outlines this comparison in more detail.

For the control variables of *gender* and *age*, we relied on information already collected by the organization at the time the individuals joined it.

Results

Descriptive statistics

In Table 3 we provide the descriptives of our study. To handle extreme outliers' values (more than 3 standard deviations from the average), we used a method called Winsorizing (Field, 2013). Our data didn't follow a normal distribution, so we used Spearman correlations. We did not only consider significant *p*-values in the analysis of our data but also the strength of correlations. If a correlation was not significant at the 0.05 level but seemed relevant, we report the exact value of *p*. Moreover, we could not include *negative* emotional states due to a lack of variance but kept *positive* emotional states in our analyses.

Regarding the control variable of gender and age, our findings show a negative correlation between being female and exploration-exploitation performance. A partial explanation for this connection might lie in the negative relationship between emotional stability and being female. Still, it is important to note that our sample only includes 20 female participants, and the difference in exploration-exploitation performance is relatively small (female $M = 8{,}702$, male $M = 9{,}021$). As a result, we will report all model fits and mediation effects (see Tables 4, 5) without gender. However, we did include whether the model fits with gender as a robustness check.

Three out of the five components of cognitive flexibility (vigilance, working memory, and switching) positively correlate with each other.

Exploration-exploitation performance correlates positively with emotional stability, task motivation ($p = 0.057$), and cognitive

TABLE 2 Comparison of war simulation exercises and this study's lab-in-the-field task.

	War simulations	Four-armed bandit task
Objective	Gain urban terrain (i.e., take terrain from opponent) by choosing the most effective attack options.	Maximize income by choosing the options with the highest possible payoffs.
Available options	Choose the most effective tactical option (e.g., line vs. column or combination of both) and potentially use other creative moves within these basic options.	Choose the most effective option among four given options (four slots).
Uncertainty	High in the beginning; learning reduces uncertainty to some degree as some patterns and facts are recognizable (opponent's tactics and reactions, not everything in the terrain is visible at the beginning but becomes clearer).	High in the beginning, learning reduces uncertainty to some degree as some patterns and facts are recognizable (how high the payoffs can be, increasing/decreasing patterns).
Description of task structure	Well-structured regarding the goal, the presence of basic choice options (e.g., tactical formation options: line vs. column or combination), and basic warfare principles, but ill-structured regarding other aspects (e.g., leaders must not only make decisions for themselves but also for others; information regarding opponent is incomplete; the environment is changing; the setting allows leaders and opposing leaders to come up with unexpected moves, such as creative attack ideas within the basic options although they do not occur frequently).	Well-structured regarding the goal and presence of clear options to choose from, but ill-structured regarding the dynamic and not always predictable changes in the environment.
Task characteristics	Main task characteristics evoking the allocation of attention include task instruction, urban terrain, weather conditions, superiors, own troops, enemy, condition of required items (food, radio, vehicle, weapons, etc.) and binding regulations.	Main task characteristics evoking the allocation of attention include task instruction, used computer, visual representation of four-armed bandits in different colors and varying payoffs provided by different bandits.
Behaviors	Explore or exploit the given options.	Explore or exploit the given options.
Exploitation	Exploitation is favored when the current option (considering available human, material, and time resources) is believed to bring the troops closer to their military objective.	Exploitation is favored when the current option is believed to offer the highest payoff.
Exploration	Exploration is favored when the current option is not believed to bring the troops closer to their military objective and, instead, an alternative option is believed to be better.	Exploration is favored when an alternative option is believed to offer a higher payoff.
Required previous knowledge	Some, leaders need awareness of the basic principles of warfare and tactical options.	None, all participants were exposed to the same payoff instantiation for the first time.
End state	Typically ends when one party has achieved its military objective.	Ends after a predetermined number of trials (150).

TABLE 3 Descriptives and Spearman correlations among study variables ($N = 282$).

Variables		*M*	SD	1	2	3	4	5	6	7	8	9	10	11
1.	Exploration-exploitation performance	8,998	637											
2.	Gender[a]	0.07	0.26	−0.16**										
3.	Age	23.7	3.3	0.14*	0.00									
4.	Conscientiousness	3.82	0.51	−0.03	0.07	0.02								
5.	Emotional stability	3.73	0.53	0.16**	−0.14*	0.11	0.46**							
6.	Agreeableness	3.79	0.48	0.08	−0.03	0.00	0.31**	0.37**						
7.	Openness to experience	3.54	0.56	0.05	0.12*	0.06	0.19**	0.16**	0.21**					
8.	Extraversion	3.62	0.52	−0.02	0.05	−0.11	0.34**	0.31**	0.16**	0.31**				
9.	Stress	2.47	0.54	−0.13*	0.07	−0.17**	−0.31**	−0.55**	−0.09	−0.17**	−0.20**			
10.	Emotional states	3.20	0.60	−0.04	0.00	−0.03	0.21**	0.26**	0.16**	0.19**	0.21**	−0.26**		
11.	Task motivation	4.03	0.73	0.11	0.05	0.11	−0.03	0.06	0.08	0.26**	−0.04	−0.08	0.18**	
12.	Salience detection (msec.)[b,c]	−25	11.90	0.02	0.02	−0.00	0.07	0.01	0.05	0.01	−0.01	0.02	0.05	0.04
13.	Vigilance[b]	11.10	2.84	0.14*	−0.08	0.15*	0.13*	0.16**	0.08	0.25**	−0.01	−0.10	0.16**	0.19**
14.	Working memory[b]	27.40	6.96	0.25**	−0.08	0.04	0.02	0.04	0.02	0.06	−0.04	−0.06	0.09	0.19**
15.	Inhibition (msec.)[b,c]	−123.85	61.57	−0.04	0.01	−0.08	−0.07	−0.02	0.02	−0.03	−0.06	0.14**	−0.00	0.05
16.	Switching [b]	59.46	4.82	0.16**	0.08	0.18**	0.16**	0.14*	0.09	0.11	0.10	−0.10	−0.00	0.13*
17.	Cognitive flexibility[d]	-	-	0.43***	0.01	0.27**	0.24*	0.28**	0.06	0.35**	0.03	−0.19	0.22	0.45***
Variables				**12**	**13**	**14**	**15**	**16**						
13.	Vigilance			0.08										
14.	Working memory			0.11	0.19**	-								
15.	Inhibition (msec.)			0.12*	0.05	0.03								
16.	Switching			−0.00	0.18**	0.13*	−0.09							
17.	Cognitive flexibility [d]			0.08	-	-	−0.01	-						

[a]Gender: male = 0, female = 1. Sample includes 20 female participants. [b]Components of cognitive flexibility. [c]Msec., milliseconds, where a low number equals high performance. [d]For latent factors of cognitive flexibility including vigilance, working memory, and switching see factor loadings above. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

10.3389/fpsyg.2023.1167135

TABLE 4 Standardized effects of one-mediator path model (Proposition 1).

Model pathway	Direct effect	Indirect effect	*p*	95% CI
Emotional stability ➔ Cognitive flexibility ➔ Exploration-exploitation performance	0.045 ($p = 0.495$)	$0.244 \times 0.472 = 0.115$	0.003	52.218, 368.125

TABLE 5 Standardized effects of two-mediator path model (Propositions 2 and 3b).

Model pathways	Direct effect	Indirect effect	*p*	95% CI
Stress ➔ Emotional stability ➔ Cognitive flexibility	0.016 ($p = 0.862$)	$-0.584 \times 0.257 = -0.150$	0.004	−1.489, −0.212
Task motivation ➔ Cognitive flexibility ➔ Exploration-exploitation performance	−0.100 ($p = 0.234$)	$0.444 \times 0.544 = 0.242$	0.000	77.881, 421.539

flexibility and negatively with stress. However, it does not correlate with emotional states. Cognitive flexibility, in turn, correlates positively with age, emotional stability, emotional states ($p = 0.136$), and task motivation and negatively with stress ($p = 0.058$).

We will not test Proposition 3a as emotional states do not correlate with exploration-exploitation performance. We consider stress and task motivation as relevant for our sample, even if their correlations with exploration-exploitation and cognitive flexibility, respectively, are slightly below the 0.5 value of p threshold. There is very strong evidence for the notion that stress has a negative effect on human cognition and, overall, cognitive flexibility. We outlined a fraction of this evidence. Similarly, task motivation has been shown to influence decision-making across various contexts and samples.

We found further associations between our study variables. For instance, consciousness and openness to experience are correlated with cognitive flexibility and stress. Likewise, openness to experience is correlated with task motivation. While these findings provide insights into how personality and context-evoked antecedents are related and impact cognitive flexibility, they fall outside the theoretical scope of this article. Therefore, we will not consider them further.

Path models

We tested our propositions through one-mediator (Proposition 1) and two-mediator (Propositions 2 and 3b) path models using structural equation modeling with Amos SPSS 28 (see Collier, 2020; Arbuckle, 2021). We conducted a maximum likelihood estimation and report standardized regression coefficients to quantify the strength of the mediations within the two models as well as bootstrapping analysis with 5,000 random samples to test the indirect effects (Hayes, 2013).

The correlations between vigilance, working memory, and switching indicate the possibility of building a factor variable for cognitive flexibility through structural equation modeling (Collier, 2020; Arbuckle, 2021). According to recommendations in the field of strategic management (Hair et al., 2012) and psychology (Gong et al., 2020; Hu et al., 2021), factor loadings should lie above 0.50. This applied to vigilance and switching. However, a strong theoretical rationale and overall model fit can justify the inclusion of factor loadings between 0.30 and 0.40 (Brown, 2015; Smedslund et al., 2022). Theory and empirics (Miyake et al., 2000; Ionescu, 2012; Diamond, 2013) clearly support the notion that working memory is a component of cognitive flexibility, and our model fits were very good to excellent, including working memory. Vigilance showed a factor loading of 0.54 in the one-mediation analysis of Proposition 1, and 0.50 in the two-mediation analysis combining Propositions 2 and 3. Switching showed a factor loading of 0.52 (one-mediation) and 0.54 (two-mediation). And working memory showed a factor loading of 0.36 (one-mediation) and 0.36 (two-mediation).

We assessed the overall fit of the models based on the following indices (Hu and Bentler, 1999; Zyphur et al., 2023): chi-square statistic (χ^2), df, the standardized root mean square residual (SRMR) ≤ 0.08, the root mean square error of approximation (RMSEA) ≤ 0.06, the comparative fit index (CFI) ≥ 0.95, and the Tucker-Lewis index (TLI) ≥ 0.95.

First, we tested a path model in which age, emotional stability, stress, task motivation, and cognitive flexibility are directly associated with exploration-exploitation performance. This model provided an unsatisfactory fit to the data: $\chi^2(10, N = 282) = 148.013$, $p = 0.000$; SRMR = 0.132; RMSEA = 0.222, CFI = 0.348, TLI = −0.369. Note that no model referencing our propositions and including direct links to exploration-exploitation performance shows a satisfactory fit.

Second, we ran a path model to test Proposition 1, including the variables of age, emotional stability, cognitive flexibility, and exploration-exploitation performance. The fit of this model was very good: $\chi^2(6, N = 282) = 7.187$, $p = 0.304$; SRMR = 0.030; RMSEA = 0.027, CFI = 0.986, TLI = 0.966. The mediation effect showed that cognitive flexibility significantly mediates the relationship between emotional stability and exploration-exploitation performance ($\beta = 0.115$, $p = 0.003$; mediation path a and b) and there remains an insignificant direct effect of emotional stability on exploration-exploitation performance ($\beta = 0.045$, $p = 0.495$; mediation path c`). The bootstrap analysis showed that there is no zero in the 95% CI for the estimates, confirming a mediation effect (Preacher and Hayes, 2008; Proposition 1 accepted). Note that all effects reported in this results section are standardized. The mediation analysis of Proposition 1 is presented in Table 4 and Figure 6.

Third, we ran the two-mediation path model to test Propositions 2 and 3b, including the variables of age, stress, emotional stability, cognitive flexibility, task motivation, and exploration-exploitation performance. This model showed an excellent fit: $\chi^2(14, N = 282) = 10.742$, $p = 0.767$; SRMR = 0.027; RMSEA = 0.000, CFI = 1.000, TLI = 1.028. Considering Proposition 2, the results show that emotional stability significantly mediates the relationship between stress and cognitive flexibility ($\beta = -0.150$, $p = 0.004$; mediation path a and b) and that there is an insignificant (remaining) direct effect of stress on cognitive flexibility ($\beta = 0.016$, $p = 0.862$; mediation path c`). The bootstrap analysis additionally confirmed a mediation effect (Preacher and Hayes, 2008). Thus, although the initial correlation between stress and cognitive flexibility did not meet the 0.5 value of p,

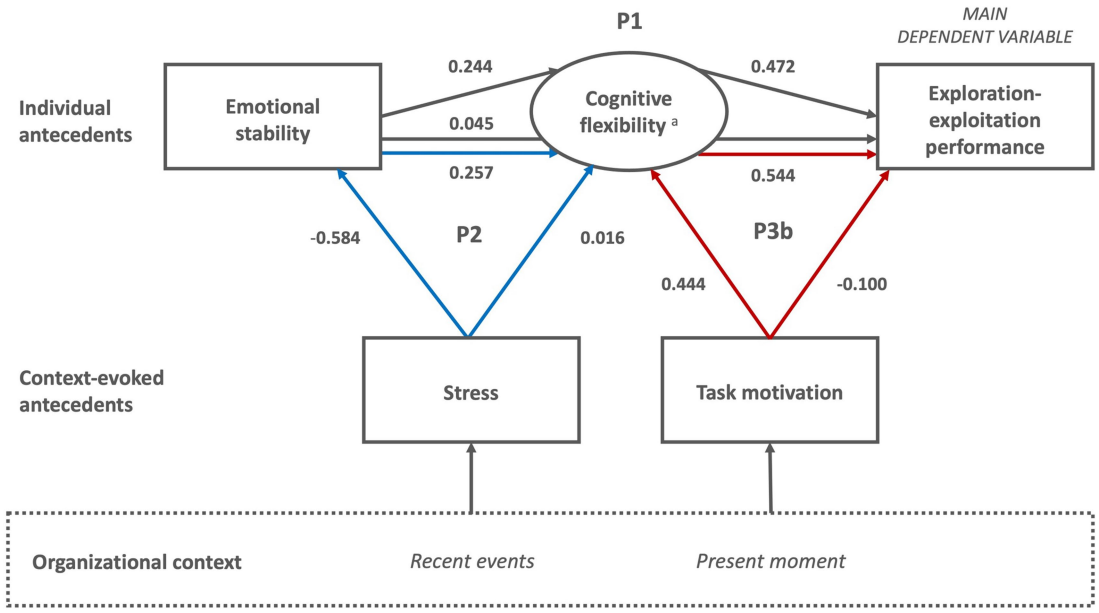


FIGURE 6
Integrative path-model of exploration-exploitation performance including results for the Propositions 1, 2, and 3b. [a]Cognitive flexibility is based on vigilance, working memory and switching. For simplicity, the control variable of age is not included into the figure. All shown parameters are standardized. All indirect effects are significant, and the direct effects insignificant representing full mediations.

the path model resulted in a full mediation (Proposition 2 accepted). Considering Proposition 3b, the results showed that cognitive flexibility mediates the relationship between task motivation and exploration-exploitation performance (β = 0.242, p = 0.000; mediation path a and b) and that there is an insignificant (remaining) direct effect of task motivation on exploration-exploitation performance (β = −0.100, p = 0.234; mediation path c`). The bootstrap analysis confirmed the mediation effect (Preacher and Hayes, 2008). Again, although the initial correlation between task motivation and exploration-exploitation did not meet the 0.5 value of p, the path model resulted in a full mediation (Proposition 3b accepted). The two-mediation path model for Propositions 2 and 3b is presented in Table 5 and Figure 6.

Based on guidelines (Gignac and Szodorai, 2016) for assessing beta weights on the individual level of analysis, the identified mediation effects are small (Proposition 1) to moderate (Propositions 2 and 3b). Hence, while being meaningful, the outlined mediation effects can only explain a small to moderate amount of variance in our model.

Robustness checks

To test the robustness of our findings, we conducted four additional analyses, all of which supported our results.

First, an alternative explanation to Proposition 1 is that emotional stability mediates the relationship between cognitive flexibility and exploration-exploitation performance. This mediation effect is clearly insignificant (p = 0.356).

Second, an alternative explanation to Proposition 2 is that stress affects cognitive flexibility under the condition of low emotional stability. We tested this assumption through a moderation analysis, which was clearly insignificant (p = 0.924). This means that emotional stability is a mediator as outlined in Proposition 2, not a moderator.

Third, the direct correlation between stress and exploration-exploitation performance might challenge the notion that stress affects such performance through cognitive flexibility as implied in Proposition 2. Hence, we included a direct link between stress and exploration-exploitation performance in the two-mediation analysis and found that this correlation disappears (r = −0.009, p = 0.896). This means that the direct correlation between stress and exploration-exploitation performance is based on the effect that stress has on cognitive flexibility, which then affects exploration-exploitation performance.

Fourth, we tested alternative explanations for the role of emotional states in our model. We excluded emotional states from Proposition 3 because they are not related to exploration-exploitation performance, contradicting a mediation effect. However, given the insignificant but noteworthy correlation between emotional states and cognitive flexibility (r = 0.22), we tested whether emotional stability mediates the relationship between emotional states and cognitive flexibility. This analysis led to an unsatisfactory model fit: $\chi^2(14, N = 282) = 32.919$, p = 0.003; SRMR = 0.054; RMSEA = 0.069, CFI = 0.877, TLI = 0.754. This finding provides support for the notion that emotional states play a subordinated role in the explanation of exploration-exploitation performance.

Fifth, we included gender in the one-mediation (Proposition 1) and two-mediation (Propositions 2 and 3b) analysis. This led to a just sufficient fit in the one-mediation [$\chi^2(3, N = 282) = 6.996$, p = 0.072; SRMR = 0.029; RMSEA = 0.069, CFI = 0.948, TLI = 0.741] and a good fit in the two-mediation [$\chi^2(8, N = 282) = 8.366$, p = 0.399; SRMR = 0.027; RMSEA = 0.013, CFI = 0.998, TLI = 0.994]. This means that our results also hold if we include the control variable of gender.

Our findings support our theoretical model, leading to the following conclusion: emotionally stable leaders perform better on exploration-exploitation decisions than their less emotionally stable counterparts. This advantage is based on the favorable effect that emotional stability has on cognitive flexibility (Proposition 1). Context-evoked stress occurring over a recent period of time has a negative effect on cognitive flexibility, as one might expect, but importantly, emotional stability decreases this detrimental effect (Proposition 2). Likewise, a leader's present task motivation positively affects exploration-exploitation performance, but this effect is fully mediated by cognitive flexibility (Proposition 3b). Interestingly, our results indicate that present emotional states are not related to exploration-exploitation performance. This finding suggests that present and positive affective signals only play a role if they are directly relevant to the task.

Discussion

Congruent with the Carnegie approach, our study examined a central issue in everyday organizational life: the need to dynamically switch between exploratory and exploitative decisions to adapt to the environment. Organizations must rely on leaders who manage exploration and exploitation in an adaptive way by making decisions appropriate to a given context at any moment in time.

We proposed a model that situates exploration-exploitation decisions in context. Drawing on March and Simon's (1958, 2004) view of a complex interaction between affective and cognitive processes, our integrative model included individual antecedents (i.e., personality and cognitive flexibility) as well as context-evoked antecedents with different time horizons that capture how leaders rely on affective signals to interpret the organizational context (i.e., stress, emotional states, and task motivation). We relied on a lab-in-the-field study to test our model with a sample of leaders taking part in training and practicing leadership skills within the Swiss Armed Forces. First, we identified cognitive flexibility as a central antecedent of exploration-exploitation performance, which mediates the positive effect that emotional stability has on exploration-exploitation performance. Second, we found that emotional stability plays an additional and very important role in exploration-exploitation: this personality antecedent mediates the negative effect of recent, task-unrelated stress on cognitive flexibility. Thus, emotional stability acts as a protective shield by thwarting the detrimental effect of negative context signals on leaders' cognition and, ultimately, on exploration-exploitation performance. Third, we found that present task motivation affects exploration-exploitation performance positively but indirectly through cognitive flexibility. This means that the motivation to conduct a certain task requiring exploration and exploitation favors the cognitive flexibility needed to show high performance in the corresponding decisions. Taken together, the results provide empirical evidence of leaders' adaptive exploration-exploitation decisions taking place in a truly situated manner: they leverage cognitive flexibility and specific personality antecedents to process helpful and potentially harmful context-evoked signals to achieve higher exploration-exploitation performance.

We make two contributions to the understanding of the antecedents of exploration-exploitation performance in organizations. First, we contribute to the Carnegie literature by putting forward and testing an integrative model that studies together individual and context-evoked antecedents that predict exploration-exploitation performance. In contrast to reductionist approaches, our model and statistical approach lay the foundations for explaining the complex interplay between different mechanisms behind adaptive behavioral responses to exploration-exploitation problems. To do so, the model considers variables that capture fundamental antecedents of human decisions in everyday organizational life that affect each other and jointly affect exploration-exploitation. The individual antecedents considered are personality and cognitive flexibility, and the context-evoking antecedents rely on variables related to how individuals' affective signals capture elements of the context over different time horizons. Some affective signals capture aspects of the recent past that are unrelated to the task environment. Our integrative approach shows that affective signals such as stress and task motivation can flaw and bias cognition or, on the contrary, capture important contextual cues, interact positively with cognition, and in turn lead to higher decision performance. We hope that this richer understanding of the antecedents of exploration-exploitation performance and their interactions in the setting of the Swiss Armed Forces can serve as the basis for future replications in other organizational settings.

Second, we contribute to psychology by putting context at the center of our model seeking to explain exploration-exploitation behavior. Organizational psychology suffers from a lack of research incorporating the role of context when explaining human behavior (Johns, 2018). The chosen lab-in-the-field approach allows us to combine the control of the lab with the realism of having participants respond to questions and tasks in their everyday setting over a long period of time—something that is fundamental when trying to capture context-evoked antecedents in a more realistic manner, favoring the external validity of our findings. Hence, our study provides further evidence for the notion that context and behavior are intrinsically linked through personality and cognition and that contextual factors are decisive for a better understanding of behavior in organizations. We shed further light on the role of perceived context by subdividing context-evoked antecedents according to their time horizon (recent past or present). Our findings show that recent, task-unrelated stress and present task motivation both influence behavior. However, present task-unrelated emotional states do not have an effect. This finding highlights the crucial role of motivation in activating cognitive flexibility and promoting vigilant switching between exploration and exploitation. Nevertheless, to make appropriate exploration-exploitation decisions in a periodically stressful environment, leaders must also overcome past pressures, focusing on the present and immediate priorities.

In addition, we hope that our study can serve as a basis for deriving practical implications. Our model presents antecedents that have a positive and negative impact on exploration-exploitation performance depending on contextual and individual conditions. While we do not claim that these findings are applicable to any organization, the rich picture that they paint of individual antecedents of adaptive exploration-exploitation behavior may guide organizations' reflections toward

improvements on both the individual and organizational levels. On the individual level, organizations could invest in the careful assessment of cognitive flexibility and emotional stability to select new leaders or promote existing leaders who already excel in these antecedents. Conversely, organizations can develop training programs for both their new and existing leaders to improve these antecedents through cognitive flexibility interventions (Buttelmann and Karbach, 2017). On the organizational level, it is possible to account for both the negative and positive effects of affective signals by implementing appropriate organizational designs and job roles that allow leaders to better cope with stressors and choose work tasks that motivate them. Furthermore, by cultivating the importance of self-awareness and emotional regulation, leaders can effectively prepare themselves for the critical moments of making exploration-exploitation decisions and transcend past pressures.

We are aware that the model we put forward presents only a limited representation of the myriad variables that make up a given context and might affect decision-making. In their writing, March and Olsen (1989, 1996) extended the notion of context to include broader social and cultural norms and values. We see at least four ways in which future studies could expand our efforts, which we outline below.

One, future studies could change the type of task to include more complex or even ill-structured tasks, which are vital for organizations (Baer et al., 2012). Most of the time, exploration-exploitation tasks are conceptualized and operationalized as well-structured tasks with predefined alternatives. However, exploration often involves not only choosing an unknown outcome but also coming up with an unknown alternative. Therefore, the antecedents we found in this study might not apply to ill-defined exploration-exploitation tasks. In contrast to our findings, or those of Laureiro-Martinez et al. (2019) and Bergenholtz et al. (2023) found no robust link between cognitive flexibility and exploration-exploitation performance. The reason for this finding might lie in the more complex tasks they used, to the point where cognitive flexibility could no longer play a positive role in performance. Clarifying this and identifying the boundary conditions for cognitive flexibility's influence on exploration-exploitation performance could have useful theoretical and empirical implications.

Two, we see promise in expanding the variables that are part of the context and might affect exploration-exploitation performance, hopefully increasing the effect sizes in our model. We see the possibility of doing this in a very controlled manner, by manipulating the context, or in a less-controlled manner, by developing methods that would allow the consideration of more context variables while still capturing dynamic responses to exploration-exploitation problems. Both approaches have important advantages. Control over the amount of change in a certain context-evoked variable is promising in terms of deriving practical implications and could lead to causal results. Capturing dynamic exploration-exploitation decisions, meanwhile, is promising in terms of understanding the processes that unfold and the "values" of the variables with more realism, without the effect of artificial manipulations or rather extreme external shocks to the context. Work along these lines will open opportunities to study how interactions with other individuals shape interpretations of the context. The question is whether the personality and cognitive variables identified in our findings would continue to affect exploration-exploitation performance in significant ways if, for example, the decisions are taken jointly with other individuals.

Three, a potentially more psychologically oriented future development lies in further clarifying the role of emotional states as context-evoked antecedents. In our study, positive emotional states did not affect exploration-exploitation performance and we could not reliably measure the effect of negative emotional states due to the lack of variance. Correlations between positive emotional states and emotional stability let us speculate that emotional stability also captures the effect of (positive) emotional states on exploration-exploitation and that emotional states do not represent optimal antecedents to capture context.

However, this is rather speculative, and we suggest testing that assumption on another sample with more variance in both emotional states to solidify the relation. Further studies could advance our starting model to better understand the links between the variables themselves. As an example, let us take the positive correlation between positive emotional states and task motivation found in our study. Since it has been shown in previous studies that emotion can either enhance or impair cognitive performance, in order to have a better understanding of how emotional states affect cognitive flexibility and exploration-exploitation, we could consider an additional factor: the strength or arousal of the stimulus in relation to its task relevance. So, for example, when arousal is "high" and the stimulus/manipulation is task-irrelevant, resources are more fully diverted toward the processing of the emotional item and, because the mobilization of resources is more pronounced, the effects on behavior are greater (Mather and Sutherland, 2011). Future studies could manipulate or use more detailed measures and better understand how different levels of these variables affect each other.

Four, an empirical test of our microfoundational model in a non-military context would allow elaboration on whether our findings apply to leaders operating in less hierarchical and regulated organizations (e.g., startups) than the Swiss Armed Forces. Relatedly, and building on our argument that context indirectly affects performance through affective signals, we consider it important to understand whether the interplay between positive and negative context-evoked and individual antecedents would differently influence adaptive responses to the exploration-exploitation tension. In our study, gender, or being a female leader, showed a negative correlation with exploration-exploitation performance. However, the proportion of female leaders in our sample (20 out of 282) does not allow for the generalization of this finding. Given that remarkable gender imbalance, further studies are needed to study if gender does have an effect on adaptive exploration-exploitation decisions.

In conclusion, this study emphasizes the importance of the interplay between individual and context-evoked antecedents for adaptive exploration-exploitation decisions. Cognitive flexibility affects exploration-exploitation performance most directly by mediating the positive effects of emotional stability and context-evoked task motivation. Emotional stability, in turn, mediates the negative effect of context-evoked stress on cognitive flexibility. We interpret these mediation effects as evidence that emotionally stable leaders regulate the detrimental effect of recent context-evoked stress to facilitate the effective use of cognitive flexibility in a given exploration-exploitation task. Likewise, cognitive flexibility is further enhanced by the motivation to perform the task.

Data availability statement

The datasets presented in this article are not readily available. This restriction is based on the approval of data use consented by the participants when they agreed to voluntarily participate in this study. Requests to access the datasets should be directed to DL-M, dlaureiro@ethz.ch.

Ethics statement

The study was approved by Prof. Lutz Wingert ETH Zurich, Ethics Commission, and conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in the study.

Author contributions

ZZ-U and DL-M conceived the study. JR, ZZ-U, and DL-M designed the empirical strategy and wrote the manuscript. JR collected the data and performed the statistical analyses. All authors contributed to the manuscript revision and read and approved the submitted version.

Funding

The study was funded by the Swiss National Science Foundation (application number 100013_185199) and ETH Zürich.

Acknowledgments

Many people supported this project with valuable contributions, and we would like to particularly express our gratitude to the following: Hans-Peter Walser of the Swiss Armed Forces and Hubert Annen of the Military Academy at the ETH Zurich (with extra thanks for facilitating access to the data); Professor Stefano Brusoni of the TIM Group at ETH Zurich; Sidonia Widmer and her team at the Aarau Recruitment Center of the Swiss Armed Forces; and the leaders of the involved officer schools: Dominik Belser and Philipp Thalmann (Tank and Artillery 22), Jörg Baumann and Marcel Winiger (Infantry 10), Toni Schmid (Air Force), and Michael Kaufmann (Leadership Support 30). Special thanks are owed to Remo Hertig for his proficient design of the behavioral measures and to Sebastian Niederberger, Eldad Davidov and Alina Gerlach for their helpful reviews. We also received useful comments from members of the TIM Group at ETH Zurich, the Ph.D. Workshop on Technology Management at Bocconi University in December 2021, the EAWOP in Katowice in May 2023, and the University of Maastricht. We would especially like to thank the Swiss National Science Foundation for the funding. Finally, we wish to express our grateful appreciation for the feedback from the editor and two reviewers.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Alessandretti, L., Lehmann, S., and Baronchelli, A. (2018). Understanding the interplay between social and spatial behaviour. *EPJ Data Sci.* 7:36. doi: 10.1140/epjds/s13688-018-0164-6

Allen, A. P., Kennedy, P. J., Cryan, J. F., Dinan, T. G., and Clarke, G. (2014). Biological and psychological markers of stress in humans: focus on the Trier social stress test. *Neurosci. Biobehav. Rev.* 38, 94–124. doi: 10.1016/j.neubiorev.2013.11.005

American Psychological Association Dictionary of Psychology. (2023). Emotion Available at: https://dictionary.apa.org/emotion (Accessed 18 September 2023).

Arbuckle, J. L. (2021). IBM SPSS Amos 28: User's Guide. Microsoft Corporation. Available at: https://www.ibm.com/docs/en/SSLVMB_28.0.0/pdf/amos/IBM_SPSS_Amos_User_Guide.pdf (Accessed 13 February 2023).

Augier, M., Dew, N., Knudsen, T., and Stieglitz, N. (2018). Organizational persistence in the use of war gaming and scenario planning. *Long Range Plann.* 51, 511–525. doi: 10.1016/j.lrp.2017.12.005

Baer, M., Dirks, K. T., and Nickerson, J. A. (2012). Microfoundations of strategic problem formulation. *Strateg. Manag. J.* 34, 197–214. doi: 10.1002/smj.2004

Bergenholtz, C., Vuculescu, O., and Amidi, A. (2023). Microfoundations of adaptive search in complex tasks: the role of cognitive abilities and styles. *Organ. Sci.* doi: 10.1287/orsc.2023.1654

Bibbey, A., Carroll, D., Roseboom, T. J., Phillips, A. C., and de Rooij, S. R. (2013). Personality and physiological reactions to acute psychological stress. *Int. J. Psychophysiol.* 90, 28–36. doi: 10.1016/j.ijpsycho.2012.10.018

Bleidorn, W., Schwaba, T., Zheng, A., Hopwood, C. J., Sosa, S. S., Roberts, B. W., et al. (2022). Personality stability and change: a meta-analysis of longitudinal studies. *Psychol. Bull.* 148, 588–619. doi: 10.1037/bul0000365

Borg, R. (2004). Memoir 44: Rules and battle scenarios. Available at: https://ncdn0.daysofwonder.com/memoir44/en/img/mm_rules_part1_en.pdf (Accessed 18 September 2023).

Breyer, B., and Bluemke, M. (2016). *Deutsche Version der Positive and Negative Affect Schedule PANAS (GESIS Panel)*. Zusammenstellung sozialwissenschaftlicher Items und Skalen (ZIS).

Brown, T. A. (2015). *Confirmatory factor analysis for applied research*. London: Guilford Publications.

Brusoni, S., Laureiro-Martínez, D., Canessa, N., and Zollo, M. (2020). Exploring exploration: the role of affective states as forces that hinder change. *Ind. Corp. Change* 29, 207–223. doi: 10.1093/icc/dtz070

Buttelmann, F., and Karbach, J. (2017). Development and plasticity of cognitive flexibility in early and middle childhood. *Front. Psychol.* 8:1040. doi: 10.3389/fpsyg.2017.01040

Campbell, J. P. (1990). "Modeling the performance prediction problem in industrial and organizational psychology" in *Handbook of Industrial and Organizational Psychology*. eds. M. D. Dunnette and L. M. Hough (Palo Alto, CA: Consulting Psychologists Press), 687–732.

Cohen, R. A. (2011). "Sustained Attention" in *Encyclopedia of Clinical Neuropsychology*. eds. J. S. Kreutzer, J. DeLuca and B. Caplan (New York: Springer), 2440–2443.

Collier, J. E. (2020). *Applied structural equation modeling using AMOS: basic to advanced techniques*. London: Routledge.

Cyert, R. M., and March, J. G. (1963). *A behavioral theory of the firm*. New Jersey: Prentice Hall/Pearson Education.

Dajani, D. R., and Uddin, L. Q. (2015). Demystifying cognitive flexibility: implications for clinical and developmental neuroscience. *Trends Neurosci.* 38, 571–578. doi: 10.1016/j.tins.2015.07.003

Derakshan, N., and Eysenck, M. W. (2010). Introduction to the special issue: emotional states, attention, and working memory. *Cognit. Emot.* 24, 189–199. doi: 10.1080/02699930903412120

DeYoung, C. G., Peterson, J. B., and Higgins, D. M. (2005). Sources of openness/intellect: cognitive and neuropsychological correlates of the fifth factor of personality. *J. Pers.* 73, 825–858. doi: 10.1111/j.1467-6494.2005.00330.x

Diamond, A. (2013). Executive functions. *Annu. Rev. Psychol.* 64, 135–168. doi: 10.1146/annurev-psych-113011-143750

Diefendorff, J. M., and Chandler, M. M. (2011). "Motivating employees" in *APA handbook of industrial and organizational psychology (vol. 3): Maintaining, expanding, and contracting the organization*. ed. S. Zedeck (Washington, DC: American Psychological Association), 65–135.

Dolan, R. J. (2002). Emotion, cognition, and behavior. *Science* 298, 1191–1194. doi: 10.1126/science.1076358

Eidgenössisches Department für Verteidigung, Bevölkerungsschutz und Sport (2023): Panzer/Artillerie Offiziersschule 22. Available at: https://www.vtg.admin.ch/de/organisation/kdo-ausb/lvb-pz-art/pzartos.html-news (Accessed 18 September 2023).

Feist, G. J. (2019). Creativity and the big two model of personality: plasticity and stability. *Curr. Opin. Behav. Sci.* 27, 31–35. doi: 10.1016/j.cobeha.2018.07.005

Field, A. (2013). *Discovering statistics using IBM SPSS statistics: and sex and drugs and rock "n" roll* (*4th* Edn.). Sage: Los Angeles, London, New Delhi.

Fink, G. (2016). "Stress, definitions, mechanisms, and effects outlined" in *Stress: concepts, cognition, emotion, and behavior*. ed. G. Fink (London: Elsevier), 3–11.

Forgas, J. P. (1995). Mood and judgment: The affect infusion model (AIM). *Psychol. Bull.* 117, 39–66. doi: 10.1037/0033-2909.117.1.39

Freund, P. A., Kuhn, J.-T., and Holling, H. (2011). Measuring current achievement motivation with the QCM: short form development and investigation of measurement invariance. *Pers. Individ.* 51, 629–634. doi: 10.1016/j.paid.2011.05.033

Furr, N. (2009). Cognitive Flexibility: the Adaptive Reality of Concrete Organization Change (Ph.D. dissertation, Stanford University). Available at: https://www.proquest.com/openview/ea91a4de772a302ab296a11b18b61926/1?pq-origsite=gscholar&cbl=18750 (Accessed 18 September 2023).

Gavetti, G., Levinthal, D., and Ocasio, W. (2007). Perspective — Neo-Carnegie: the Carnegie school's past, present, and reconstructing for the future. *Organ. Sci.* 18, 523–536. doi: 10.1287/orsc.1070.0277

Gignac, G. E., and Szodorai, E. T. (2016). Effect size guidelines for individual differences researchers. *Pers. Individ. Differ.* 102, 74–78. doi: 10.1016/j.paid.2016.06.069

Gneezy, U., and Imas, A. (2017). "Lab in the field: measuring preferences in the wild" in *Handbook of Economic Field Experiments*. eds. A. V. Banerjee and E. Duflo (Amsterdam: North Holland), 439–464.

Gong, Y., Wu, Y., Huang, P., Yan, X., and Luo, Z. (2020). Psychological empowerment and work engagement as mediating roles between trait emotional intelligence and job satisfaction. *Front. Psychol.* 11:232. doi: 10.3389/fpsyg.2020.00232

Hair, J. F., Sarstedt, M., Pieper, T. M., and Ringle, C. M. (2012). The use of partial least squares structural equation modeling in strategic management research: a review of past practices and recommendations for future applications. *Long Range Plann.* 45, 320–340. doi: 10.1016/j.lrp.2012.09.008

Håkonsson, D. D., Eskildsen, J. K., Argote, L., Mønster, D., Burton, R. M., and Obel, B. (2016). Exploration versus exploitation: emotions and performance as antecedents and consequences of team decisions. *Strateg. Manag. J.* 37, 985–1001. doi: 10.1002/smj.2380

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: a regression-based approach*. New York, NY: The Guilford Press.

Herrmann, P., and Nadkarni, S. (2014). Managing strategic change: the duality of CEO personality. *Strateg. Manag. J.* 35, 1318–1342. doi: 10.1002/smj.2156

Hirst, A. (2022). Wargames resurgent: the hyperrealities of military gaming from recruitment to rehabilitation. *Int. Stud. Q.* 66:sqac021. doi: 10.1093/isq/sqac021

Howlett, C. A., Wewege, M. A., Berryman, C., Oldach, A., Jennings, E., Moore, E., et al. (2021). Same room – different windows? A systematic review and meta-analysis of the relationship between self-report and neuropsychological tests of cognitive flexibility in healthy adults. *Clin. Psychol. Rev.* 88:102061. doi: 10.1016/j.cpr.2021.102061

Hu, L.-T., and Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Struct. Equ. Modeling* 6, 1–55. doi: 10.1080/10705519909540118

Hu, Y., Ye, B., and Tan, J. (2021). Stress of COVID-19, anxiety, economic insecurity, and mental health literacy: A structural equation modeling approach. *Front. Psychol.* 12:707079. doi: 10.3389/fpsyg.2021.707079

Humphreys, K. L., Lee, S. S., Telzer, E. H., Gabard-Durnam, L. J., Goff, B., Flannery, J., et al. (2015). Exploration-exploitation strategy is dependent on early experience: exploration-exploitation. *Dev. Psychobiol.* 57, 313–321. doi: 10.1002/dev.21293

Ionescu, T. (2012). Exploring the nature of cognitive flexibility. *New Ideas Psychol.* 30, 190–200. doi: 10.1016/j.newideapsych.2011.11.001

Johns, G. (2018). Advances in the treatment of context in organizational research. *Annu. Rev. Organ. Psych. Organ. Behav.* 5, 21–46. doi: 10.1146/annurev-orgpsych-032117-104406

Judge, T. A., and Zapata, C. P. (2015). The person–situation debate revisited: effect of situation strength and trait activation on the validity of the big five personality traits in predicting job performance. *Acad. Manage. J.* 58, 1149–1179. doi: 10.5465/amj.2010.0837

Kanfer, R., and Ackerman, P. L. (1989). Motivation and cognitive abilities: an integrative/aptitude-treatment interaction approach to skill acquisition. *J. Appl. Psychol.* 74, 657–690. doi: 10.1037/0021-9010.74.4.657

Kashdan, T. B., and Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. *Clin. Psychol. Rev.* 30, 865–878. doi: 10.1016/j.cpr.2010.03.001

Keller, T., and Weibler, J. (2014). Behind managers' ambidexterity—studying personality traits, leadership, and environmental conditions associated with exploration and exploitation. *Schmalenbach Bus. Rev.* 66, 309–333. doi: 10.1007/BF03396909

Kirchner, W. K. (1958). Age differences in short-term retention of rapidly changing information. *J. Exp. Psychol.* 55, 352–358. doi: 10.1037/h0043688

Kiss, A. N., Libaers, D., Barr, P. S., Wang, T., and Zachary, M. A. (2020). CEO cognitive flexibility, information search, and organizational ambidexterity. *Strateg. Manag. J.* 41, 2200–2233. doi: 10.1002/smj.3192

Krebs, R. M., and Woldorff, M. G. (2017). "Cognitive control and reward" in *The Wiley Handbook of Cognitive Control*. ed. T. Egner (Chichester, UK: John Wiley & Sons, Ltd), 422–439.

Laureiro-Martínez, D. (2014). Cognitive control capabilities, routinization propensity, and decision-making performance. *Organ. Sci.* 25, 1111–1133. doi: 10.1287/orsc.2014.0899

Laureiro-Martínez, D., and Brusoni, S. (2018). Cognitive flexibility and adaptive decision-making: evidence from a laboratory study of expert decision makers. *Strateg. Manag. J.* 39, 1031–1058. doi: 10.1002/smj.2774

Laureiro-Martínez, D., Brusoni, S., Canessa, N., and Zollo, M. (2015). Understanding the exploration-exploitation dilemma: an fMRI study of attention control and decision-making performance. *Strateg. Manag. J.* 36, 319–338. doi: 10.1002/smj.2221

Laureiro-Martinez, D., Brusoni, S., Tata, A., and Zollo, M. (2019). The manager's notepad: working memory, exploration, and performance. *J. Manage. Stud.* 56, 1655–1682. doi: 10.1111/joms.12528

Lerner, J. S., Li, Y., Valdesolo, P., and Kassam, K. S. (2015). Emotion and decision making. *Annu. Rev. Psychol.* 66, 799–823. doi: 10.1146/annurev-psych-010213-115043

Leutner, F., Ahmetoglu, G., Akhtar, R., and Chamorro-Premuzic, T. (2014). The relationship between the entrepreneurial personality and the big five personality traits. *Pers. Individ. Differ.* 63, 58–63. doi: 10.1016/j.paid.2014.01.042

Levens, S. M., and Phelps, E. A. (2008). Emotion processing effects on interference resolution in working memory. *Emotion* 8, 267–280. doi: 10.1037/1528-3542.8.2.267

Levinthal, D. A., and March, J. G. (1993). The myopia of learning. *Strateg. Manag. J.* 14, 95–112. doi: 10.1002/smj.4250141009

Lin, W.-L., Tsai, P.-H., Lin, H.-Y., and Chen, H.-C. (2013). How does emotion influence different creative performances? The mediating role of cognitive flexibility. *Cognit. Emot.* 28, 834–844. doi: 10.1080/02699931.2013.85419

Liston, C., McEwen, B. S., and Casey, B. J. (2009). Psychosocial stress reversibly disrupts prefrontal processing and attentional control. *Proc. Natl. Acad. Sci. U. S. A.* 106, 912–917. doi: 10.1073/pnas.0807041106

Luger, J., Raisch, S., and Schimmer, M. (2018). Dynamic balancing of exploration and exploitation: the contingent benefits of ambidexterity. *Organ. Sci.* 29, 449–470. doi: 10.1287/orsc.2017.1189

Mackworth, N. H. (1948). The breakdown of vigilance during prolonged visual search. *Q. J. Exp. Psychol.* 1, 6–21. doi: 10.1080/17470214808416738

Mallik, P. R., Metzger, M. M., Outen, M. K., Fogle, T., Wilson, J., and Lewis, S. (2020). Assessing differences in visual cognition between nongamers, moderate action gamers, and heavy action gamers: an alternative to extreme group designs. *J. Cogn. Enhanc.* 6, 514–518. doi: 10.1007/s41465-020-00169-1

March, J. G. (1994). *Primer on decision making: How decisions happen*. New York: The Free Press.

March, J. G., and Olsen, J. P. (1989). *Rediscovering institutions: the organizational basics of politics*. New York: The Free Press.

March, J. G., and Olsen, J. P. (1996). Institutional perspectives on political institutions. *Governance* 9, 247–264. doi: 10.1111/j.1468-0491.1996.tb00242.x

March, J. G., and Simon, H. A. (1958). *Organizations*. New York: Wiley.

March, J. G., and Simon, H. A. (2004). "From organizations: cognitive limits on rationality" in *The New Economic Sociology: A Reader*. ed. F. Dobbin (Princeton, New Jersey: Princeton University Press), 518–532.

Mather, M., and Sutherland, M. R. (2011). Arousal-biased competition in perception and memory. *Perspect. Psychol. Sci.* 6, 114–133. doi: 10.1177/1745691611400234

McCrae, R. R., and Costa, P. T. (1987). Validation of the five-factor model of personality across instruments and observers. *J. Pers. Soc. Psychol.* 52, 81–90. doi: 10.1037/0022-3514.52.1.81

Mehlhorn, K., Newell, B. R., Todd, P. M., Lee, M. D., Morgan, K., Braithwaite, V. A., et al. (2015). Unpacking the exploration–exploitation tradeoff: a synthesis of human and animal literatures. *Decision.* 2, 191–215. doi: 10.1037/dec0000033

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., and Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: a latent variable analysis. *Cogn. Psychol.* 41, 49–100. doi: 10.1006/cogp.1999.0734

Mom, T. J. M., Chang, Y.-Y., Cholakova, M., and Jansen, J. J. P. (2019). A multilevel integrated framework of firm HR practices, individual ambidexterity, and organizational ambidexterity. *J. Manage* 45, 3009–3034. doi: 10.1177/0149206318776775

Moore, A., and Malinowski, P. (2009). Meditation, mindfulness, and cognitive flexibility. *Conscious. Cogn.* 18, 176–186. doi: 10.1016/j.concog.2008.12.008

Murdock, K. W., Oddi, K. B., and Bridgett, D. J. (2013). Cognitive correlates of personality: links between executive functioning and the big five personality traits. *J. Individ. Differ.* 34, 97–104. doi: 10.1027/1614-0001/a000104

O'Reilly, C. A., and Tushman, M. L. (2004). The ambidextrous organization. *Harv. Bus. Rev.* 82, 74–81, 140.

Ocasio, W. (2011). Attention to attention. *Organ. Sci.* 22, 1286–1296. doi: 10.1287/orsc.1100.0602

Pertusa-Ortega, E. M., Molina-Azorín, J. F., Tarí, J. J., Pereira-Moliner, J., and López-Gamero, M. D. (2021). The microfoundations of organizational ambidexterity: a systematic review of individual ambidexterity through a multilevel framework. *BRQ Bus. Res. Q.* 24, 355–371. doi: 10.1177/2340944420929711

Pessoa, L. (2017). "Cognitive control and emotional processing" in *The Wiley Handbook of Cognitive Control*. ed. T. Egner (Chichester, UK: John Wiley & Sons, Ltd), 392–407.

Phelps, E. A., Lempert, K. M., and Sokol-Hessner, P. (2014). Emotion and decision-making: multiple modulatory neural circuits. *Annu. Rev. Neurosci.* 37, 263–287. doi: 10.1146/annurev-neuro-071013-014119

Piccolo, R. F., and Colquitt, J. A. (2006). Transformational leadership and job behaviors: the mediating role of core job characteristics. *Acad. Manage. J.* 49, 327–340. doi: 10.5465/amj.2006.20786079

Posen, H. E., and Levinthal, D. A. (2012). Chasing a moving target: exploitation and exploration in dynamic environments. *Manag. Sci.* 58, 587–601. doi: 10.1287/mnsc.1110.1420

Preacher, K. J., and Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav. Res. Methods* 40, 879–891. doi: 10.3758/BRM.40.3.879

Raisch, S., Birkinshaw, J., Probst, G., and Tushman, M. L. (2009). Organizational ambidexterity: balancing exploitation and exploration for sustained performance. *Organ. Sci.* 20, 685–695. doi: 10.1287/orsc.1090.0428

Rhoades, J. A., Arnold, J., and Jay, C. (2001). The role of affective traits and affective states in disputants' motivation and behavior during episodes of organizational conflict. *J. Organ. Behav.* 22, 329–345. doi: 10.1002/job.72

Schneider, E. E., Schönfelder, S., Domke-Wolf, M., and Wessa, M. (2020). Measuring stress in clinical and nonclinical subjects using a German adaptation of the Perceived Stress Scale. *Int. J. Clin. Health Psychol.* 20, 173–181. doi: 10.1016/j.ijchp.2020.03.004

Schwarz, N., and Bless, H. (2020). "Happy and mindless, but sad and smart? The impact of affective states on analytic reasoning" in *Emotion and Social Judgments*. ed. J. Forgas (London: Garland Science), 55–71.

Schwarz, N., and Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *J. Pers. Soc. Psychol.* 45, 513–523. doi: 10.1037/0022-3514.45.3.513

Sherman, G. D., Lee, J. J., Cuddy, A. J. C., Renshon, J., Oveis, C., Gross, J. J., et al. (2012). Leadership is associated with lower levels of stress. *Proc. Natl. Acad. Sci. U. S. A.* 109, 17903–17907. doi: 10.1073/pnas.1207042109

Shields, G. S., Sazma, M. A., and Yonelinas, A. P. (2016). The effects of acute stress on core executive functions: a meta-analysis and comparison with cortisol. *Neurosci. Biobehav. Rev.* 68, 651–668. doi: 10.1016/j.neubiorev.2016.06.038

Simon, H. A. (1967). Motivational and emotional controls of cognition. *Psychol. Rev.* 74, 29–39. doi: 10.1037/h0024127

Simon, H. A. (1997). *Administrative behavior: a study of decision-making processes in administrative organizations* (*4th* Edn.). New York: The Free Press.

Smedslund, G., Arnulf, J. K., and Smedslund, J. (2022). Is psychological science progressing? Explained variance in PsycINFO articles during the period 1956 to 2022. *Front. Psychol.* 13:1089089. doi: 10.3389/fpsyg.2022.1089089

Soldz, S., and Vaillant, G. E. (1999). The big five personality traits and the life course: a 45-Year longitudinal study. *J. Res. Pers.* 33, 208–232. doi: 10.1006/jrpe.1999.2243

Soto, C. J., and John, O. P. (2017). The next Big Five Inventory (BFI-2): Developing and assessing a hierarchical model with 15 facets to enhance bandwidth, fidelity, and predictive power. *J. Pers. Soc. Psychol.* 113, 117–143. doi: 10.1037/pspp0000096

Stoet, G. (2011). Sex differences in search and gathering skills. *Evol. Hum. Beh.* 32, 416–422. doi: 10.1016/j.evolhumbehav.2011.03.001

Tarba, S. Y., Jansen, J. J. P., Mom, T. J. M., Raisch, S., and Lawton, T. C. (2020). A microfoundational perspective of organizational ambidexterity: critical review and research directions. *Long Range Plann.* 53:102048. doi: 10.1016/j.lrp.2020.102048

Tripsas, M., and Gavetti, G. (2000). Capabilities, cognition, and inertia: evidence from digital imaging. *Strateg. Manag. J.* 21, 1147–1161. doi: 10.1002/1097-0266(200010/11)21:10/11<1147::AID-SMJ128>3.0.CO;2-R

Uddin, L. Q. (2015). Salience processing and insular cortical function and dysfunction. *Nat. Rev. Neurosci.* 16, 55–61. doi: 10.1038/nrn3857

Uddin, L. Q. (2021). Cognitive and behavioural flexibility: neural mechanisms and clinical considerations. *Nat. Rev. Neurosci.* 22, 167–179. doi: 10.1038/s41583-021-00428-w

Unsworth, N., Miller, J. D., Lakey, C. E., Young, D. L., Meeks, J. T., Campbell, W. K., et al. (2009). Exploring the relations among executive functions, fluid intelligence, and personality. *J. Individ. Differ.* 30, 194–200. doi: 10.1027/1614-0001.30.4.194

Van Iddekinge, C. H., Aguinis, H., Mackey, J. D., and DeOrtentiis, P. S. (2018). A meta-analysis of the interactive, additive, and relative effects of cognitive ability and motivation on performance. *J Manage.* 44, 249–279. doi: 10.1177/0149206317702220

Vujic, A. (2017). Switching on or switching off? Everyday computer use as a predictor of sustained attention and cognitive reflection. *Comput. Hum. Behav.* 72, 152–162. doi: 10.1016/j.chb.2017.02.040

Wang, Y., Chen, J., and Yue, Z. (2017). Positive emotion facilitates cognitive flexibility: an fMRI study. *Front. Psychol.* 8:1832. doi: 10.3389/fpsyg.2017.01832

WHO (2023). Stress. Available at: https://www.who.int/news-room/questions-and-answers/item/stress (Accessed September 18, 2023).

Xin, Y., Wu, J., Yao, Z., Guan, Q., Aleman, A., and Luo, Y. (2017). The relationship between personality and the response to acute psychological stress. *Sci. Rep.* 7:16906. doi: 10.1038/s41598-017-17053-2

Yang, H., Yang, S., and Isen, A. M. (2013). Positive affect improves working memory: implications for controlled cognitive processing. *Cognit. Emot.* 27, 474–482. doi: 10.1080/02699931.2012.713325

Zadra, J. R., and Clore, G. L. (2011). Emotion and perception: the role of affective information. *WIREs Cogn Sci* 2, 676–685. doi: 10.1002/wcs.147

Zmigrod, L., Rentfrow, P. J., and Robbins, T. W. (2020). The partisan mind: is extreme political partisanship related to cognitive inflexibility? *J. Exp. Psychol.* 149, 407–418. doi: 10.1037/xge0000661

Zyphur, M., Bonner, C., and Tay, L. (2023). Structural equation modeling in organizational research: the state of our science and some proposals for its future. *Annu. Rev. Organ. Psych. Organ. Behav.* 10, 495–517. doi: 10.1146/annurev-orgpsych-041621-031401

frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 27 February 2024
DOI 10.3389/fpsyg.2024.1144638

OPEN ACCESS

EDITED BY
Daniel A. Newark,
HEC Paris, France

REVIEWED BY
Scott Ganz,
Georgetown University, United States
Ozgecan Kocak,
Emory University, United States

*CORRESPONDENCE
Ishani Aggarwal
ishani.aggarwal@fgv.br

†These authors have contributed equally to this work and share first authorship

RECEIVED 14 January 2023
ACCEPTED 24 January 2024
PUBLISHED 27 February 2024

CITATION
Aggarwal I, Mayo AT, Murase T, Zhang EY, Aven B and Woolley AW (2024) Cognitive versatility and adaptation to fluid participation in hospital emergency department teams. *Front. Psychol.* 15:1144638. doi: 10.3389/fpsyg.2024.1144638

Cognitive versatility and adaptation to fluid participation in hospital emergency department teams

Ishani Aggarwal[1*†], Anna T. Mayo[2†], Toshio Murase[3], Evelyn Y. Zhang[4], Brandy Aven[5] and Anita Williams Woolley[5]

[1]Brazilian School of Public and Business Administration, FGV, Rio de Janeiro, Brazil, [2]Heinz College of Information Systems and Public Policy, Carnegie Mellon University, Pittsburgh, PA, United States, [3]School of Commerce, Waseda University, Tokyo, Japan, [4]Nanyang Business School, Nanyang Technological University, Singapore, Singapore, [5]Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, United States

Role-based frameworks have long been the cornerstone of organizational coordination, providing clarity in role expectations among team members. However, the rise of "fluid participation"—a constant shift in team composition and skill sets—poses new challenges to traditional coordination mechanisms. In particular, with fluid participation, a team's roles can oscillate between disconnected and intersecting, or between lacking and having overlap in the capabilities and expectations of different roles. This study investigates the possibility that a disconnected set of roles creates a structural constraint on the flexible coordination needed to perform in volatile contexts, as well as the mitigating role of cognitive versatility in a team's strategically-central member. Utilizing a sample of 342 teams from a hospital Emergency Department, we find that teams with a disconnected role set are less effective than teams with an intersecting role set as demonstrated by longer patient stays and increased handoffs during shift changes. Importantly, the presence of a cognitively versatile attending physician mitigates these negative outcomes, enhancing overall team effectiveness. Our findings remain robust even after accounting for other variables like team expertise and familiarity. This research extends the Carnegie School's seminal work on fluid participation by integrating insights from psychology and organizational behavior, thereby identifying key individual attributes that can bolster team coordination in dynamic settings.

KEYWORDS

Carnegie School, fluid participation, teams, cognitive style, roles, team composition

Introduction

As management scholars have established over the last several decades, any form of organizing must solve two fundamental and interlinked problems—the division of labor and the integration of effort (March and Simon, 1958; Puranam et al., 2014). The foundational work of the Carnegie School, including their major pillars of bounded rationality, routine-based behavior, and learning, has resulted in the adoption of many essential mechanisms for addressing these basic problems of organizing. Examples include the use of role-based structures (e.g., Bechky, 2006) and protocols or standard operating procedures (e.g., Faraj and

Xiao, 2006), which have served as important anchors for enabling the effective division and integration of labor in many organizational settings, particularly when groups need to assemble and respond to a range of planned and unplanned events.

However, it has become more challenging for traditional structures and routines to facilitate effective organizing given the increasing complexity of the environments organizations work within (Edmondson and Harvey, 2018). Many organizations began to adopt team-based forms of organizing in the 1980s in order to facilitate the adaptation needed to solve problems and carry out work, but scholars have noted a sharp increase in the fluidity of even these team structures, where the boundaries of a work unit are increasingly hard to identify and the problems of organizing more and more difficult to solve across an ever-changing cast of contributors (Humphrey and Aime, 2014; Mortensen and Haas, 2018; Mayo, 2022). The result can bear a strong resemblance to the organized anarchies articulated by Cohen et al. (1972), which are characterized, in part, by what they termed "fluid participation." Even in these more dynamic environments, research following Cohen et al.'s (1972) work has explored how organizational structures can support individuals' ability to adapt to the conditions of organized anarchy (Cohen et al., 2012). In adjacent literature, research on fluid participation in teams has similarly demonstrated the value of structural elements such as "structured role systems" (Bechky, 2006) or "de-identified role sets" (Valentine and Edmondson, 2015), whereby clear expectations for a defined set of roles (e.g., a nurse and physician in a healthcare setting) enable coordination despite fluid participation. However, the ever-increasing dynamism characterizing many work contexts renders even the practice of structured role sets inadequate, as fluid participation often comes with a changing skill set configuration across members (Bechky and Okhuysen, 2011; Mayo, 2022), and this could alter the extent to which roles overlap in the tasks that they could do, yielding what we refer to as a more-or less-connected role set.

Here we suggest that in light of the weakening of structural elements, such as roles and routines, traditionally relied upon to organize work, team members' individual characteristics are likely to become an increasingly important influence on a team's ability to coordinate effectively in the face of fluid participation. Specifically, we build on recent research to theorize that teams needing to adapt to fluid participation can benefit from team members' cognitive versatility, a quality characterizing individuals who have flexibility in thinking style for acquiring, organizing, and processing information (Ausburn and Ausburn, 1978; Aggarwal et al., 2019, 2023). The extant literature on cognitive styles has demonstrated the benefits of the ability to shift between cognitive styles for individual flexibility and adaptation to change (Kozhevnikov et al., 2014). Recent research also explored the benefits of individual cognitive versatility in the context of teamwork, finding that the presence of cognitively versatile members facilitates the task and social processes necessary for effective team information processing, leading to better performance (Aggarwal et al., 2023). We consider these observations alongside related work on team composition demonstrating the outsize influence of central or "core" team members (Humphrey et al., 2009), such that their characteristics are particularly influential for team outcomes (Mathieu et al., 2014; Emich et al., 2022). We integrate these arguments to theorize that the cognitive versatility of core members can enhance a team's ability to coordinate in the face of fluid participation, particularly under conditions that require a team to operate with a less-connected role set.

We test our theory related to the benefit of cognitively versatile members in a sample of 342 teams working in an Emergency Department (ED) in a medium-sized suburban hospital in the U.S. The *more-connected role set* for staffing teams on each shift included an attending physician, a nurse practitioner, and an average of seven nurses. However, in approximately half of the teams, there was not a nurse practitioner included, forcing those teams to operate with a *less-connected role set*. Even if the same number of team members were involved, the inclusion of the nurse practitioner role offered teams additional flexibility as members with that role can perform nursing duties as well as most of the duties of the attending physician (while working on a team supervised by an attending physician). Therefore, operating with a less-connected role set reduced the level of flexibility a team could exercise in their coordination. The results confirmed our predictions that less-connected role sets are associated with less team effectiveness as indexed by the efficiency of care teams provided, reflected in longer length of stay in the ED and the number of patients handed off to the next team during a staffing shift change. However, if a team's attending physician—considered to be the strategically-core member—was more cognitively versatile, the team provided more efficient care overall, and was less negatively affected by working with a less-connected role set compared to teams with less cognitively versatile attending physicians. Effects remained robust after accounting for other potential explanations, such as team-member familiarity and the attending physician's prior job experience, along with other team member characteristics shown to be beneficial to teamwork in prior studies. This work contributes to the Carnegie School tradition by identifying attributes of team members which can complement team structure to enable effective coordination.

Theoretical background

The Carnegie School, attention and fluid participation

Among the variety of foundational concepts emerging from the Carnegie School is "the notion that the organization of attention is a central process out of which decisions arise" (DiMaggio and Powell, 1991, p. 19). Indeed, early work within this tradition by Simon and March challenged dominant views of a rational choice model by introducing the concept of bounded rationality, which emphasized attentional limits that constrain our understanding of problems and solutions (March and Simon, 1958; Simon, 1997). As Simon writes, "rationality requires a choice among all possible alternative behaviors. In actual behavior, only a very few of all these possible alternatives ever come to mind" (Simon, 1997, p. 81). This attention to attention has had a wide-reaching influence that spans disciplines, impacting, for example, the study of cognitive biases and heuristics in individual decision making (e.g., Tversky and Kahneman, 1981; Bazerman and Moore, 2012) as well as the development of an attention-based view of the firm (Ocasio, 1997). Moreover, these ideas are foundational to the argument that organizational structures can guide our limited attention and thereby support coordination (March and Simon, 1958).

Like many others who picked up on the importance of attention, the concept was integrated into Cohen et al.'s (1972, p. 2) "garbage can model of organizational choice," in which the authors note the need to "understand the attention patterns within organizations." Influenced

by writings such as Lindblom's essay on "muddling through" (Lindblom, 1959), Cohen and colleagues departed from some of the Carnegie School's traditional assumptions of the rational decision-making model to introduce the notion of an "organized anarchy," characterized by goal ambiguity, solutions searching for problems, and fluid participation. In developing their theory, their fundamental insight was to disentangle solutions from problems and propose that—far from rational—decision-making is the result of the temporal coupling of participants, solutions, problems, and choice opportunities. Notably, fluid participation's contribution to organized anarchy is via the ways it limits the attention that participants can direct toward decisions (Ocasio, 2012) even in *stable* membership environments. Elements of the garbage can model have had a lasting impact on the subsequent study of decision-making, spanning disciplines from education to political science, public administration, management, and sociology (Jann, 2015), and it is still the focus of special issues of journals even 40 years after its introduction (Lomi and Harrison, 2012). However, most of the work building on the garbage can model has centered on mitigating or adapting to goal ambiguity (Cohen et al., 2012; Ocasio, 2012) while the role of fluid participation remains relatively under-developed (c.f., Ganz, 2021).

We argue that the concept of fluid participation has become increasingly important to understanding the challenges many organizations face, and particularly as it relates to teamwork. Organizational use of team structures accelerated starting in the 1980s as technological advances allowed for more rapid sharing of information that could support decentralized decision-making and thus more agile responses to complex and volatile environments (Malone, 2004). And as team structures become increasingly fluid, we see parallels between work demonstrating the support of intelligent action within an organized anarchy via structures to guide attention, as described in the garbage can model (e.g., see review in Cohen et al., 2012), and the benefits of mechanisms like role structures to guide attention in temporary teams with fluid participation (Bechky, 2006; Valentine and Edmondson, 2015). In drawing these parallels, we see an opportunity to further develop the original conception of fluid participation from the garbage can model and connect it with extant work on temporary, role-based teams that experience increasing fluidity in participation.

Fluid teams are characterized by changing sets of participants working on a shared task (Hackman and Wageman, 2004; Humphrey and Aime, 2014; Mortensen and Haas, 2018), where the number and configuration of skill sets vary over time (Mayo, 2022). Teams experience increasing fluidity in response to a variety of conditions, including labor shortages, conflicting priorities, double-booked schedules, or (un) scheduled absences from work. Even when a team has the usual number of members, sometimes the configuration of skills across members can vary, requiring team members to adapt their role structure. Thus, even when the required number of people and expertise is available, the coordination patterns need to change if, for example, a team now has one team member handling some tasks that used to be done by two different team members, or if different tasks that were done together by one member now need to be separated and handled by different members. Given this state of work in many organizations, in the parlance of the garbage can model, decisions might arise from the confluence of fluid participation and the loosely coupled choice opportunities (e.g., the need to allocate attention given who is currently available), problems (e.g., the need to reconfigure coordination due to changing role sets) and the available solutions (e.g., as identified based on the cognition of whoever happens to be involved in the work at that given time). In building on extant work to seek solutions to facilitate adaptation to the current state of "anarchy" and thus support more intelligent action (e.g., see review in Cohen et al., 2012) in fluid teams, we draw on research in adjacent literatures including psychology and organizational behavior to further identify ways teams can adapt to changing role structures. In doing so, we draw on work on the features of team design that can guide attention, specifically team composition.

Team composition: cognitive versatility in the strategic core

A team's composition, or the mix of its members, is one of the key levers available for impacting the team's processes and thereby team effectiveness (Bell et al., 2018). Studies in this area generally consider how the combination of team members' attributes (including demographic characteristics as well as other personal traits) influence team effectiveness (e.g., Loyd et al., 2013; Riedl et al., 2021; Emich et al., 2022). Research on team composition has developed over several decades and has evolved from considering strictly task-relevant abilities to considering other traits and characteristics that affect team collaboration (Mathieu et al., 2014). Extant work has examined a variety of individual characteristics considered to be relatively stable traits that influence behavior across situations, such as personality, or cultural values, and more recently attention has turned to cognitive style. Cognitive styles capture stable tendencies in how individuals "acquire, organize and process information" (Ausburn and Ausburn, 1978; Aggarwal et al., 2019). Cognitive styles can drive how people learn and the approaches they take to problem-solving, including the solutions they conceptualize (e.g., see Kozhevnikov et al., 2014) and the ways they coordinate with team members (Aggarwal and Woolley, 2013), making them a significant influence in many areas of work. One framework developed initially by cognitive neuroscientists identifies three distinct cognitive styles (object visualization, spatial visualization, and verbalization) that affect an individual's facility with, and preference for, distinct ways of encoding, presenting, and processing information (Kozhevnikov et al., 2002). As summarized by Kozhevnikov et al. (2014), individuals who are strong in object visualization think more holistically, processing and communicating information by using detailed pictorial images of objects. In contrast, those who are strong in spatial visualization are more analytical than holistic in their thinking, processing and communicating information with images, but with an emphasis on the spatial relations among parts of the whole. Lastly, those strong in verbalization are also more-analytical thinkers and also break information down into parts and their relations, but they tend to encode, process, and express it verbally rather than in images, facilitating processes such as analogical reasoning. Cognitive styles have been shown to emerge in early childhood based on innate tendencies, which are reinforced by associated choices of hobbies, school coursework, and occupation (Blajenkova et al., 2006; Kozhevnikov et al., 2010).

Initial research on cognitive styles in teams explored the impact of having members with diverse cognitive styles, finding that a mix of cognitive styles was essential for problem-solving (Woolley et al.,

2007) and that cognitive style diversity among members enhanced teamwork by providing cues to complementary strengths and facilitating the development of transactive memory systems (Aggarwal et al., 2019). It is also the case that team cognitive style diversity can create coordination difficulties by reducing strategic consensus (Aggarwal and Woolley, 2013) and, if not managed well, maintains a non-monotonic, inverted-U shaped relationship with collective intelligence such that the benefits of a moderate level of cognitive style diversity are reversed at the highest levels (Aggarwal et al., 2019).

Furthermore, where possible, coaching interventions to help teams make use of their complementary strengths can facilitate high performance, even in highly cognitively diverse teams (Woolley et al., 2008). However, coaching a team effectively requires more stability in team membership than is the reality in a growing number of work contexts (Mayo, 2022). Consequently, some have turned to considering other qualities of team members themselves that might help teams benefit from the diverse skills of members. One related area of research has considered whether within-team diversity might be facilitated by within-person cognitive diversity, building on studies demonstrating that some individuals exhibit flexibility in cognitive style, also termed cognitive versatility (Aggarwal et al., 2023). As observed by Kozhevnikov et al. (2014), an individual's diversity and flexibility in cognitive styles can lead them to be able to adapt to and learn in different situations. Across a variety of studies examining within-person or intrapersonal diversity, research demonstrates that individuals who are more intrapersonally diverse facilitate collaboration and performance within diverse teams (e.g., Bunderson and Sutcliffe, 2002; Mok and Morris, 2010; Lu et al., 2022) even when they do not share specific diversity traits in common with other members (Jang, 2017). This seems to occur, in part, because they themselves are more flexible and creative, as extant research has demonstrated that cognitive versatility is associated with creativity (Meneely and Portillo, 2005; c.f., Ho and Kozhevnikov, 2023) as well as efficiency in problem solving due to an ability to adapt one's strategies to a given situation (for review, see Kozhevnikov, 2007). In addition, recent research demonstrates that the presence of cognitively versatile individuals enhances social integration in teams, leading teams to experience less task and process conflict, and better team performance (Aggarwal et al., 2023). Taken together, the evidence suggests that teams benefit from the presence of cognitively-versatile members who are more flexible and creative in solving problems as well as able to convey ideas and plans in ways that facilitate the comprehension and cooperation of diverse team members. However, since most individuals operate predominantly with one cognitive style (Kozhevnikov et al., 2014), it is unlikely that organizations can create teams with members who are all cognitively-versatile. Thus an important question is how many of these members are needed, or is there a way to use these unusual contributors to best effect?

We consider the question of how best to use cognitively-versatile members by integrating literature on team composition with related work that examines team structure using a network lens. Specifically, research over the last decade or so suggests that teams working in dynamic environments often organize into patterns around one or a small group of members who, from a networks lens, are central to the work and information flow, typically involving decision-making authority (Ancona and Bresman, 2007; Humphrey et al., 2009). Such members are considered strategically "core" members, and often coordinate with a variety of "peripheral" members who contribute in more narrow or specialized ways to collective work. A variety of studies have demonstrated that the characteristics of core members can have an outsize impact on teamwork and effectiveness (Humphrey et al., 2009; Mathieu et al., 2014). For example, Pearsall and Ellis (2006) found that the assertiveness of core members had a significant influence on the performance of student teams completing a decision-making simulation, whereas the assertiveness of non-core members did not. Similarly, in a study of Major League baseball teams, Humphrey et al. (2009) found that the career experience of pitchers and catchers—the two roles involved in almost every defensive play in a game—was more strongly related to overall team performance than the career experience of other players on the field. Conversely, just as some attributes of core members can have a large positive impact on team outcomes, other attributes can have an outsized negative impact. For instance, in a study of National Basketball Association teams, those with more-narcissistic point guards (i.e., the position often most central to a team's offense) exhibited significantly worse coordination, as well as less improvement in coordination over time with increased team familiarity, compared to teams whose point guards were less narcissistic (Grijalva et al., 2020).

Connecting these findings demonstrating the influence of core member characteristics with the evidence of the benefits of member cognitive versatility, we propose that the cognitive style versatility of core team members will be particularly influential for team effectiveness in dynamic settings, especially settings requiring adjustment to changes in role sets.

Adapting to fluid participation

The research on cognitive versatility, discussed above, demonstrates a variety of potential benefits to including such individuals on teams, and we have further argued that cognitive versatility could be particularly helpful for core team members. We extend this line of reasoning further to suggest that a core member's cognitive versatility may be especially beneficial in settings involving fluid participation that affects the role sets within teams.

As mentioned in the introduction, it has become increasingly common for organizations to use roles as an organizing mechanism (Okhuysen and Bechky, 2009), whereby roles provide individuals with clear expectations for their own work and an understanding of their interdependencies with other roles. Clearly defined role sets can allow for coordination despite fluid participation in that specific people may come and go so long as each requisite role is filled (Bechky, 2006; Valentine and Edmondson, 2015). However, just as changes in membership can cause difficulties in teamwork (e.g., see Lewis et al., 2007), changes in the configuration of member skills, leading to changes in the role set, can also disrupt teamwork. Even when the requisite number of members with the necessary skills are present, a change in the configuration of skills across members can lead to the reconfiguration of the role set, which contributes an additional source of disruption. While any change could create difficulty, we contend that when individuals are frequently reassigned to new temporary teams, teams formed with intersecting role sets, with overlap in the capabilities and expectations of different roles, can be particularly disruptive relative to more disconnected role sets (see Figure 1).

Panel **A**: Disconnected Role Set

	Task 1	Task 2	Task 3	Task 4
Role 1, Person A	X	X		
Role 2, Person B			X	X
Role 2, Person C			X	X
Role 2, Person D			X	X

Panel **B**: Intersecting Role Set

	Task 1	Task 2	Task 3	Task 4
Role 1, Person A	X	X		
Role 2, Person B			X	X
Role 2, Person C			X	X
Role 3, Person D		X	X	

FIGURE 1
Illustrations of teams disconnected and intersecting role sets. The teams illustrated in Panels **(A,B)** have the same team size and both can accomplish the full set of Tasks 1–4. However, in Panel **(A)**, Roles 1 and 2 have no overlap in the tasks they can do. In Panel **(B)**, Roles 1 and 3 have overlap in their ability to do Task 2, while Roles 2 and 3 also have overlap in their ability to do Task 3.

Intersecting role sets include built-in coordination and adaptation mechanisms by creating more opportunities for backup behaviors, whereas disconnected role sets lack these connections and make backup behavior by team members less likely (Porter, 2005; Bechky and Okhuysen, 2011).

A disconnected role set may be particularly likely to affect the work of the core member of the team, who must navigate the bulk of coordination demands and yet no longer has the same structural flexibility available for task delegation. We theorize, though, that the negative impact of a disconnected role set just described can be mitigated by the presence of a cognitively versatile member in the team's core position. As discussed above, cognitively versatile core members can enhance team effectiveness as a result of their abilities to think flexibly. They may be able to identify solutions such as re-prioritizing tasks or re-deploying physical resources—solutions other than those related to task-delegation—that could facilitate adaptation to dynamic and demanding work settings. Thus, in dealing with a disconnected role set that is disruptive in part because it limits structural flexibility, cognitively versatile members occupying core roles can offer another mechanism (cognitive flexibility rather than structural flexibility) for flexibly responding to the dynamic environment, thus mitigating the negative impact of missing a role.

Taken together, in the study presented below we will test the following hypotheses:

> *Hypothesis 1*: The core member's (attending physician's) cognitive style versatility is positively associated with team effectiveness.
>
> *Hypothesis 2*: A disconnected role set (i.e., lacking a nurse practitioner) is negatively associated with team effectiveness.
>
> *Hypothesis 3*: The negative relationship between a disconnected role set (i.e., lacking a nurse practitioner) and team effectiveness is mitigated by the team's core member's (attending physician's) cognitive style versatility.

We test these hypotheses in a field study conducted in an emergency department of a community hospital, a dynamic setting with fluid participation. Below, we introduce our research setting and study design before presenting our analyses and discussing related implications for future research.

Methods

Research setting and sample

Data for this study come from a 12-bed emergency department (ED) in a community hospital on the West coast of the United States. Data were collected over a period of 5 months during the first half of 2011. Patients visiting this ED were treated by teams consisting of one attending physician, several nurses (average per team = 7), and, for some shifts, one nurse practitioner. As is typical of scheduling in many EDs, physicians and nurses are scheduled in overlapping shifts to facilitate continuity of care for patients by mixing providers who are familiar with current cases with those just starting their shift. For the purposes of defining the teams we use as our unit of analysis for this study, we carve each 24 h period into 4 blocks, demarcated by the shift changes involving some providers, and consider the set of providers working together during a given block of time as a "team" (see Figure 2; each column indicates one team) and account for the overlap/lack of independence of different teams resulting from the carryover of members in our analyses (as we address further in the "Results" section). Defined in this manner, our dataset includes seven physicians working on a total of 342 teams. Individuals working a particular shift 1 day did not necessarily work the same shift subsequently, such that the individuals composing each team varied and the familiarity of team members varied from team to team.

Team composition

Of note, in this setting, as in many other hospitals, staffing is planned based on anticipated demand, and shifts that were expected to be busier were more likely to include NPs. In this setting, that meant that the nurse practitioner (NP) position was typically staffed on shifts between noon and 7 pm. Additionally, just as NPs were assigned when demand was expected to be higher, so, too, were nurses, such that the number of nurses tended to be greater when the NP position was staffed. This lack of random assignment raises a concern for the current study. Namely, any observed effect of the NP on our outcomes of interest could be driven not by the *role* of the NP but by having

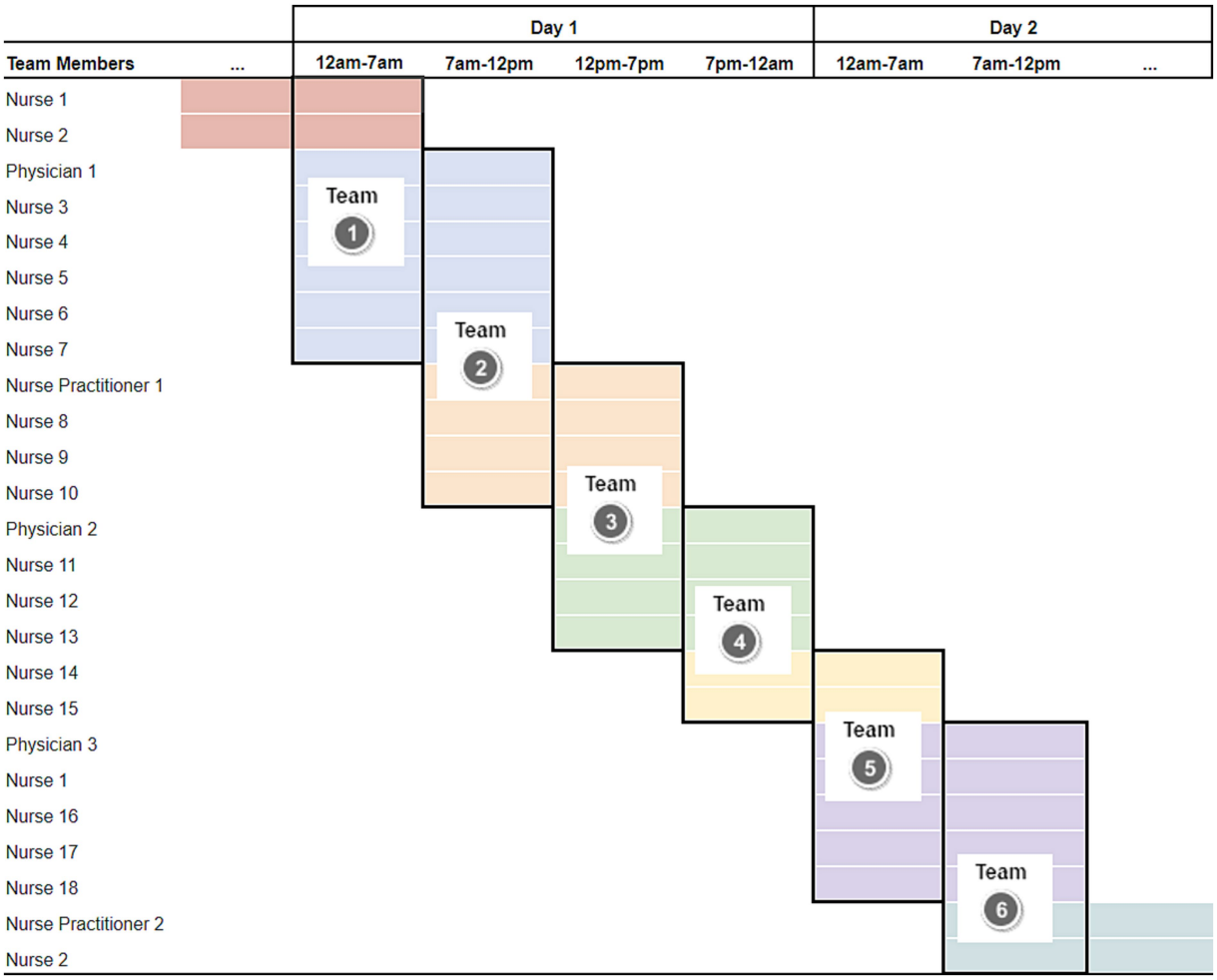


FIGURE 2
Illustration of approach for defining teams for analysis based on shift schedules. Black outlines within each column indicate members of a team. Different color shading indicates different 12-h shifts. Individuals can repeat in the data. For instance, Nurse 1 appears in teams 1, 5, and 6.

more labor available (from the NP themselves or more nurses). That said, our data allow for a couple of steps to address this empirically, from control variables in our main analyses to a robustness test that employs a coarsened exact matching approach to balance the sample with regard to the number of nurses (as well as the team's total number of patients). We elaborate on these steps where relevant in our reporting of the results.

Measures

The data for the study come from a combination of hospital scheduling records, patient health records, as well as surveys completed by attending physicians.[1]

Disconnected role set (lacking a nurse practitioner)

While all hospital shifts included an attending physician and several nurses, about 50% of the shifts also included a nurse practitioner NP. The nurse practitioners (NPs) were staffed at times of expected higher patient volumes to ease the burden on the team's attending physician; similarly, more nurses tended to be staffed during these shifts of higher anticipated patient volume. Regardless of the role configuration, the team members had to work interdependently in providing patient care.

While the three roles were distinct, there was overlap in what the roles could do when an NP was present, as the NPs were trained initially as nurses and could do many tasks that a physician otherwise would do. In contrast, when teams lacked an NP, the roles of attending physician and nurse had little overlap in the tasks they could and were expected to do. We thus considered this role configuration without an NP to reflect a *disconnected role set*. These teams with a disconnected role set had less structural flexibility in the way that tasks could be delegated. Using hospital scheduling records, we created a *disconnected role set* variable for each team which was coded as 1 when the team lacked an NP and 0 when the team included an NP.

1 Non-physician roles were also surveyed on two occasions; however, there are a substantial number of these non-physicians for whom surveys were not administered.

TABLE 1 Descriptive statistics and correlations.

				Correlations								
		M	SD	1	2	3	4	5	6	7	8	9
1	Core member cognitive style versatility (reverse of the standard deviation)	−3.73	1.50									
2	Disconnected role set (1 = no NP)	0.50	0.50	0.00								
3	Avg. ALOS	−0.04	0.38	**−0.16**	−0.10							
4	Patients handed off	7.78	4.27	**−0.30**	**−0.42**	**0.56**						
Controls												
5	Number of nurses	7.06	2.08	0.01	**−0.85**	0.10	**0.35**					
6	Patients carried over from prior team	7.11	4.26	**0.23**	**−0.50**	**0.18**	**0.16**	**0.43**				
7	Admissions	14.16	7.24	**−0.26**	**−0.67**	**0.24**	**0.79**	**0.54**	**0.17**			
8	Average typicality of admissions	111.57	21.77	−0.05	−0.08	0.00	−0.02	0.06	0.00	0.00		
9	Team's 28-day familiarity	8.14	2.53	**0.47**	**0.46**	−0.10	**−0.48**	**−0.41**	0.01	**−0.55**	0.01	
10	Core member cognitive style strength (mean)	47.61	1.50	−0.50[a]	0.00	**0.17**	**0.29**	0.08	**−0.15**	**0.22**	**−0.13**	**−0.29**
11	Core member social perceptiveness	25.65	5.65	−0.43[a]	0.00	0.01	**0.12**	−0.01	**−0.17**	**0.16**	0.08	**−0.27**
12	Core member conscientiousness	5.78	1.33	0.62[a]	0.00	**−0.12**	**−0.23**	−0.05	**0.20**	**−0.20**	**0.11**	**0.29**
13	Core member experience (Years)	19.46	12.5	0.32[a]	0.00	0.01	**−0.16**	0.03	**0.25**	**−0.24**	−0.04	**0.44**

Bolded coefficients are significant at $p < 0.05$. $N = 342$ unless otherwise indicated; [a]$n = 7$ for intercorrelations of core member attribute control variables with core member cognitive versatility. Intercorrelations among core member attribute control variables (9–12) are not shown due to the small sample at the individual level (vs the team-level analysis).

Core member cognitive versatility

For each of these teams, we considered the attending physician to be the "core" team member because they had the ultimate decision-making authority in this setting and were involved in every case their team handled. Each attending physician in the sample completed the 45-item Object-Spatial Imagery and Verbal Questionnaire (OSIVQ; Blazhenkova and Kozhevnikov, 2009) assessing their strength on the object visualization, spatial visualization, and verbalization cognitive styles. We computed the standard deviation of each attending physician's scores across the three cognitive style dimensions measured by the OSIVQ to capture the extent to which the attending physician on each team exhibited varied versus similar levels of facility across cognitive styles. We transformed this measure for each individual by multiplying it by −1 so that higher scores indicate greater *core member cognitive versatility*, and we report these scores in Table 1.[2]

Team effectiveness

In an ED, a common indicator of performance is the total time elapsed between when a patient arrives and when they are discharged, as this measure is strongly correlated with patient outcomes (Casalino et al., 2012; Valentine and Edmondson, 2015). Since a patient's primary diagnosis plays a large role in influencing how long a patient stays in the ED (as more complicated problems would require a longer stay), this time must be interpreted in the context of the patient's diagnosis to create a measure of *adjusted length of stay (ALOS)*, where the time for a given patient is normalized based on the average for patients with the same diagnosis. Based on patient health records, we calculated each team's *average adjusted length of stay* based on all the patients the team admitted.[3] As calculated, lower scores signal higher team effectiveness, as they indicate more efficient treatment compared to patients with similar diagnoses. As an additional performance indicator, we also calculated the *number of patients handed off* to the next team, as these are cases that the team initiated but did not resolve before the team was reconstituted due to a shift change. While the overlapping work schedules of doctors and nurses meant that some team members remained involved with the case, the introduction of new providers in a healthcare setting always increased the risk of error either as a result of omitted details in the hand-off and/or gaps in coordination within the newly constituted team, even if some of the original providers remained involved in the case. Therefore, best practices in healthcare often include avoiding handoffs across shifts as much as possible, thus handing off more cases to the next team can be a signal of less effective teamwork.

2 A substantial literature on cognitive versatility includes considerable debate about how it is best measured (Sadler-Smith, 2009). In recent work examining cognitive versatility in teams, team-level cognitive versatility was indexed based on the number of members whose scores exceeded a specific threshold on more than one cognitive style dimension, where the number of members meeting those criteria served as one indicator of team-level cognitive versatility (Aggarwal et al., 2023). By contrast, here we focus on the impact of the level of cognitive versatility of one specific team member, the core role holder, and theorize benefits related to higher (versus lower) levels of the cognitive versatility exhibited by that individual. Therefore, we use a continuous measure based on the standard deviation across the three dimensions to enable us to accurately capture the level of cognitive versatility of the core member of each team. We also replicated our effects using the coefficient of variation, which some have suggested is particularly well-suited for questions of asymmetrical dispersion (Bedeian and Mossholder, 2000; Harrison and Klein, 2007) – a pattern that is of theoretical interest to us. Results are consistent in direction and significance when using this alternative measure.

3 Some patient stays in the ED extended across multiple teams; we attribute length of stay for a patient to the team that first saw the patient in the ED, as the initial diagnostic and care plan this team originates has a large influence on how efficiently a case is handled overall.

Control variables

We controlled for a number of variables in our analyses that could be alternative explanations for the relationships observed. First, we controlled for a series of attributes of the core member (attending physician) that are often correlated with performance in extant research.[4] These included *conscientiousness*, measured here using the TIPI (Gosling et al., 2003); *social perceptiveness*, measured with the "Reading the Mind in the Eyes" test (Baron-Cohen et al., 1985); and *experience*, assessed as the individual's self-reported years spent working as an attending physician. In addition, as is recommended practice when analyzing the effect of a measure of variation, we also controlled for the combined mean of a physician's scores on the three cognitive styles, termed *core member cognitive strength*.

In addition, we controlled for a series of team-level variables demonstrated to influence team effectiveness in prior work. We controlled for the team's *familiarity* (Reagans et al., 2005), calculated as the average number of teams on which each dyad worked together in the past 28 days, as team familiarity is often associated with team performance.[5] We also controlled for factors affecting the team's workload including the *number of patients carried over from the prior team* (patients that were admitted by a prior team but not yet discharged out of the ED, either home or to the inpatient unit) and the *number of admissions* (patients admitted to the ED during the team's shift together). Along with these we controlled for the total *number of nurses* on the team as well as the presence of other staff supporting the team during their work such as an *ED technician*, *nurse assistant*, and *patient ambassador* (each coded 1 if present, 0 if absent) as having more support staff can reduce team workload. We also controlled for another factor that can affect workload, the *average case typicality of admitted patients* for each team, based on the frequency with which the primary diagnostic categories of the patients treated by a particular team were observed in the dataset during the timeframe of the study. Case typicality provides an important complement to overall workload and ALOS since dealing with more atypical or unfamiliar diagnoses offers a different challenge to a healthcare team than dealing with a large number of cases or with cases that are complex but familiar.

Finally, we included fixed effects for whether the team was working at *night* (7-midnight and midnight-7 am = 1; else = 0), as well as the team's *weekday* and *month* to account for related variations in the types of cases handled in the ED (e.g., weather-related accidents, flu season, etc.).

Results

Descriptive statistics and correlations are reported in Table 1. We estimated a series of Mixed Effects (or Random Coefficient) Models that include random effects for the physicians; we did so using R's lmer function (see Table 2).[6] In all of the results reported, we test the hypothesized effects on both of the team effectiveness measures described — *number of patients handed off (handoffs)* and average *adjusted length of stay (Avg. ALOS)*, where for each variable, lower scores are better, indicating greater team effectiveness.

First, we find that, once controlling for other individual differences, above and beyond those other individual differences, the core member's cognitive versatility is associated with fewer handoffs to the next team (Table 2, Model 1; $B = -0.76$, $p < 0.001$) and a shorter average ALOS for the patients the team admitted (Model 5; $B = -0.11$, $p = 0.001$).[7] This supports Hypothesis 1.

Second, we find that having a disconnected role set is associated with more handoffs (see Table 2, Model 1; $B = 3.23$, $p < 0.001$) and a

4 We also explored two additional models. First, we estimated an OLS model using fixed effects for physicians to control for all characteristics of the physicians that remain stable during our observation window. In doing so, we were limited to testing hypotheses 2 and 3. Results are consistent with the model we present and reported in the Appendix. Because we sought to differentiate cognitive versatility and its moderating effect from other specific individual differences, we have opted to report as our primary models those that include specific physician features (e.g., social perceptiveness, etc.) rather than include only fixed effects for the physicians. Second, we also estimated mixed-effects models with cluster-robust standard errors, clustered by the physician with a method suggested for small sample sizes (Imbens and Kolesár, 2016; Pustejovsky and Tipton, 2018). Our results are unchanged for the effects related to H1 and H2, although they do change for H3 ($B = -0.55$, $p = 0.36$, and $B = -0.05$, $p = 0.42$, for the interactions predicting handoffs and ALOS, respectively). That said, we take the fact that the mixed-effects models do not address the clustering of both physicians and other roles, the significant findings for H1-H3 in the multiple membership models that do account for that clustering when estimating standard errors (Zhang et al., 2016), and the significant findings from the fixed effects models regarding H2-H3, to collectively offer reason to believe that the evidence for not just H1 and H2, but also H3 is compelling.

5 We chose a 28-day lookback window following recent work demonstrating familiarity effects based on a lookback window of this length (Kim et al., 2023). The length of the lookback window has implications for the amount of data available for analysis, as longer windows require us to reserve more data to provide one period to "look back" on at the beginning of the study time period. We present robustness checks using lookback windows of different lengths to ensure our findings are robust to this decision.

6 The data notably violate an assumption of this hierarchical model in that both physicians *and* individuals in other roles can appear in the data as members of multiple teams (i.e., individuals never worked on more than one team at the same time, but they did work on multiple teams during our data collection window). To account for the subsequent lack of independence between teams, we also estimated multiple membership models (Browne et al., 2001) using the R package R2MLwiN. We report the results in the Appendix. Because the key findings are consistent in direction and significance, we report the simpler models here for ease of interpretation.

7 We note that these effects are only significant in Models 1 and 5, where we control for other core-member individual differences (as opposed to Models 3 and 7).

longer average ALOS (Model 5; $B = 0.31$, $p = 0.002$) compared to teams operating with an intersecting role set,[8] supporting Hypothesis 2.[9]

Finally, consistent with Hypothesis 3, the core members' cognitive versatility moderates the negative association between having a less-connected role set and the number of handoffs (Table 2, Model 2; $B = -0.55$, $p = 0.002$), and this is robust to the exclusion of physician characteristics that we treat as control variables (Model 4, $B = -0.57$, $p = 0.002$). The core member's cognitive versatility also moderates the negative effect of a disconnected role set on average ALOS, an effect that is significant based on standard thresholds when excluding the physician characteristics that we treat as control variables (Model 8; $B = -0.06$, $p = 0.041$), but did not quite reach significance when including those controls (Table 2, Model 6; $B = -0.05$, $p = 0.058$). In examining the patterns of relationships in a bit more detail (see Figure 3), we observe that the benefit of core member cognitive versatility for both measures of team effectiveness is significantly stronger in teams with a disconnected role set. Moreover, at high levels of cognitive versatility, the benefit of having an intersecting role set is significantly diminished, particularly for average ALOS, such that either having an intersecting role set or a cognitive versatile core team member might afford similar efficiency. To put it in more concrete terms, the findings indicated that when a team has a disconnected role set, a core member with one standard deviation greater cognitive versatility than another team, it would hand off approximately one and a half fewer patients per shift. Given the inefficiency and potential errors introduced when patients are handed off to new healthcare providers, the high financial costs of extending a patient's stay in the hospital, as well as the value of making beds available for other patients in the ED, reducing the stay for just one patient could be quite consequential.

Robustness tests

Other core member attributes

We hypothesized and found support for predictions based on our theory that the cognitive versatility of a core team member enables that member to think more flexibly and connect with diverse others in order to adapt accordingly. We interpreted our findings showing that core member cognitive versatility moderates the negative relationship impact of a disconnected role set on team efficiency as supporting that argument—that the unique capabilities cognitively versatile core members bring facilitate that adaptation. However, there could always be other reasons why a core member improves team efficiency, and so we examine a few competing explanations as a means of probing our theory about why cognitive versatility is helpful.

Two other individual characteristics that extant research demonstrates are beneficial for teamwork are social perceptiveness and conscientiousness (Riedl et al., 2021; Homan and van Kleef, 2022). Social perceptiveness relates to an individual's ability to pick up on subtle nonverbal cues and draw inferences about what others are thinking or feeling (Baron-Cohen et al., 1985) which has, like cognitive versatility, been shown to facilitate team coordination, but is orthogonal to cognitive style. Similarly, given all of the details that must be managed in order to treat patients in an ED setting, undoubtedly the conscientiousness of physicians will influence at least some aspects of their performance. But the attention to detail that is often part of individual conscientiousness is not the same as thinking flexibly about those details to adapt to changes that need to be made to get work done. That said, these characteristics could be correlated highly enough that the effects we are attributing to cognitive versatility are in reality the result of these other, correlated characteristics. To examine whether our findings are robust to these potential alternative explanations, we first analyzed whether core members' social perceptiveness and conscientiousness moderate the relationship between a disconnected role set and average ALOS using two separate models, one for each interaction, wherein the interaction is added to the variables in Table 2, Model 4. We then conducted the same analysis focused on the effects on patient handoffs. In the analysis of the effects of core member social perceptiveness, we observed that the core member's social perceptiveness did *not* moderate the relationship between a disconnected role set and either average ALOS ($B = -0.01$, $p = 0.105$) or handoffs ($B = -0.08$, $p = 0.110$). In our analysis of core members' conscientiousness, we observed that it also did *not* moderate the relationship between a disconnected role set and average ALOS ($B = -0.07$, $p = 0.080$); however, conscientiousness did significantly moderate the negative effect of a disconnected role set on handoffs ($B = -0.65$, $p = 0.009$). We interpret these observations to suggest that cognitive versatility captures a unique ability with respect to social perceptiveness, supporting the idea that the ability to pick up on subtle social cues (social perceptiveness) is not enhancing teamwork in quite the same way as the ability to interpret a variety of different ways individuals might convey information and to think flexibly across the different related perspectives (cognitive versatility). Similarly, our analysis of conscientiousness suggests that there may be some unique ways, above and beyond conscientiousness, that cognitive versatility is contributing to more efficient teamwork. That said, individuals' attention to detail and adherence to requirements (conscientiousness) may coexist with their ability to accurately comprehend and flexibly communicate this information (cognitive versatility).

Robustness of varying time frames to analyze effects of familiarity

As another robustness check, we conducted an alternative analysis of the effect of familiarity on team effectiveness using a shorter look-back window; rather than 28 days, we reduced the time

8 We note that these effects are significant whether controlling for all core-member individual differences (Models 1 and 5) or not (Models 3 and 7).

9 Of note, these effects emerge when controlling for the number of nurses on the team, which helps to address any concern that the effect of the NP is not due to the NP role, *per se*, but that this staffing often co-occurs with more nurse staffing. Additionally, the presence of the NP implies an extra person available on the team, and thus the impact of having the NP could be simply having more labor (not from nurses, but the NP themselves), rather than something about the team's role composition. Thus, we conducted additional analyses in which we explored the role of team size measured as the sum of the number of nurses, the physician, and the nurse practitioner, if present. As with our primary analyses, we find that the effects we predicted are observed above and beyond this team size measure, which itself was not associated with average ALOS or handoffs. We further note that cognitive versatility does not moderate the effect of either the number of nurses or the team size on average ALOS or handoffs. Finally, we further address this concern below in a robustness test using a coarsened exact matching approach.

TABLE 2 Mixed-effects models predicting team effectiveness.

	Dependent variable							
	# Patients handed off				Avg. Adj. Length of stay			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Core member cognitive versatility	−0.759*** (0.216)	−0.461* (0.235)	0.051 (0.376)	0.313 (0.360)	−0.107*** (0.032)	−0.079* (0.036)	−0.017 (0.039)	0.009 (0.038)
Disconnected role set (1 = no NP)	3.227*** (0.693)	1.161 (0.966)	3.059*** (0.685)	0.936 (0.957)	0.314** (0.104)	0.119 (0.146)	0.277** (0.102)	0.066 (0.144)
Core member cog. versatility * disconnected role set		−0.552** (0.182)		−0.568** (0.182)		−0.052+ (0.028)		−0.056* (0.028)
# Admissions	0.525*** (0.034)	0.538*** (0.034)	0.522*** (0.034)	0.536*** (0.034)	0.021*** (0.005)	0.022*** (0.005)	0.020*** (0.005)	0.021*** (0.005)
# Patients received from prior team	0.157*** (0.043)	0.163*** (0.042)	0.153*** (0.042)	0.161*** (0.042)	0.023*** (0.006)	0.024*** (0.006)	0.023*** (0.006)	0.023*** (0.006)
Avg. typicality of cases	0.004 (0.006)	0.004 (0.006)	0.005 (0.006)	0.004 (0.006)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
# RNs	0.102 (0.173)	0.090 (0.170)	0.058 (0.171)	0.047 (0.169)	0.025 (0.026)	0.024 (0.026)	0.017 (0.026)	0.015 (0.025)
ED tech (1 = yes)	0.025 (0.449)	0.146 (0.445)	0.077 (0.449)	0.205 (0.445)	0.036 (0.067)	0.047 (0.067)	0.049 (0.067)	0.062 (0.067)
Nurse assistant (1 = yes)	−0.123 (0.352)	−0.084 (0.348)	−0.097 (0.352)	−0.055 (0.348)	−0.022 (0.053)	−0.018 (0.053)	−0.018 (0.053)	−0.013 (0.052)
Patient ambassador (1 = yes)	0.142 (0.535)	0.156 (0.528)	0.216 (0.533)	0.225 (0.526)	−0.045 (0.080)	−0.044 (0.080)	−0.032 (0.080)	−0.031 (0.079)
Avg. Familiarity over 28 days	−0.278*** (0.081)	−0.199* (0.084)	−0.257** (0.081)	−0.176* (0.084)	−0.010 (0.012)	−0.002 (0.013)	−0.005 (0.012)	0.003 (0.013)
Core member experience	0.102*** (0.024)	0.095*** (0.024)			0.012** (0.004)	0.011** (0.004)		
Core member social perceptiveness	−0.111*** (0.031)	−0.104*** (0.031)			−0.013** (0.005)	−0.012** (0.005)		
Core member Conscientiousness	0.049 (0.318)	0.083 (0.315)			−0.020 (0.048)	−0.017 (0.048)		
Core member cog. style strength	−0.398 (0.387)	−0.330 (0.383)	0.071 (0.332)	0.085 (0.311)	−0.061 (0.058)	−0.055 (0.058)	0.017 (0.036)	0.018 (0.034)
Constant	16.803 (19.245)	13.750 (19.027)	−2.758 (15.306)	−3.210 (14.333)	2.016 (2.884)	1.727 (2.876)	−1.524 (1.669)	−1.566 (1.567)
Fixed effects (weekday, month, night team)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Random effects (Physician)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342	342	342	342	342	342	342	342
Log likelihood	−786.28	−782.53	−786.43	−782.43	−188.39	−189.27	−181.96	−182.56
AIC	1,630.58	1,625.06	1,624.85	1,618.86	434.78	438.54	415.92	419.12
BIC	1,741.78	1,740.10	1,724.56	1,722.40	545.99	553.58	515.63	522.66

$^{+}p < 0.1$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$. This table reports results for the primary analyses, revealing a generally positive association between a core member's (Physician's) cognitive versatility and team effectiveness in that it is associated with fewer handoffs and shooter average lengths of stay, a generally negative association between having a disconnected role set in which the team lacks a nurse practitioner and both team effectiveness measures, and an interaction effect whereby the harmful association between the disconnected role set and team effectiveness is less harmful when the core member is more cognitively versatile.

frame to 7 days. The use of a shorter look-back window enables us to use a larger sample of teams for analysis (due to having to set aside fewer observations to serve as the look-back window for the initial time period of our analysis) and it's possible that the increase in statistical power we have in this larger sample would reveal a significant effect we did not observe in our initial analysis. However, our key findings with respect to familiarity remain unchanged (see Table 3).

Robustness via coarsened exact matching

Finally, we observed that the absence of an NP was intended to correlate with a lighter workload and, indeed, in our data set the

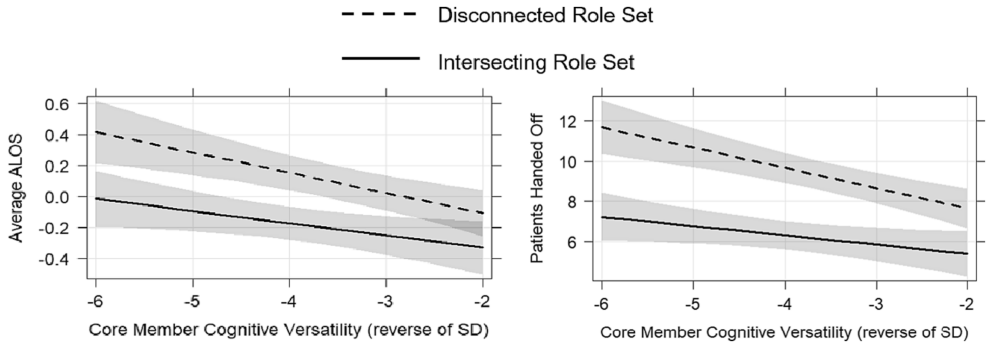


FIGURE 3
Team effectiveness by core member (Physician) cognitive versatility and role set connectedness (absence of a Nurse Practitioner). The lower scores for Average ALOS (on the left) and the number of patients handed off (on the right) indicate greater team effectiveness. For both outcomes, having a disconnected role set (i.e., missing a Nurse Practitioner) is less harmful if the core member's (Attending Physician's) cognitive versatility is greater.

absence of an NP was associated with an overall lower patient load as a result of fewer holdovers from the prior team and fewer admissions. As noted in the description of team composition, the absence of an NP was also associated with having fewer nurses (driven also by wanting fewer staff when there is less work), and greater team familiarity (a byproduct of the generally smaller teams). To address concerns that the effect a disconnected role set, and the moderating effect of cognitive style diversity, might be attributed to factors other than missing the NP, we use the R function MatchIt to implement coarsened exact matching and generate a more balanced data set regarding a patient load variable (the sum of admissions and holdovers) and the number of nurses (which is the main source of variation in team size). Given that the team's familiarity was largely a function of the number of nurses, matching only on these two variables yielded a balance also on team familiarity. Although the resulting data set retained just 39% of the original data set ($n = 132$), estimations of mixed-effects models using the matched data set yield results consistent with our main analyses. The core member's cognitive versatility is associated with both fewer handoffs at the next shift change ($B = -1.16$, $p < 0.001$; Table 4, Model 1) and a shorter average adjusted length of stay ($B = -0.17$, $p < 0.001$; Table 4, Model 3). In contrast, having a disconnected role set (lacking a NP) is not significantly associated with our outcomes of interest, but the direction of the effects are consistent with our primary analyses ($B = 1.65$, $p = 0.103$; $B = 0.11$, $p = 0.424$, see Table 4, Models 1 and 3, respectively). Most critically, the interaction effect of the physician's cognitive versatility and a disconnected role set is significantly associated with both handoffs at the next shift change ($B = -1.59$, $p < 0.001$; Table 4, Model 2) and the average adjusted length of stay ($B = -0.09$, $p = 0.020$; Table 4, Model 4), such that a disconnected role set is less harmful when a team has a more cognitively versatile physician.

In sum, the primary analyses that include control variables, when taken together with the robustness tests reported above, provide results consistent with our theory that the impact of a disconnected role set, which omits the NP role, presents a challenge to team coordination that is not explained by having more or less labor, having more or fewer nurses, specifically, or having a greater/lesser workload.

Discussion

In our study of hospital Emergency Department (ED) teams, we find that disconnected role sets, measured as the absence of a Nurse Practitioner (NP) such that there is less overlap in the tasks that roles could do, is associated with less team effectiveness, measured in terms of patients' length of stay in the ED and patient handoffs at the next shift change. However, we also find that the cognitive style versatility of the strategically core team members (i.e., the attending physician) is associated with greater team effectiveness and mitigates the negative relationship between a disconnected role set and team effectiveness. These findings have implications for the Carnegie School, research on fluid teams, and research on intrapersonal diversity.

Carnegie School

The work of the Carnegie School and the work it inspired has uncovered a variety of organizational structures that can guide attention and coordination to support more effective collective work. This is true, too, in teams, where role structures can support the coming and going of individuals. Yet, with increasingly fluid participation in teams, teams are beginning to resemble the organized anarchies they once were used to control. Indeed, the garbage can model's element of fluid participation (Cohen et al., 1972) that has largely gone underdeveloped has emerged anew in the study of teams (e.g., Mortensen and Haas, 2018), where team forms are so fluid as to call into question what constitutes a team today (Wageman et al., 2012), but where scholars nonetheless have turned attention to understanding what might support these teams to enable the effective teamwork today's organizations demand (Mayo, 2022). By integrating across the Carnegie School and teams research, drawing from psychology and organizational behavior research to do so, we move from typical structures (e.g., roles), or even the network properties of role structures (e.g., the connectedness of role sets) to consider another fundamental lever in team design (team composition), uncovering another possible antidote to the chaos of organized anarchy in the form of member cognition.

TABLE 3 Mixed effects models predicting team effectiveness using shortened lookback window for familiarity measure.

	Dependent variable			
	# Patients handed off		Avg. Adj. Length of stay	
	(1)	(2)	(3)	(4)
Core member cognitive versatility	−0.780*** (0.167)	−0.480** (0.186)	−0.089*** (0.026)	−0.064* (0.030)
Disconnected role set (1 = no NP)	3.373*** (0.599)	1.384^{+} (0.827)	0.310** (0.095)	0.145 (0.132)
Core member cog. versatility * disconnected role set		−0.531*** (0.154)		−0.044^{+} (0.025)
# Admissions	0.556*** (0.028)	0.566*** (0.028)	0.020*** (0.005)	0.021*** (0.005)
# Patients received from prior team	0.181*** (0.035)	0.187*** (0.035)	0.023*** (0.006)	0.023*** (0.006)
Avg. typicality of cases	0.002 (0.005)	0.002 (0.005)	0.001 (0.001)	0.001 (0.001)
# RNs	0.094 (0.145)	0.081 (0.143)	0.014 (0.023)	0.012 (0.023)
ED tech (1 = yes)	0.292 (0.363)	0.397 (0.360)	0.026 (0.057)	0.034 (0.057)
Nurse assistant (1 = yes)	0.128 (0.291)	0.137 (0.288)	0.015 (0.046)	0.016 (0.046)
Patient ambassador (1 = yes)	−0.683 (0.444)	−0.622 (0.439)	−0.092 (0.070)	−0.087 (0.070)
Avg. familiarity over 7 Days	−0.857*** (0.169)	−0.675*** (0.175)	−0.041 (0.027)	−0.026 (0.028)
Core member experience	0.090*** (0.018)	0.086*** (0.018)	0.010*** (0.003)	0.010*** (0.003)
Core member social perceptiveness	−0.075** (0.025)	−0.071** (0.025)	−0.010* (0.004)	−0.010* (0.004)
Core member conscientiousness	−0.060 (0.244)	−0.005 (0.242)	0.013 (0.039)	0.018 (0.039)
Core member cog. style strength	−0.519^{+} (0.297)	−0.429 (0.295)	−0.020 (0.047)	−0.012 (0.047)
Constant	22.025 (14.920)	17.981 (14.791)	0.032 (2.360)	−0.304 (2.362)
Fixed effects (weekday, month, night team)	Yes	Yes	Yes	Yes
Random effects (Physician)	Yes	Yes	Yes	Yes
Observations	479	479	479	479
Log likelihood	−1,01.18	−1,096.26	−267.69	−268.88
AIC	2,260.36	2,252.52	593.39	597.76
BIC	2,381.34	2,377.68	714.37	722.91

$^{+}p < 0.1$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$. This table reports a replication of the primary models reported in Table 2; here the results use a measure of familiarity that is based on a shorter look-back window (7 vs. 28 days). Because fewer observations had to be retained to score the familiarity measure based on this shorter look-back window, these results are based on a larger sample size (479) relative to Table 2 (342).

Fluid teams

Research on teams has increasingly been grappling with the reality of fluid participation in teams (e.g., Edmondson, 2012; Mortensen and Haas, 2018; Mayo, 2022). While role-based team structures have been shown to offer one mechanism of support to fluid teams (e.g., Bechky, 2006; Valentine and Edmondson, 2015), the current study highlights one condition under which this mechanism falls short: when the fluidity of participation alters the set of roles available such that a team must work with a disconnected role set. This could emerge due to limited role availability as a result of organizational decisions to not make a role available at all times, as in the case of nurse practitioners. In short, we extend from past work suggesting that role-based systems work in part because they offer clear understanding of how to coordinate; here, we highlight how having a role set with more overlap in the tasks the roles can perform might also be critical for adaptation in that it allows for members to back up one another, creating a structural mechanism for some flexibility. Indeed, that seems to be why, in health care, the nurse practitioner role emerged at all (Berg, 2020). In short, such roles afford the team some structural flexibility. Removing such a role, which may be sensible at times from the perspective of staffing costs, requires that members reconsider how they are allocating their attention while having less structural flexibility to handle their collective workload. We both highlight this as an organizational problem and suggest one antidote in the form of core team member's cognitive style versatility.

Beyond the possibility that an intersecting role set creates structural flexibility useful for adaptation, the presence of certain roles might offer the added benefit of serving as a bridge between other members. For instance, in our empirical setting of emergency departments, the healthcare industry has created a variety of new positions, or roles, over time. This expanding set of roles is typically considered to either allow for more targeted care via positions that are increasingly specialized in their training, or to allow for more effective access to care via positions that require less training, are less expensive, and can ease the demand on more specialized and expensive positions. The NP role we focused on is an example of the latter. While already noted above that the NP is capable of (and allowed to do) many tasks otherwise delegated to a physician, NPs also share a common training with registered nurses in that NPs are first trained as registered nurses. NPs thus could serve as a sort of broker between physicians and nurses, helping to bridge a divide rooted in training and professional

TABLE 4 Mixed effects models predicting team effectiveness using matched data.

	Dependent variable			
	# Patients handed off		Avg. Adj. Length of stay	
	(1)	(2)	(3)	(4)
Core member cognitive versatility	−1.156*** (0.342)	−0.308 (0.331)	−0.172*** (0.049)	−0.128^{+} (0.067)
Disconnected role set (1 = no NP)	1.646 (1.009)	−4.306** (1.341)	0.108 (0.135)	−0.248 (0.202)
Core member cog. versatility * disconnected role set		−1.593*** (0.271)		−0.095* (0.041)
# Admissions	0.638*** (0.071)	0.693*** (0.063)	0.016^{+} (0.010)	0.020* (0.009)
# Patients received from prior team	0.021 (0.078)	0.031 (0.068)	0.007 (0.010)	0.008 (0.010)
Avg. typicality of cases	−0.017 (0.014)	−0.008 (0.012)	0.000 (0.002)	0.000 (0.002)
# RNs	−0.509 (0.319)	−0.618* (0.278)	−0.020 (0.043)	−0.025 (0.042)
ED tech (1 = yes)	2.126 (1.541)	2.074 (1.341)	0.170 (0.206)	0.163 (0.201)
Nurse assistant (1 = yes)	−0.662 (0.722)	−0.357 (0.630)	−0.028 (0.096)	−0.015 (0.095)
Patient ambassador (1 = yes)	2.919 (2.245)	1.431 (1.971)	−0.287 (0.300)	−0.357 (0.297)
Avg. familiarity over 28 days	−0.302^{+} (0.160)	−0.093 (0.144)	−0.022 (0.021)	−0.009 (0.022)
Core member experience	0.137*** (0.041)	0.141*** (0.036)	0.018** (0.006)	0.020** (0.007)
Core member social perceptiveness	−0.159** (0.054)	−0.165*** (0.047)	−0.023** (0.008)	−0.024* (0.011)
Core member conscientiousness	0.343 (0.521)	0.282 (0.454)	−0.001 (0.072)	−0.010 (0.085)
Core member cog. style strength	−0.219 (0.592)	−0.321 (0.516)	−0.019 (0.081)	−0.033 (0.088)
Constant	12.963 (29.487)	17.951 (25.687)	0.639 (4.025)	1.358 (4.428)
Fixed effects (weekday, month, night team)	Yes	Yes	Yes	Yes
Random effects (Physician)	Yes	Yes	Yes	Yes
Observations	132	132	132	132
Log likelihood	−315.69	−301.03	−104.41	−104.09
AIC	689.38	662.06	266.83	268.17
BIC	772.98	748.55	350.43	354.66

$^{+}p < 0.1$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$. This table reports a replication of the primary models reported in Table 2; here the results are based on a matched data set created using coarsened-exact matching to balance the data set on a patient load variable (the sum of admissions and holdovers) and the number of nurses (which is the main source of variation in team size). Thirty-two percent of the original sample was retained in this process ($n = 132$).

status that has long been acknowledged to detract from patient care (Bransby et al., 2023). Future work on fluid participation thus may do well to take a contextualized approach to the problem at hand (Johns, 2006).

Our focus was notably on disconnected role sets that were planned, as could arise with, for instance, scheduled vacation time. However, surprises could yield the same outcome, such as when a swat team loses a member mid-operation (Bechky and Okhuysen, 2011), someone takes sick leave, or a scheduling conflict arises, for instance, due to their participation in multiple ongoing teams, forcing individuals to choose where to allocate attention. Future work could explore these unanticipated shifts in available roles.

Intrapersonal diversity

Our focus on cognitive versatility is an example of a way in which an individual exhibits intrapersonal diversity, and we contribute to the growing research on intrapersonal diversity, broadly, in multiple ways. First, we theoretically focus here on the potential mechanisms of cognitive versatility in terms of the ability for cognitively versatile members to think flexibly. This theorizing is consistent with research that has documented that other forms of intrapersonal diversity (e.g., having intrapersonal diversity in functional area or cultural experiences) can fuel greater breadth and less rigidity in information processing (Bunderson and Sutcliffe, 2002; Jang, 2017). Critically, extant research suggests that intrapersonal diversity operates by offering individuals multiple lenses through which to view and interpret the world (e.g., Maddux et al., 2021), much like is achieved with cognitive style versatility. Moreover, above we noted that, in our setting, the NPs could facilitate connection across other roles. Here, too, other forms of intrapersonal diversity have been shown to breed greater communication competence and an ability to bridge diverse team members or subgroups and resolve conflict (Mok and Morris, 2010; Marian and Shook, 2012; Jang, 2017; Aggarwal et al., 2019; Mell et al., 2021; Maddux et al., 2021; Lu et al., 2022). Collectively, these prior studies suggest that individuals with intrapersonal diversity as a result of their background and diverse experiences bring a variety of valuable attributes to teams as a result of their own cognitive

flexibility, their enhanced communication competence, and their capacity to use these skills to facilitate information sharing and integration. Future work to tease out the mechanisms of intrapersonal diversity in general, and cognitive versatility in particular, could be fruitful.

Second, we integrate a specific focus on cognitive style versatility with a role-based view of team composition. This integration allowed for uncovering that strategically core team member's greater cognitive versatility may allow for adaptation, and specifically in the face of disconnected role sets. In our specific setting of emergency department teams, where the core member is the attending physician, cognitive versatility could facilitate the flexible thinking noted to be required for, to name few examples, adapting to changing clinical scenarios or deviating from a protocol when necessary, re-prioritizing patients as a team as the panel of patients changes and individual patient needs evolve, and redistributing limited tools (e.g., monitors, mobile computers) throughout the team (Ward et al., 2006). Indeed, our definition of the physician as the core role reflects the fact that they hold decision-making authority, which positions the attending well to make these adjustments if he or she notices the need to do so and can identify possible solutions. While we do not have data that would allow us to identify the underlying mechanism in our setting, our findings are consistent with this theory, and suggest a future path for exploring the importance of intrapersonal diversity among core team members.

Further, we found that the relationship between strategically core members' cognitive style versatility and team effectiveness held above and beyond other well-studied personality and social attributes such as conscientiousness and social perceptiveness. We also find that the core member's social perceptiveness was associated with team effectiveness, as we might expect (e.g., see Riedl et al., 2021), but it did not moderate the relationship between a disconnected role set and team effectiveness. While we hesitate to over-interpret this null finding, it bolsters our interpretation of our findings. We theorized that disconnected role sets hinder performance because they limit the requisite adaptation for performing in volatile contexts, such as an ED. As such, if a core role holder's cognitive versatility moderates the impact of a disconnected role set then it is likely doing so via adaptation; this adaptation is not something we would necessarily expect social perceptiveness to facilitate (Baron-Cohen et al., 2001) and so the lack of a significant interaction is consistent with our logic. It is also possible that the core role holder's conscientiousness, a personality trait that is a strong predictor of taskwork (Homan and van Kleef, 2022) plays a similar role in fluid teams. Empirical evidence, however, did not support its effects on either team effectiveness measure, but core member conscientiousness did significantly mitigate the adverse effect of a disconnected role set on patient handoffs. It could be that core team members who are more conscientious are also more likely to attend to who is doing what, such that they ensure that no tasks are dropped, something perhaps at greater risk when the role that creates role intersections is missing. Nonetheless, accounting for this interaction did not significantly change the impact that cognitive versatility had on the same outcome, indicating that these characteristics are likely to operate in different ways in how they impact team effectiveness. Future work could explore the interplay of various traits of team members.

Limitations

There are multiple limitations to this work that we would be remiss not to mention. First, we note that this work is only correlational. While we have attempted to account for alternative explanations for our effects with our control variables and robustness tests, we caution that these results be interpreted as suggestive of the role of intrapersonal diversity given the possibility of endogenous factors that may not be fully accounted for here (particularly the risk of omitted variable bias). Future work to unpack the causal effects of intrapersonal diversity on team adaptation to the chaos of fluid participation is needed. Second, we speculate that cognitive versatility may affect the possible solution set that a core member is able to identify and choose from when facing general problems in a dynamic work environment, as well as the specific challenge of a less-connected role set. However, we do not have data that would allow us to observe this mechanism. Future work to assess this possible mechanism could shed further light on interventions that could support a fluid team's work irrespective of its core member's cognitive style versatility. Similarly, we speculate that a disconnected role set can affect the team's capacity to coordinate, but here, too, we do not have data that would allow us to observe coordination behaviors. Future work to explore the specific impacts of changes in the overall role set could be fruitful given the amount of work that is both role-based and fluid in today's organizations.

Conclusion

The Carnegie School laid an impressive foundation for a profound variety of fields of study, let alone topics of study within psychology and organizational behavior. The early identification of attention and fluid participation as key factors that could influence effective organizing rings as true today as it did when first developed, and perhaps even more so in the teams literature given new forms of organizing that stretch members' attention, in part because of increased fluidity. This study contributes to the Carnegie tradition, then, by connecting research from psychology and organizational behavior to uncover one possible antidote to the organized anarchies that are teams today.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Carnegie Mellon University Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

IA, BA, EZ, and AW contributed to the conception or design of the work. IA, BA, and AW contributed to data collection. IA, AM, TM, and EZ contributed to data analysis and interpretation. IA and AM contributed to drafting the article. All authors contributed to critical revision of the article and approved publication of the content.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2024.1144638/full#supplementary-material

References

Aggarwal, I., Schilpzand, M. C., Martins, L. L., Woolley, A. W., and Molinaro, M. (2023). The benefits of cognitive style versatility for collaborative work. *J. Appl. Psychol.* 108, 647–659. doi: 10.1037/apl0001035

Aggarwal, I., and Woolley, A. W. (2013). Do you see what I see? The effect of members' cognitive styles on team processes and errors in task execution. *Organ. Behav. Hum. Decis. Process.* 122, 92–99. doi: 10.1016/j.obhdp.2013.04.003

Aggarwal, I., Woolley, A. W., Chabris, C. F., and Malone, T. W. (2019). The impact of cognitive style diversity on implicit learning in teams. *Front. Psychol.* 10:112. doi: 10.3389/fpsyg.2019.00112

Ancona, D. G., and Bresman, H. (2007). X-teams: how to build teams that lead, innovate, and succeed. *Harvard Business School Publishing Corporation*. Boston, Massachusetts: Harvard Business Press.

Ausburn, L. J., and Ausburn, F. B. (1978). Cognitive styles: some information and implications for instructional design. *Educ. Commun. Technol.* 26, 337–354.

Baron-Cohen, S., Leslie, A. M., and Frith, U. (1985). Does the autistic child have a "theory of mind?". *Cognition* 21, 37–46. doi: 10.1016/0010-0277(85)90022-8

Baron-Cohen, S., Wheelwright, S., Hill, J., Raste, Y., and Plumb, I. (2001). The "Reading the mind in the eyes" test revised version: a study with normal adults, and adults with Asperger syndrome or high-functioning autism. *J. Child Psychol. Psychiatry Allied Discip.* 42, 241–251. doi: 10.1017/S0021963001006643

Bazerman, M. H., and Moore, D. A. (2012). Judgement in managerial decision making (eighth). *Wiley*. New York, NY: John Wiley & Sons.

Bechky, B. A. (2006). Gaffers, gofers, and grips: role-based coordination in temporary organizations. *Organ. Sci.* 17, 3–21. doi: 10.1287/orsc.1050.0149

Bechky, B. A., and Okhuysen, G. A. (2011). Expecting the unexpected? How swat officers and film crews handle surprises. *Acad. Manag. J.* 54, 239–261. doi: 10.5465/amj.2011.60263060

Bedeian, A. G., and Mossholder, K. W. (2000). On the use of the coefficient of variation as a measure of diversity. *Organ. Res. Methods* 3, 285–297. doi: 10.1177/109442810033005

Bell, S. T., Brown, S. G., Colaneri, A., and Outland, N. (2018). Team composition and the ABCs of teamwork. *Am. Psychol.* 73, 349–362. doi: 10.1037/amp0000305

Berg, J. A. (2020). The perils of not knowing the history of the nurse practitioner role. *J. Am. Assoc. Nurse Pract.* 32, 602–609. doi: 10.1097/JXX.0000000000000441

Blajenkova, O., Kozhevnikov, M., and Motes, M. A. (2006). Object-spatial imagery: a new self-report imagery questionnaire. *Appl. Cogn. Psychol.* 20, 239–263. doi: 10.1002/acp.1182

Blazhenkova, O., and Kozhevnikov, M. (2009). The new object-spatial-verbal cognitive style model: theory and measurement. *Appl. Cogn. Psychol.* 23, 638–663. doi: 10.1002/acp.1473

Bransby, D. P., Mayo, A. T., Cronin, M. A., Park, K., and Yuan, C. T. (2023). A systematic review of respect between acute care nurses and physicians. *Health Care Manag. Rev.* 48, 237–248. doi: 10.1097/HMR.0000000000000370

Browne, W. J., Goldstein, H., and Rasbash, J. (2001). Multiple membership multiple classification (MMMC) models. *Stat. Model.* 1, 103–124. doi: 10.1177/1471082X0100100202

Bunderson, J. S., and Sutcliffe, K. M. (2002). Comparing alternative conceptualizations of functional diversity in management teams: process and performance effects. *Acad. Manag. J.* 45, 875–893. doi: 10.2307/3069319

Casalino, E., Choquet, C., Bernard, J., Debit, A., Doumenc, B., Berthoumieu, A., et al. (2012). Predictive variables of an emergency department quality and performance indicator: a 1-year prospective, observational, cohort study evaluating hospital and emergency census variables and emergency department time interval measurements. *Emerg. Med. J.* 30, 638–645. doi: 10.1136/emermed-2012-201404

Cohen, M. D., March, J. G., and Olsen, J. P. (1972). A garbage can model of organizational choice. *Adm. Sci. Q.* 17:1. doi: 10.2307/2392088

Cohen, M. D., March, J. G., and Olsen, J. P. (2012). ""A garbage can model" at forty: a solution that still attracts problems" in *Research in the sociology of organizations*. eds. A. Lomi and J. R. Harrison, vol. *36* (Bingley: Emerald Group Publishing Limited), 19–30.

DiMaggio, P. J., and Powell, W. P. (1991). "Introduction" in *The new institutionalism in organizational analysis*. eds. W. P. Powell and P. J. DiMaggio (Chicago, IL: University of Chicago Press)

Edmondson, A. C. (2012). *Teaming: How organizations learn, innovate, and compete in the knowledge economy*. San Francisco, CA: John Wiley & Sons, Inc.

Edmondson, A. C., and Harvey, J. F. (2018). Cross-boundary teaming for innovation: integrating research on teams and knowledge in organizations. *Hum. Resour. Manag. Rev.* 28, 347–360. doi: 10.1016/j.hrmr.2017.03.002

Emich, K. J., Lu, L., Ferguson, A., Peterson, R. S., and McCourt, M. (2022). Team composition revisited: a team member attribute alignment approach. *Organ. Res. Methods* 25, 642–672. doi: 10.1177/10944281211042388

Faraj, S., and Xiao, Y. (2006). Coordination in fast-response organizations. *Manag. Sci.* 52, 1155–1169. doi: 10.1287/mnsc.1060.0526

Ganz, S. C. (2021). "Adaptive rationality, garbage cans, and the policy process" in *Research in the sociology of organizations*. ed. C. M. Beckman (Bingley: Emerald Publishing Limited), 79–96.

Gosling, S. D., Rentfrow, P. J., and Swann, W. B. (2003). A very brief measure of the big-five personality domains. *J. Res. Pers.* 37, 504–528. doi: 10.1016/S0092-6566(03)00046-1

Grijalva, E., Maynes, T. D., Badura, K. L., and Whiting, S. W. (2020). Examining the "I" in team: a longitudinal investigation of the influence of team narcissism composition on team outcomes in the NBA. *Acad. Manag. J.* 63, 7–33. doi: 10.5465/amj.2017.0218

Hackman, J. R., and Wageman, R. (2004). When and how team leaders matter. *Res. Organ. Behav.* 26, 37–74. doi: 10.1016/S0191-3085(04)26002-6

Harrison, D. A., and Klein, K. J. (2007). What's the difference? Diversity constructs as separation, variety, or disparity in organizations. *Acad. Manag. Rev.* 32, 1199–1228. doi: 10.5465/amr.2007.26586096

Ho, S., and Kozhevnikov, M. (2023). Cognitive style and creativity: the role of education in shaping cognitive style profiles and creativity of adolescents. *Br. J. Educ. Psychol.* 93, 978–996. doi: 10.1111/bjep.12615

Homan, A. C., and van Kleef, G. A. (2022). Managing team conscientiousness diversity: the role of leader emotion-regulation knowledge. *Small Group Res.* 53, 532–562. doi: 10.1177/10464964211045015

Humphrey, S. E., and Aime, F. (2014). Team microdynamics: toward an organizing approach to teamwork. *Acad. Manag. Ann.* 8, 443–503. doi: 10.5465/19416520.2014.904140

Humphrey, S. E., Morgeson, F. P., and Mannor, M. J. (2009). Developing a theory of the strategic core of teams: a role composition model of team performance. *J. Appl. Psychol.* 94, 48–61. doi: 10.1037/a0012997

Imbens, G. W., and Kolesár, M. (2016). Robust standard errors in small samples: some practical advice. *Rev. Econ. Stat.* 98, 701–712. doi: 10.1162/REST_a_00552

Jang, S. (2017). Cultural brokerage and creative performance in multicultural teams. *Organ. Sci.* 28, 993–1009. doi: 10.1287/orsc.2017.1162

Jann, W. (2015). "Michael D. Cohen, James G. March, and Johan P. Olsen, A garbage can model of organizational choice" in *The Oxford handbook of classics in public policy and administration*. eds. S. J. Balla, M. Lodge and E. C. Page (Oxford: Oxford University Press).

Johns, G. (2006). The essential impact of context on organizational behavior. *Acad. Manag. Rev.* 31, 386–408. doi: 10.5465/amr.2006.20208687

Kim, S.-H., Song, H., and Valentine, M. A. (2023). Learning in temporary teams: the varying effects of partner exposure by team member role. *Organ. Sci.* 34, 433–455. doi: 10.1287/orsc.2022.1585

Kozhevnikov, M. (2007). Cognitive styles in the context of modern psychology: toward an integrated framework of cognitive style. *Psychol. Bull.* 133, 464–481. doi: 10.1037/0033-2909.133.3.464

Kozhevnikov, M., Blazhenkova, O., and Becker, M. (2010). Trade-off in object versus spatial visualization abilities: restriction in the development of visual-processing resources. *Psychon. Bull. Rev.* 17, 29–35. doi: 10.3758/PBR.17.1.29

Kozhevnikov, M., Evans, C., and Kosslyn, S. M. (2014). Cognitive style as environmentally sensitive individual differences in cognition: a modern synthesis and applications in education, business, and management. *Psychol. Sci. Public Interest* 15, 3–33. doi: 10.1177/1529100614525555

Kozhevnikov, M., Hegarty, M., and Mayer, R. E. (2002). Revising the visualizer-verbalizer dimension: evidence for two types of visualizers. *Cogn. Instr.* 20, 47–77. doi: 10.1207/S1532690XCI2001_3

Lewis, K., Belliveau, M., Herndon, B., and Keller, J. (2007). Group cognition, membership change, and performance: investigating the benefits and detriments of collective knowledge. *Organ. Behav. Hum. Decis. Process.* 103, 159–178. doi: 10.1016/j.obhdp.2007.01.005

Lindblom, C. E. (1959). The science of "muddling through". *Public Adm. Rev.* 19, 79–88. doi: 10.2307/973677

Lomi, A., and Harrison, J. R. (2012). "The garbage can model of organizational choice: looking forward at forty" in *Research in the sociology of organizations*. eds. A. Lomi and J. R. Harrison, vol. *36* (Bingley: Emerald Group Publishing Limited), 3–17.

Loyd, D. L., Wang, C. S., Phillips, K. W., and Lount, R. B. (2013). Social category diversity promotes premeeting elaboration: the role of relationship focus. *Organ. Sci.* 24, 757–772. doi: 10.1287/orsc.1120.0761

Lu, J. G., Swaab, R. I., and Galinsky, A. D. (2022). Global leaders for global teams: leaders with multicultural experiences communicate and lead more effectively, especially in multinational teams. *Organ. Sci.* 33, 1554–1573. doi: 10.1287/orsc.2021.1480

Maddux, W. W., Lu, J. G., Affinito, S. J., and Galinsky, A. D. (2021). Multicultural experiences: a systematic review and new theoretical framework. *Acad. Manag. Ann.* 15, 345–376. doi: 10.5465/annals.2019.0138

Malone, T. W. (2004). *The future of work: how the new order of business will shape your organization, your management style, and your life*. Boston: Harvard Business School Publishing.

March, J. G., and Simon, H. A. (1958). *Organizations*. New York: John Wiley & Sons, Inc.

Marian, V., and Shook, A. (2012). The cognitive benefits of being bilingual. *Cerebrum* 2012:13. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3583091/

Mathieu, J. E., Tannenbaum, S. I., Donsbach, J. S., and Alliger, G. M. (2014). A review and integration of team composition models: moving toward a dynamic and temporal framework. *J. Manag.* 40, 130–160. doi: 10.1177/0149206313503014

Mayo, A. T. (2022). Syncing up: a process model of emergent interdependence in dynamic teams. *Adm. Sci. Q.* 67, 821–864. doi: 10.1177/00018392221096451

Mell, J. N., Jang, S., and Chai, S. (2021). Bridging temporal divides: temporal brokerage in global teams and its impact on individual performance. *Organ. Sci.* 32, 731–751. doi: 10.1287/orsc.2020.1406

Meneely, J., and Portillo, M. (2005). The adaptable mind in design: relating personality, cognitive style, and creative performance. *Creat. Res. J.* 17, 155–166. doi: 10.1080/10400419.2005.9651476

Mok, A., and Morris, M. W. (2010). An upside to bicultural identity conflict: resisting groupthink in cultural ingroups. *J. Exp. Soc. Psychol.* 46, 1114–1117. doi: 10.1016/j.jesp.2010.05.020

Mortensen, M., and Haas, M. R. (2018). Rethinking teams: from bounded membership to dynamic participation. *Organ. Sci.* 29, 341–355. doi: 10.1287/orsc.2017.1198

Ocasio, W. (1997). Towards an attention-based view of the firm. *Strateg. Manag. J.* 18, 187–206.

Ocasio, W. (2012). "Situated attention, loose and tight coupling, and the garbage can model" in *Research in the sociology of organizations*. eds. A. Lomi and J. R. Harrison, vol. *36* (Bingley: Emerald Group Publishing Limited), 293–317.

Okhuysen, G. A., and Bechky, B. A. (2009). Coordination in organizations: an integrative perspective. *Acad. Manag. Ann.* 3, 463–502. doi: 10.5465/19416520903047533

Pearsall, M. J., and Ellis, A. P. J. (2006). The effects of critical team member assertiveness on team performance and satisfaction. *J. Manag.* 32, 575–594. doi: 10.1177/0149206306289099

Porter, C. O. L. H. (2005). Goal orientation: effects on backing up behavior, performance, efficacy, and commitment in teams. *J. Appl. Psychol.* 90, 811–818. doi: 10.1037/0021-9010.90.4.811

Puranam, P., Alexy, O., and Reitzig, M. (2014). What's "new" about new forms of organizing? *Acad. Manag. Rev.* 39, 162–180. doi: 10.5465/amr.2011.0436

Pustejovsky, J. E., and Tipton, E. (2018). Small-sample methods for cluster-robust variance estimation and hypothesis testing in fixed effects models. *J. Bus. Econ. Stat.* 36, 672–683. doi: 10.1080/07350015.2016.1247004

Reagans, R., Argote, L., and Brooks, D. (2005). Individual experience and experience working together: predicting learning rates from knowing who knows what and knowing how to work together. *Manag. Sci.* 51, 869–881. doi: 10.1287/mnsc.1050.0366

Riedl, C., Kim, Y. J., Gupta, P., Malone, T. W., and Woolley, A. W. (2021). Quantifying collective intelligence in human groups. *Proc. Natl. Acad. Sci.* 118:e2005737118. doi: 10.1073/pnas.2005737118

Sadler-Smith, E. (2009). "Cognitive styles and learning strategies in management education" in *The SAGE handbook of management learning, education and development*. eds. S. J. Armstrong and C. V. Fukami (Los Angeles: Sage), 301–324.

Simon, H. A. (1997). *Administrative behavior: a study of decision-making processes in administrative organizations. 4th*. New York, NY: The Free Press.

Tversky, A., and Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science* 211, 453–458. doi: 10.1126/science.7455683

Valentine, M. A., and Edmondson, A. C. (2015). Team scaffolds: how mesolevel structures enable role-based coordination in temporary groups. *Organ. Sci.* 26, 405–422. doi: 10.1287/orsc.2014.0947

Wageman, R., Gardner, H., and Mortensen, M. (2012). The changing ecology of teams: new directions for teams research. *J. Organ. Behav.* 33, 301–315. doi: 10.1002/job.1775

Ward, L. C., Thorn, B. E., Clements, K. L., Dixon, K. E., and Sanford, S. D. (2006). Measurement of agency, communion, and emotional vulnerability with the personal attributes questionnaire. *J. Pers. Assess.* 86, 206–216. doi: 10.1207/s15327752jpa8602_10

Woolley, A. W., Gerbasi, M. E., Chabris, C. F., Kosslyn, S. M., and Hackman, J. R. (2008). Bringing in the experts: how team composition and collaborative planning jointly shape analytic effectiveness. *Small Group Res.* 39, 352–371. doi: 10.1177/1046496408317792

Woolley, A. W., Hackman, J. R., Jerde, T. J., Chabris, C. F., Bennett, S. L., and Kosslyn, S. M. (2007). Using brain-based measures to compose teams: how individual capabilities and team collaboration strategies jointly shape performance. *Soc. Neurosci.* 2, 96–105. doi: 10.1080/17470910701363041

Zhang, Z., Parker, R. M. A., Charlton, C. M. J., Leckie, G., and Browne, W. J. (2016). R2MLwiN: a package to run MLwiN from within R. *J. Stat. Softw.* 72, 1–46. doi: 10.18637/jss.v072.i10

frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 23 August 2023
DOI 10.3389/fpsyg.2023.1141571

OPEN ACCESS

EDITED BY
Daniella Laureiro Martinez,
ETH Zürich, Switzerland

REVIEWED BY
Ishani Aggarwal,
Brazilian School of Public and Business Administration, FGV, Brazil
Semin Park,
The University of Iowa, United States
Francisco Brahm,
London Business School, United Kingdom
Ray Reagans,
Massachusetts Institute of Technology, United States

*CORRESPONDENCE
Jerry Guo
✉ jerry.guo@fs.de

RECEIVED 10 January 2023
ACCEPTED 07 August 2023
PUBLISHED 23 August 2023

CITATION
Guo J, Argote L, Kush J and Park J (2023) Communication networks and team performance: selecting members to network positions.
Front. Psychol. 14:1141571.
doi: 10.3389/fpsyg.2023.1141571

Communication networks and team performance: selecting members to network positions

Jerry Guo[1]*, Linda Argote[2], Jonathan Kush[3] and Jisoo Park[4]

[1]Frankfurt School of Finance and Management, Frankfurt, Germany, [2]Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, United States, [3]Charlton College of Business, University of Massachusetts Dartmouth, Dartmouth, MA, United States, [4]School of Management, Clark University, Worcester, MA, United States

This study examines how individuals come to occupy communication network positions and the effect of selection processes on group performance. Drawing on the Carnegie perspective and research on communication networks, we compare the performance of groups whose members receive their choice of who occupies which network position to the performance of groups whose members do not receive their choice. We integrate ideas from the Carnegie perspective with the social psychological literature on the recognition of expertise to theorize that when group members choose who occupies which network positions, individuals select themselves and others into network positions that best suit their skillsets. The selection process allows groups to match individual member expertise to network position, thereby improving performance. We test this hypothesis in a laboratory study manipulating how members are assigned to positions in a centralized communication network. We find individuals who communicate more during training are more likely to be chosen as the central member, and that their communication activity explains the effect of choosing the central member on performance. Supplemental analyses suggest that groups allowed to select their central member performed as well as, and often better than, groups whose central member was randomly assigned. Our results contribute to the Carnegie perspective by demonstrating that the intra-team processes that develop a team's network help explain their performance.

KEYWORDS

communication networks, centrality, network positions, expertise, group performance

1. Introduction

In the Carnegie research perspective, the limits of individuals as information processors lead organizations to divide their goals into smaller units and develop structures that deal with these subgoals (March and Simon, 1958; Cyert and March, 1963). Communication networks structure the distribution of information and provide inputs for those who make key organizational decisions. The information that flows through communication structures in organizations is crucial for decision making (Cyert and March, 1963). Thus, organizations often rely on their communication networks to manage information (Cross and Prusak, 2002). Consequently, the nature of the communication networks and the individuals who comprise them have major implications for many organizational outcomes.

The Carnegie perspective studied the ways in which organizations gain efficiency through learning, routine development, and knowledge exchanges. Communication networks are a structure through which knowledge exchanges occur. Herbert Simon

recognized that network experiments offer an ideal scenario to observe the ways in which ideas are adopted and to model cognitive limitations of communication capacity (Guetzkow and Simon, 1955). Early network research (see Shaw, 1964 for a review) focused primarily on the ways in which different network structures affect performance. A common structural characteristic of interest is a network's centralization, the extent to which ties within the network are concentrated. Networks with a higher concentration of ties are "centralized," whereas networks with a more even distribution of ties are "decentralized" (Katz et al., 2004). Considerable research from social psychology and communications scholars has compared the effect of centralized versus decentralized networks on group performance (Shaw, 1964), as well as how communication networks of various forms affect performance in groups (Sparrowe et al., 2001) and organizations (Balkundi and Harrison, 2006).

This study examines decisions about the development of communication networks on group performance to determine whether the process by which individuals come to occupy network positions influences team performance. We focus on decisions about who should occupy the central position in a centralized communication network, complementary to recent work on the structural influences of networks on performance (see Argote et al., 2018). Centralization captures the extent to which communication ties are concentrated in only one or a few members (Freeman, 1978). Centralized, dyadic communication networks are prevalent in organizations. For example, consider a team that spans multiple levels of an organizational hierarchy. In such a team, it is unlikely that a member at the bottom of the hierarchy will communicate directly with a member at the top. It is likely that communication will be dyadic, such that the member in the middle of the hierarchy will mediate communication. Similarly, consider a team that spans subunits within an organization such as when an engineer interacts with a marketing representative in addition to team members within their own department. The role of the engineer in this case is to serve as the link between their department and another unit in the organization; communication would be dyadic in this case because of the members' roles.

Central members in a network are often responsible for gathering and sharing information (Cyert and March, 1963, p. 108). The Carnegie perspective speaks to formal and informal communication structures in organizations (Simon, 1997) but is silent about the processes through which workers come to occupy network positions. We extend the Carnegie perspective by showing that the process through which individuals come to occupy network positions affects the performance of networks. We integrate research on the Carnegie perspective with the social psychological research on expertise recognition to examine the process of assigning group members to network positions, specifically, which individual skills affect network position assignment. Subsequently, we compare the performance of networks in which members receive their choice of a central member to those where they do not.

We argue that individuals who occupy central positions within centralized networks require specific skillsets for the group to realize its performance potential. For example, a coordinator who interacts with unconnected team members in two separate departments occupies a central position, collecting and distributing information from the two unconnected team members and facilitating the work of the team. When the central member possesses skills such as communication and task expertise, a group's performance potential is enhanced. Communication skills are necessary for individuals occupying central positions because those individuals control the information flow within a group (Freeman, 1978) which is imperative for successful task completion (Mesmer-Magnus and Dechurch, 2009). Task expertise benefits central members in interpreting information received from team members and orchestrating the team's task performance strategy. For instance, in the above example, a coordinator would need to possess the ability to effectively relay task-relevant information to two team members who are not connected to each other. Additionally, the coordinator should have sufficient task expertise to comprehend and rephrase the information received from the two different departments. Drawing on the expertise recognition literature (e.g., Littlepage et al., 1997; Bunderson, 2003; Bonner and Baumann, 2012), we theorize that members learn about one another's relevant skills as they work together (Argote, 2013) and that this knowledge enables members to select those who have the requisite skills for particular positions.

We build on this research tradition by examining how the process through which individuals come to occupy network positions affects the performance of networks. We use the controlled environment of a network experiment to investigate how networking choices affect group performance. In this way, we contribute to an understanding of how the development of a network, not just its structure, influences performance.

2. Theory and hypotheses

Individuals in work groups use communication networks, defined by which members communicate with one another, to accomplish their tasks (Shaw, 1964). In many settings, network structures are imposed by an organization through design or communication rules (Cyert and March, 1963). Centralized networks—where one or a few members are connected to more members relative to their peers—are common. In a centralized network, central members control the flow of communication within the group (Shaw, 1964; Freeman, 1978) and thus can be more influential than members in other network positions. Individuals within a firm can each possess unique knowledge and skills (March, 1991), but their ability to leverage those skills to benefit the firm may depend on their position within the network. For example, a member with exceptional communication skills would most benefit the firm if that skill were recognized and the member were placed in a network position, such as a central position.

Communication networks are frequently treated as dyadic in nature, where members communicate one-to-one with each other. The examples we provide in the introduction are representative of broader patterns of dyadic communication through which network structures emerge. Despite the rising prevalence of electronic communication, dyadic communication persists in organizations for multiple reasons. Hierarchies and roles in organizations can create status dynamics that favor centralized communication. Lower-level employees may not feel comfortable communicating directly with senior employees, preferring to communicate through

an intermediary. Senior employees may feel that it is not appropriate or efficient for them to communicate with many lower-level employees. The nature of tasks that teams perform could also lead to dyadic communication, whereby team members interact directly with those relevant to the task at hand and do not broadcast information that is not relevant to others.

More importantly, individual team members may choose to communicate dyadically to mitigate their cognitive burdens. The concept of network inertia, though traditionally applied at the organization level, provides valuable insight into why individuals, bound by cognitive constraints, may sometimes favor dyadic communication (Kim et al., 2006). Individuals might prefer dyadic communication over all-channel communication due to the difficulty of managing a large volume of information and complex social relationships. Moreover, consistent dyadic communication with certain counterparts can establish shared routines, values, and languages. This familiarity obviates the need to reinvent the wheel with each interaction. In essence, the cognitive limitations of individuals in networks lead members in teams to make deliberate decisions about when and with whom to communicate. By being selective about communication, individuals can reduce the likelihood of information overload (Savolainen, 2007) and focus attention on information and tasks relevant to their work.

Findings in the literature about the influence of centralization on group performance are somewhat inconsistent. Early network research suggests that decentralized teams—where ties are evenly distributed between members—perform better on complex tasks (Shaw, 1964). Several more recent studies have found that decentralized network structures perform better than centralized structures on complex tasks. For example, Borgatti and Cross (2003) find that teams in the field with high centralization perform worse than those without such a structure. Balkundi and Harrison (2006) similarly find in a meta-analysis of field data that teams with high network density—strongly correlated with being decentralized—perform better than teams with low network density. In contrast, Ehrlich and Cataldo (2014), studying software development teams in the field, found that communication network centrality was associated with improved performance. Recent simulation (Lazer and Friedman, 2016) and experimental findings (Mason and Watts, 2011) also suggest that teams with centralized communication networks perform better on complex tasks than teams with decentralized structures. Other recent experimental work has also shown that centralized structures, as opposed to decentralized structures, can more efficiently integrate new members and thus new information into teams, even when their work is complex, thereby improving performance (Argote et al., 2018). Additionally, recent laboratory evidence shows that purely centralized five-person networks are better able to develop shared language and consequently perform better in an abstract symbol naming task than decentralized groups (Burt and Reagans, 2022; Reagans, 2022).

These disparate results suggest that additional factors outside of task complexity affect the performance of networks. It is not always clear, however, in non-experimental studies whether the effects of a network structure are driven by the network's structural properties, the processes through which the structure emerged, and/or the characteristics of the person(s) who occupy network positions (Park et al., 2020). Laboratory studies benefit from the imposition of network structures and the random assignment of individuals to structures, which enable the causal identification of the effects of the networks on performance. Most of the above studies with conflicting result were conducted in the field where teams had already formed. We suggest that a key factor that may help explain these inconsistent findings is the process by which individuals enter network positions.

In this study, we examine the extent to which allowing group members to select who occupies the central position in a centralized communication network affects the group's performance. In doing so, we bridge structural perspectives from laboratory studies with emergent perspectives from both the field and the laboratory. Through this bridging, we draw on insights from both the Carnegie perspective and psychology to investigate the member selection process. Our focus on whether and how an organization can gain efficiencies through worker choices in network formation could help explain a micro-foundation of the emergence of larger organizational structures, such as those described in the Carnegie perspective.

2.1. Communication networks and network positions in the Carnegie perspective

The Carnegie perspective represents a research tradition that emerged in the 1950s and 1960s from the work of scholars housed at the Graduate School of Industrial Administration at the Carnegie Institute of Technology. Emphasizing a plausibly realistic analysis of decision making within organizations, Carnegie perspective scholars introduced concepts like bounded rationality (Simon, 1957), coalitions (March, 1962), and problemistic search (Cyert et al., 1958) to the study of organizations.

Communication networks, in Organizations (March and Simon, 1958), influence decision processes in organizations, especially for non-programmed tasks. Coordination can be preprogrammed with planned responses to stimuli for programmed tasks, whereas communication networks facilitate organizational adaptation to emergent events in non-programmed tasks. Consequently, in these non-programmed scenarios, the shape of an organization's communication network is particularly important, as only locally available information can be applied to the problem (March and Simon, 1958, p. 190).

March and Simon (1958) describe two general hypotheses about the emergence of communication networks in organizations. First, the more efficient a communication channel between two parties, the more it will be used. Second, a communication channel will be self-reinforcing (March and Simon, 1958, p. 189), such that a communication tie will evolve beyond its original purpose and encompass other purposes. The shape of the network that emerges has consequences for organizational outcomes by determining the frequency with which organizational members come into contact with one another and the information to which organization members are exposed. Thus, the network is important for both access to information and its transmission in solving problems.

The Carnegie perspective studied the development of communication structures and the effects of those structures

on group performance. Communication networks facilitate organizational communication and problem solving, but they reflect the cognitive capacity limitations of individuals. Absent capacity limitations, networks could be fully decentralized, with all individuals connected to all others. We suggest that the process by which individuals come to occupy positions in communication networks can help individuals overcome limitations in their cognitive capacities.

Important research conducted at the Massachusetts Institute of Technology (MIT) was built on an innovative experimental platform for studying small group communication networks. The research assessed the effects of various networks on group performance (e.g., see Leavitt, 1951). Guetzkow and Simon (1955) extended Leavitt's (1951) research by giving team members time between each task trial to communicate about how to organize themselves. Thus, in addition to examining the effects of the communication networks, the researchers examined how the communication networks shaped the patterns of information exchange in the groups.

Guetzkow and Simon (1955) studied three communication networks—wheel, all-channel, and circle—that affected the difficulty groups had in organizing themselves. Groups in the wheel condition had the least difficulty because they did not need to solve the organizational problems of eliminating communication channels, establishing relays, or determining who decides the solution, whereas the circle groups had to solve all three organizational problems and therefore had the most difficulty. Groups in the all-channel condition had an intermediate level of difficulty. Consistent with the researchers' predictions about the difficulty of the task, the wheel groups organized earliest and completed the task trials most quickly. The all-channel groups organized more slowly than the wheel groups but eventually performed as well as groups in the wheel condition. The circle groups did not reach the performance of groups in the other two conditions during the study's 20 trials. The researchers concluded that the communication networks do not affect the performance of the groups directly but rather do so indirectly through their influence on the ability of groups to organize themselves.

What Carnegie perspective research did not investigate is the process by which individuals are selected to network positions (which is rarely randomly determined in the field) and how this selection process influences performance. Research in social psychology speaks to member selection to position. Through collaborative interaction, individuals learn who possesses which skills. We argue that when teams determine members' network positions, the selection process enables them to select members to occupy network positions that fit their skillsets and thereby improve group performance. This selection process, we suggest, is the mechanism that allows communication networks to overcome individual capacity limitations by creating a match between the capacity of the individuals and the requirements of the positions.

2.2. The recognition of roles and expertise

Network positions differ in nature within a given communication network. Network analysts identify roles within a network by identifying who has similar patterns of connections (Hanneman and Riddle, 2005). A given individual could share the same pattern of communication ties with another individual. For example, if two employees each had only one communication tie to a manager, these two employees would be considered equivalent to each other; if two managers were tied to two employees and a superior, the managers would also be considered equivalent to each other. The employees and managers each occupy network positions similar to others in their same functional role but different from those with a different role. The employees would engage in communication behaviors similar to other employees but different from their managers. We contend that network positions require specific skills that vary depending on the position within the network and that there can be a match (or mismatch) between an individuals' skills and the requirements for the position they occupy.

Because our focus is on the selection of individuals to network positions, we turn to the literature on the recognition of expertise. Specifically, research on expertise recognition indicates that groups effectively identify members' expertise when they have access to information about each other's relative competencies (Liang et al., 1995; Bonner et al., 2002). One method for acquiring this information is through working together (Littlepage et al., 1997). Through collaborative work, members learn who possesses which skills and develop a shared understanding of the tasks at hand. Based on this shared understanding, group members assess each member's skills, identify the expert, and give more weight to the expert's opinions when making group decisions (e.g., Bonner, 2004; Bonner and Baumann, 2012). There is substantial work finding that teams perform better on decision-making tasks if members can identify and defer to their expert members (Yetton and Bottger, 1982; Stasser and Titus, 1987; Littlepage et al., 1995, 1997; Bonner et al., 2002; Bonner, 2004; Ho and Wong, 2009; Bonner and Baumann, 2012). Consequently, this line of research suggests that groups can assign members to network positions that best suit their expertise, and that such assignment will improve group performance.

2.3. Network position selection

Given that network positions require specific skills of those who occupy them, we suggest that one reason that individuals come to occupy network positions is because they have signaled their expertise to others who then select them into a specific position. Because they are prevalent and foundational to other networks, we focus on centralized communication networks and theorize about individual decisions around who should occupy specific positions in that network.

Centralized communication networks in their most elementary form consist of one central member who connects two otherwise disconnected alters. This central member is the sole communicator for the two disconnected members. Any information or communication the non-central members receive comes from the central member, and any information the central member receives must come from one or both alters. Consequently, as the communication core of the team (Humphrey et al., 2009). the

central member plays the most important role in coordinating the work of the team and in managing communication; without a central member communicating, no information would flow through the team. The central member's attributes are therefore of outsized importance to the team's success.

Bunderson's (2003) status characteristics perspective, an important theoretical framework in the expertise recognition literature, posits that members are more likely to identify experts on the basis of status characteristics, which could be specific (task-relevant) or diffuse (social categories such as age or sex). Initially, group members tend to rely on diffuse status characteristics to identify experts. However, as groups work together and have more opportunities to learn about other members' task-relevant expertise, members increasingly utilize specific status characteristics. Similarly, Bonner et al. (2007) find that groups rely on expert members when they hold task-relevant information that can be used to gauge each member's relative task competencies, whereas groups rely on members with high levels of extroversion when they lack such information. Again, this study suggests that groups focus on the cues of members' task-relevant expertise when members have worked together and thus have information to evaluate group members' task expertise. Finally, Bonner and Baumann (2012) hint that groups working together can facilitate the development of a shared understanding of the task requirements, and that this shared understanding makes it easier for groups to judge other members' expertise.

We argue that the evocation of specific, task-relevant expertise among members of a team influences both the process by which individuals are selected into network positions and subsequent team performance. We suggest two primary criteria upon which this central member might be judged. First, members can be judged based on communication activity. We define communication activity as the volume of communication sent by an individual. In a centralized network, the group is forced to rely on the central member to coordinate work, as peripheral members are disconnected from one another and unable to understand the scope of the group's knowledge. The extent to which an individual is communicating actively signals to others that they are capable of effectively relaying information (March and Simon, 1958) and thereby coordinating the team's work effectively.

Second, members can be judged on task expertise. Central members in the communication structure not only need to communicate to coordinate the work of the team, but must interpret knowledge from the disconnected team members and either transmit that knowledge to where it is needed or to apply it to the task themselves. A member signals her expertise through her contributions to the task and through communication to others. Other team members who are presented with a centralized communication network are more likely to select an individual with task expertise to occupy the central position, recognizing the necessity of the central member in transferring knowledge across the team. Consequently, a member possessing task expertise will more likely be selected to occupy a central position.

As group members work together, they recognize which member possesses the most suitable skills to be the central member, such as the communication aptitude necessary to relay important task information and the task expertise needed to orchestrate the work of the group. Thus, we hypothesize:

> *Hypothesis 1a: Individuals with higher communication activity are more likely to be selected as the central member than individuals with less frequent communication activity.*
> *Hypothesis 1b: Individuals with higher task expertise are more likely to be selected as the central member than individuals with less task expertise.*

Next, we theorize how allowing groups to choose their central member affects the group's performance. Research on expertise recognition indicates that groups can improve their task performance by recognizing members' expertise and utilizing the skill sets of expert members in solving tasks (Littlepage et al., 1997; Bonner and Baumann, 2012). However, teams may not be able to make use of the diversity of the knowledge available in the team, and diversity in knowledge may have a positive or negative impact on a team's ability to communicate and coordinate (Martins and Sohn, 2022).

We suggest that the selection process that places a team member with appropriate skills into a central network position mitigates penalties related to knowledge diversity and communication. The central member plays a critical role in sharing information and ideas between team members (Freeman, 1978), meaning the individual occupying the central position plays an outsized role in the team's success. Teams that are able to select which members occupy network positions benefit because they are more likely to match team member characteristics to the requirements of the network position. Such a match would allow team members to complete tasks for which they are best suited, which benefits team performance by eliminating duplication of work and reducing errors (Liang et al., 1995).

A central member who has demonstrated communication activity can assign sub-tasks and coordinate the work of the group, and furthermore, can identify important information possessed by fellow group members and communicate that information to others. We argue that teams will be more likely to choose a central member who has demonstrated communication activity in previous interactions, and that the communication skills of the central member will improve performance.

Similarly, a central member with task expertise may volunteer such knowledge to help explicate the task requirements so that members with less expertise can better understand them and thereby better guide a group's task-performance strategies than a central member lacking task expertise. We argue that teams that can select central members are more likely to have individuals with higher task expertise occupying the central position than teams that cannot select central members and that this helps explain their superior team performance.

> *Hypothesis 2: Groups that receive their choice of a central member perform better than groups in which the central member is assigned.*

Hypothesis 3a: The central member's communication activity mediates the relationship between choice of central member and performance.

Hypothesis 3b: The central member's task expertise mediates the relationship between receiving choice of central member and performance.

3. Methods

We conducted a laboratory experiment to test our hypotheses. We collected a sample of 41 three-person groups for a total of 123 individuals participating. The groups were collected from a participant pool sponsored by a Mid-Atlantic University. The mean age in the sample was 21 years, 63% of the sample was Asian/Pacific Islander, and 61% of the sample was male. We had two experimental conditions. In one condition, members received their choice of who occupied the central position; in the other condition, members did not receive their choice. Participants were randomly assigned to groups, and groups were randomly assigned to conditions. As expected from the random assignment to conditions, there were no differences between the two conditions in terms of demographic representation.

3.1. Procedure

After arriving in the laboratory, each individual group member was placed into a separate room equipped with a computer where they were introduced to the study and asked to watch a training video and read introductory materials. Each group member's computer was connected to a terminal computer so that group members worked collaboratively and simultaneously on a single project. Group members could only communicate dyadically via instant-messenger accessible on their computers, and experimenters controlled the communication network through the messaging client, meaning all interaction between participants was computer mediated for the duration of the experiment.

Groups worked collaboratively on a complex, graphical programming task using a programming interface called App Inventor. Rather than traditional programming (i.e., writing actual lines of code), participants were asked to program an Android application by manipulating graphical modules. These modules, each with a specific function, are placed together like jigsaw puzzle pieces to add features to an application. Groups were provided a partially completed Android application and instructed to add a new set of features to complete the application. Participants were shown the development canvas and an emulator that presented the current status of the application they were developing. The emulator running this application updated in real-time in response to changes made by group members. To ensure group member interdependence, each member received unique information about the application features they needed to add, meaning members needed to work together to determine which specific modules to add, how to combine these modules, and what the module settings should be.

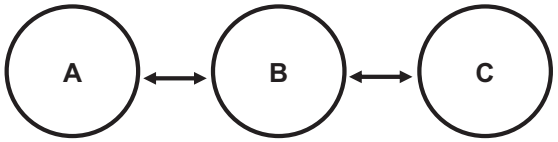


FIGURE 1
Centralized communication network. We provided the following instructions to participants to facilitate their understanding of the impending change in the communication structure and the role of the central member: "Your communication structure will change in the production task. So far, your team has communicated in an open communication structure. In the diagram below, the circles represent team members, and the lines represent communication links between them. Your communication structure for the production task will look like the diagram, with one member connecting two other members. How would you perform the task differently, and who would be the central member?"

Groups were given a 15-min practice period during which group members worked together on the task in an all-connected dyadic communication network. In this network, each member could communicate with the other two dyadically (i.e., one-to-one), but there was no option for all three members to communicate as a group. This practice period gave group members the opportunity to learn about one another's expertise.

3.2. Manipulation

Following the practice period, each participant completed an individual survey. Group members were then presented (as a group) with an image of a centralized communication network (Figure 1) where one member is the sole connector between two other disconnected members. In the centralized network, the two disconnected members cannot communicate directly with each other but can each communicate with the central member.

Group members were instructed to select each member to a network position and given 5 min to discuss via their all-connected dyadic network which group member should occupy each network position, as well as their strategy to complete the task in the centralized network. Then, as individuals, each group member identified which team member they wanted to occupy the central position in the network. We determined the group's choice by identifying the member who received the most votes.

In the position chosen condition, the group was given their choice of central member. In the position assigned condition, we randomly selected one of the two non-selected members to occupy the central position. In both conditions, group members were able to make a choice, weakening the possibility that the choice process would explain any differences between the conditions. Eighteen groups received their choice of central member, and 23 groups did not receive their choice of central member. In both conditions, however, groups were told that their positions were randomly assigned. It was crucial for us to inform all groups that their assignment was random to reduce the possibility that teams in the position chosen condition would feel more motivated or perceive greater agency as they worked on the task. Our design enabled us to attribute any differences we found between conditions to having a member with the requisite characteristics occupy the

central position rather than having a member the group believed they chose in the central position. We examine the potential trade-offs between the benefits and costs of this methodological choice more extensively in the discussion section.

Following the choice discussion and assignment, group members assumed their assigned network positions and were allotted 15 min to repeat the programming task in a production period where group performance was measured. Following their 15-min production period, group members completed a survey, were thanked and debriefed. We imputed means to address any missing data in the surveys.

3.3. Measures

3.3.1. Performance

Performance was measured by the number of errors groups committed in adding features to the Android application. There was an objective standard, a correctly constructed program, against which each group's output was compared.

3.3.2. Communication activity

We measured communication activity by measuring the number of unique ideas sent by each group member during the training period prior to the selection of the central member. Communication in the task influenced performance by allowing the group to coordinate work and transfer information. We measured the volume of ideas an individual sent, as this was a visible indicator of a member's ability to coordinate and convey information to fellow group members.

3.3.3. App Inventor familiarity

We captured familiarity with App Inventor with a survey question on a 1–4 scale. Participants were asked, "How familiar are you with App Inventor?" Across the sample, the mean was 1.31, and the standard deviation was 0.62, suggesting that most participants had little prior familiarity with App Inventor. We constructed a variable capturing the relative difference between a focal member's familiarity with App Inventor and the group's average to capture how much a given member differed from their groupmates in terms of familiarity. We created this variable by averaging the App Inventor familiarity of the three team members. We then subtracted this average from each member's reported familiarity. Higher values reflect more familiarity relative to the group's average. We used this variable for our analysis because when members select their network positions, their point of reference is not absolute familiarity or skill, but a relative comparison with their fellow team members. This variable is our measure of task expertise as referred to in Hypotheses H1b and H3b.

3.4. Alternative explanation variables

We consider alternative explanations for Hypothesis 1 and Hypotheses 2 and 3. For Hypothesis 1, we identify additional reasons that an individual might be selected to occupy a central network position. Apart from demographic characteristics, prior research has found self-monitoring, or an individual's ability to control their self-presentations, to be a predictor of occupying brokerage positions (Mehra et al., 2001) and individual centrality within a network (Sasovova et al., 2010; Fang et al., 2015). Additionally, we capture dominance motivation, whether individuals are naturally inclined to dominate in social situations, which could lead individuals to be selected for a central network position irrespective of their skills.

One alternative explanation for Hypotheses 2 and 3 is that individuals receiving their choice of a central member may feel a greater sense of control over their work and thereby be more highly motivated, performing better because they perceive control over their outcomes (Fisher, 1978; Spector, 1986). Informing all participants that positions were assigned randomly mitigated against a motivation effect. Additionally, evidence suggests that the opportunity to choose may not confer perceptions of control and thereby motivation (Klusowski et al., 2021). However, we account for the groups' perceptions of control to investigate this alternative explanation.

3.4.1. Self-monitoring

We measured individual self-monitoring with Lennox and Wolfe's (1984) scale.

3.4.2. Dominance motivation

We captured whether individuals are naturally inclined to dominate in social situations with the dominance motivation subscale of the achievement motivation scale (Cassidy and Lynn, 1989). This subscale captures a similar construct to social dominance orientation (Pratto et al., 1994) but is focused at the group level, whereas social dominance orientation focuses on an individual's feelings about hierarchy and dominance in society more broadly.

3.4.3. Perceptions of control

Perceptions of control were measured using three survey questions designed to capture perceptions of control over network positions and work, for example, "Our team had control over procedural decisions in the experiment."

3.4.4. Coordination

We measured coordination during the production period using Lewis's (2003) subscale from the transactive memory systems measure. We used the coordination subscale to account for coordination benefits for groups that received their choice of central member. We performed an analysis to determine the reliability of the coordination subscale. The rwg(j) was 0.87, and Cronbach's alpha was 0.84, within the acceptable range. The inter-class correlations were also in the acceptable range [ICC(1) = 0.37, ICC(2) = 0.60, $p < 0.01$].

3.5. Demographics

We captured demographic variables such as age, race, and gender.

4. Results

We present summary statistics and correlations in Tables 1, 2. Table 1 contains variables for the individual-level analysis around the selection of a central member, and Table 2 contains group-level variables to analyze performance.

We perform analyses at different levels to investigate the hypotheses. First, we investigate central member selection at the individual level to test Hypotheses 1a and 1b, as these hypotheses were about individual's preferences. Next, we move to group-level analysis to examine the effects of central member selection on team performance to test Hypotheses 2, 3a, and 3b, as team performance is a group-level variable. We then perform robustness checks and investigate alternative explanations. We also perform a resampling procedure to compare position chosen with random assignment to explore whether we would have obtained findings consistent with our conclusion if we had used a different experimental design. Finally, we supplement our quantitative analysis with qualitative observations of group communication logs.

4.1. Member selection

To test Hypotheses 1a and 1b, we conducted analyses at the individual level, examining the factors that predicted selection to the central position. Members of all groups were asked for their choice of central member (regardless of condition), and these data collected after the group discussion regarding which member should occupy the central position allow us to capture group preferences in both conditions for who should occupy the central position, along with characteristics of the individual selected.

We performed a probit analysis at the individual level to determine individual characteristics that predicted selection to the central position. Each observation is a group member. Standard errors were clustered at the group level to account for within-group variance and interdependence. The results of the probit analysis are shown in Table 3. We enter all predictors separately and then enter predictors in one model in column 9 in Table 3.

The dependent variable in these analyses was whether an individual was selected by their group to occupy the central position. The first variable entered is the number of messages sent by the focal individual during the training period ($\beta = 0.04$, $p < 0.001$). The more an individual communicated during the training period, the more likely they were to be selected as the central member, such that a one-standard deviation increase in communication yielded a 14% greater chance of selection to the central position. This result supports Hypothesis 1a and is shown in column 1 of Table 3.

Familiarity with App Inventor was a marginally significant predictor of selection to the central position ($\beta = 0.39$, $p = 0.06$). A one-standard deviation increase in relative App Inventor familiarity resulted in a 9% greater chance of selection. This effect is consistent with the idea that groups selected central members based on task expertise. This result provides some support for Hypothesis 1b and is shown in column 2 of Table 3. Results are consistent in column 8 of Table 3 when both communication and App Inventor familiarity are entered as predictors.

TABLE 1 Summary statistics and pairwise correlations for individual-level variables.

	Mean	SD	Selected	Communication activity	App Inventor familiarity	Self-monitoring	Dominance motivation	Age	Male	Asian
Selected	0.333	0.473	–							
Communication activity	27.325	13.146	0.336***	–						
App Inventor familiarity	1.317	0.618	0.239***	0.001	–					
Self-monitoring	57.967	7.677	0.041	−0.005	0.068	–				
Dominance motivation	10.699	2.409	0.096	0.041	−0.007	0.020	–			
Age	21.699	3.011	−0.073	−0.016	−0.109	−0.099	0.095	–		
Male	0.618	0.488	0.095	−0.048	0.104	−0.148	0.048	0.156*	–	
Asian	0.650	0.479	−0.133	−0.059	−0.080	−0.204**	0.001	−0.034	−0.015	–

$^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

TABLE 2 Summary statistics and pairwise correlations for group-level variables.

	Mean	SD	Position chosen	Errors	Communication activity	App Inventor familiarity	Control	Coordination
Position chosen	0.439	0.502	–					
Errors	11.341	6.751	−0.384**	–				
Communication activity	1.902	10.452	0.440***	−0.439***	–			
App Inventor familiarity	0.1335	0.565	0.029	0.162	0.175	–		
Perceptions of control	11.447	2.077	0.278*	−0.054	0.061	−0.071	–	
Coordination	16.650	3.196	0.337*	−0.293*	0.252	−0.214	0.353**	–

$^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

TABLE 3 Probit results for individual selection to central position.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Communication activity	0.035***							0.038***	0.038***
	(0.009)							(0.009)	(0.009)
App Inventor familiarity		0.396^{+}						0.475*	0.430*
		(0.211)						(0.203)	(0.210)
Self-monitoring			0.007						0.007
			(0.017)						(0.018)
Dominance motivation				0.052					0.054
				(0.039)					(0.045)
Age					−0.032				−0.042
					(0.036)				(0.034)
Race (Asian)						−0.286			−0.252
						(0.232)			(0.276)
Male							0.257		0.317
							(0.261)		(0.283)
Constant	−1.434***	−0.962***	−0.841	−0.991*	0.270	−0.253	−0.593***	−2.134***	−2.245
	(0.291)	(0.283)	(0.979)	(0.424)	(0.783)	(0.141)	(0.168)	(0.442)	(1.444)
Observations	123	123	123	123	123	123	123	123	123

Standard errors in parentheses, clustered by group. $^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

With respect to alternative predictors of selection, the analysis indicates that other variables (self-monitoring, dominance motivation, age, race, and gender) did not significantly predict selection (see columns 3–7 of Table 3). Only communication and App Inventor familiarity predicted selection to the central position. When all alternative predictor variables were included in the model, both communication and App Inventor familiarity remain significant (see column 9 of Table 3).

We also implemented a multi-level mixed effects probit with random slopes for group and found the same results. Communication ($\beta = 0.04$, $p < 0.001$) and App Inventor familiarity ($\beta = 0.43$, $p = 0.03$) predicted selection to the central position, with none of the other covariates predicting selection.

4.2. Explaining performance at the group level

To test Hypotheses 2 and 3, we move to the group-level and treat the team as the unit of analysis. Because of the importance of the central member in this network, however, we focus on the central member's individual measures in communication and task expertise in our mediation analyses. We first determined whether receiving choice of central member had a significant effect on team performance. An independent samples t-test shows that it did, such that groups receiving their choice of central member made fewer errors ($M = 8.44$, SD = 6.92) than groups that did not receive their choice [$M = 13.61$, SD = 5.79; $t(39) = 2.59$, $p = 0.013$]. This represents a Cohen's d of 0.81, a large effect size. This result supports Hypothesis 2.

To test Hypothesis 3a, we performed a mediation analysis to determine if communication activity explained the relationship between the manipulation and performance (Baron and Kenny, 1986). We acknowledge that communication activity was measured during the training period prior to the manipulation. However, it is essential to note that the manipulation was designed to induce a difference between the position assigned and position chosen conditions. This manipulation subsequently triggered a difference in the enduring characteristics of the central members. In light

TABLE 4 Ordinary least squares regressions for group performance.

	(1)	(2)	(3)	(4)	(5)
	Errors	Communication activity—central member	Errors	App Inventor familiarity—central member	Errors
Position chosen	−5.164*	6.865^{+}	−3.965^{+}	0.425*	−4.654*
	(2.028)	(4.049)	(2.069)	(0.181)	(2.209)
Communication activity (central member)			−0.175*		
			(0.0713)		
App Inventor familiarity (central member)					−1.201
					(1.943)
Constant	13.61***	25.91***	18.14***	1.130***	14.97***
	(1.212)	(2.773)	(2.117)	(0.0720)	(2.507)
Observations	41	41	41	41	41
R^2	0.148	0.068	0.257	0.142	0.156

Standard errors in parentheses. $^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

of this, we use the central members' communication activity as a mediator.

First, consistent with the *t*-test results, the regression examining the relationship between the position chosen condition and errors shows that groups in the position chosen condition committed fewer errors than groups in the position assigned condition (β = −5.16, $p = 0.02$). Next, we regressed communication activity on the position chosen condition and found that the communication activity of the central member in the position chosen condition was marginally higher than in the position assigned condition (β = 6.86, $p = 0.09$). When we regressed performance on the manipulation and communication activity, the position chosen condition became marginally significant (β = −3.96, $p = 0.06$) and communication activity was negatively related to errors (β = −0.17, $p = 0.02$). These results (see columns 1, 2, and 3 of Table 4) suggest that choosing central members with higher communication activity mediates the negative effects of receiving one's choice on errors. We also tested all mediation analyses with a bootstrapping procedure using the PROCESS macro for SPSS (Hayes, 2022). All analyses used 50,000 bootstrap percentile confidence intervals. We found a significant effect of the manipulation on performance, mediated by communication activity (95% CI: −4.85, −0.12). All the above analyses provide evidence for Hypothesis 3a.

We next tested Hypothesis 3b. Similar to the approach taken in Hypothesis 3a, we use the central member's App Inventor familiarity, as measured after the training period, as a mediator. We found that App Inventor familiarity for the central member was higher in the position chosen condition ($M = 1.56$, SD = 0.71) than in the position assigned condition ($M = 1.13$, SD = 0.35), and this difference is statistically significant [$t(38) = -2.44$, $p = 0.02$].

We performed a mediation analysis to determine if relative App Inventor familiarity explained the relationship between the manipulation and performance (see columns 1, 4, and 5 of Table 4). First, as noted previously, groups in the position chosen condition committed fewer errors than groups in the position assigned condition (β = −5.16, $p = 0.02$). Second, we regressed App Inventor

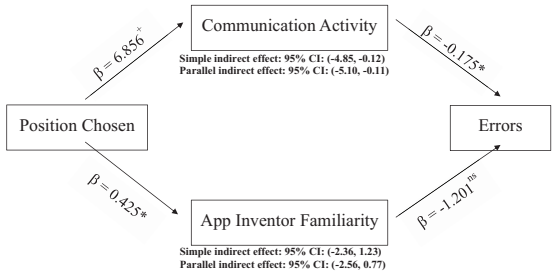


FIGURE 2
Simple and parallel mediation analyses, position manipulation, communication activity, App Inventor familiarity, errors. $^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

familiarity on the position chosen condition and found that App Inventor familiarity of the central member in the position chosen condition was higher than in the position assigned condition (β = 0.43, $p = 0.02$). Finally, we regressed performance on the manipulation and App Inventor familiarity. The position chosen variable decreased in significance and magnitude (β = −4.65, $p = 0.04$), whereas App Inventor familiarity was not significant (β = −1.20, $p = 0.53$). Using PROCESS (Hayes, 2022), we did not find that App Inventor familiarity mediated or explained the effect of the manipulation on performance (95% CI: −2.36, 1.23). Taken as a whole, this analysis does not provide evidence for Hypothesis 3b. We further discuss these results in the discussion section.

We supplemented our mediation analysis to test Hypotheses 3a and 3b with a parallel mediation analysis. Parallel mediation allows for a simultaneous test of whether both communication activity and App Inventor familiarity mediate the relationship between the manipulation and performance. We found, similar to above, that communication activity was a significant mediator (95% CI: −5.10, −0.11), but that App Inventor familiarity was not (95% CI: −2.56, 0.77). Figure 2 summarizes our mediation analyses, showing the simple indirect effects of each mediator and the parallel mediation effects.

TABLE 5 Robustness checks and alternative explanations.

	(1) Errors	(2) Coordination	(3) Errors	(4) Perceptions of control	(5) Errors
Position chosen	−5.164*	2.142*	−4.332^{+}	1.151^{+}	−5.379*
	(2.028)	(0.963)	(2.269)	(0.601)	(2.227)
Coordination			−0.388		
			(0.386)		
Perceptions of control					0.187
					(0.494)
Constant	13.61***	15.71***	19.71**	10.94***	11.56*
	(1.212)	(0.626)	(6.443)	(0.496)	(5.369)
Observations	41	41	41	41	41
R^2	0.148	0.113	0.178	0.077	0.151

Standard errors in parentheses. $^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

4.3. Robustness checks and alternative explanations

As previously mentioned, one alternative explanation for Hypotheses 2 and 3 is that individuals receiving their choice of central member may be more motivated and perform better because they perceive control over their outcomes (Fisher, 1978; Spector, 1986). We investigated whether perceptions of control indeed differed between the two conditions. We found that perceptions of control were marginally higher in the position chosen (M = 12.09, SD = 1.45) than in the position assigned (M = 10.94, SD = 2.37) condition, [$t(39) = -1.81$, $p = 0.08$]. Although participants were told that all positions were randomly assigned, merely receiving their choice of central member induced somewhat greater feelings of control.

Next, we investigated whether perceptions of control mediated the relationship between position chosen and performance. When we regressed perceptions of control on position chosen, we found a marginally significant relationship, such that perceived control is higher when groups receive their choice (β = 1.15, $p = 0.06$). When we regressed performance on both position chosen and perceptions of control, we found a significant negative relationship between position chosen and performance (β = −5.38, $p = 0.02$) and an insignificant relationship between perceptions of control and performance (β = 0.19, $p = 0.71$). These results are shown in models 1, 4, and 5 of Table 5. On the whole, we did not find evidence that perceptions of control influenced performance. Furthermore, we included perceptions of control as a covariate and repeated the test of communication activity as a mediator of the effect of choice on performance. This mediation remained significant (95% CI: −5.07, −0.06). Thus, we found no evidence that including perceptions of control as a covariate altered our results.

We also examined whether coordination mediated the relationship between choice of central member and performance because groups receiving their choice of central member may benefit their coordination (see columns 1, 2, and 3 of Table 5). Coordination is higher when groups receive their choice of central member than when they do not (β = 2.14, $p = 0.03$). When performance is regressed on position chosen and coordination, position chosen is marginally significant (β = −4.33, $p = 0.06$) but coordination is not (β = −0.388, $p = 0.321$). Bootstrapping confirms that coordination does not mediate the relationship between the manipulation and performance (95% CI: −2.81, 0.92).

Finally, we captured logs of group discussions during the period in which group members were asked to discuss their choice of central member and analyzed these logs to illuminate the quantitative findings. First, we employed Linguistic and Word Count-22 (LIWC-22), computerized text analysis software that counts terms in a text to derive psychological assessments (Boyd et al., 2022). We focus on the emotional tone measure, which is derived from an algorithm that captures words indicating both positive and negative emotional tone. Higher scores on this measure indicate more positive emotional tone, with a score 50 representing a neutral tone.

We first examined whether teams experienced higher or lower positive emotions after being assigned their central member. We measured emotional tone for teams[1] for the training period and for the post-manipulation period and calculated a difference score for each team. A positive difference score indicates an increase in positive emotion language after the manipulation and a negative score indicates the reverse. We find that teams in the position chosen condition experienced an increase in positive emotional tone after being assigned their central member (M = 4.479, SD = 23.248) and that teams in the position assigned condition experienced a decrease (M = −2.808, SD = 24.724). However, this difference was not statistically significant between conditions ($t = -0.937$, $p = 0.355$).

Next, we examined only the post-manipulation period during which performance was measured. We find that emotional tone was higher on average for teams in the position chosen condition (M = 48.473, SD = 14.514) than the position assigned condition (M = 37.833, SD = 17.203). This difference was statistically significant ($t = -2.063$, $p = 0.046$), indicating that groups who received their choice of central member communicated more positively than teams who did not receive their choice of central

1 A chatlog for one team was not available and was excluded from the analysis.

member. When we entered the emotional tone measure as a covariate in a regression predicting performance, however, we found that emotional tone was insignificant (β = −0.062, p = 0.339) and our manipulation still had a negative and significant effect on errors (β = −4.768, p = 0.042). Lastly, we find that emotional tone did not mediate the relationship between the manipulation and performance (95% CI: −2.378, 1.050). Thus, though the tone of communication varied somewhat after making a choice, this did not explain the differences in group performance.

When viewed in combination with the results on perceptions of control, we find convergent evidence that although motivation–as reflected by perceived control over procedural decisions and emotional tone in communication–may have differed between conditions, motivation did not explain the effect of positions being chosen on performance. These analyses provide further evidence to suggest that the placement of the team's preferred member in the central position indeed benefited performance and this benefit was not due to psychological benefits of receiving their choice but instead to the qualities of the member in the central position.

4.4. Supplemental analysis: synthetic random assignment

Our study compared groups that received their choice of central member to groups that did not receive their choice of central member. Our data also permit us to explore a different comparison, whether groups that receive their choice of central member perform better than groups in which the central member is randomly assigned. In the position assigned condition in our study, participants did not receive their choice of a central member. If we had used random assignment, however, groups would have received their choice of central member one-third of the time by chance, and two-thirds of the time, they would not receive their choice. Thus, a comparison of choice versus random assignment tests a different null hypothesis than our experimental design and allows us to determine if a different experimental design would have led to the same conclusions.

We constructed a dataset approximating random assignment by randomly drawing observations from both conditions. From the original data, we randomly sampled 6 observations from the position chosen groups and 12 observations from the position assigned groups. This yielded 18 observations in a synthetic random assignment condition where one-third received their choice of central member and two-thirds received a different central member. Recall that all groups were told that their central member had been randomly assigned so all were treated consistently.

We developed a bootstrapping procedure whereby we resampled from our original dataset to generate 50,000 sets of 18 synthetic random observations. We then compared each of the synthetic random datasets to groups in the position chosen condition in our original data and obtained test statistics and p-values.[2] Recall that when we tested Hypothesis 2 and compared position chosen to position assigned, we saw a significant mean difference such that the position chosen group made about 5 fewer errors than the position assigned group (p = 0.013). For the synthetic random datasets, ninety-nine percent of the mean differences in performance between the original position chosen condition and the resampled synthetic random condition were in this same predicted direction, such that groups that received their choice of central member performed better than groups whose central member was randomly assigned. Twenty-one percent of the p-values were below the 0.05 threshold, and 39% of the p-values were below the 0.10 threshold. Thus, the difference between the position chosen condition and random assignment was almost always in the predicted direction and statistically significant some of the time.

4.5. Supplemental analysis: qualitative

In addition to the quantitative analysis of the chatlogs, we also read the logs in detail, and an investigation of the content revealed two themes. The first of these was communication activity: members discussed the importance of communication in making their choice. A participant who nominated another member wrote, "so just to confirm, you will take care of facilitating the communication between all of us." Another participant, in discussing skills of other members, wrote, "[the other member] is really bad at communicating," implying that a particular member should not be placed in the center position. Participants also recognized their own communication activity: "I feel like we communicated the best, so one of us should probably be in the middle though haha."

The second theme was App Inventor familiarity. Participants recognized one another's App Inventor experience by working together on the practice task. One participant nominated another groupmate because "he has a technical background." Another participant stated, "i feel like u have a little more coding knowledge so you should be in the middle." Some participants removed themselves from the running for the central position, noting that they had no programming experience: "I think i should be either 1 or 3. . .i have no knowledge about computing."

5. Discussion

This study integrates the Carnegie perspective with the social psychology literature to show that allowing group members to choose who occupies which network positions enables teams to optimize their position assignments based on individuals' skills and expertise. Guetzkow and Simon (1955) showed that groups in different network conditions were able to develop organizational arrangements that optimized their performance. We complement this work by showing that allowing teams to choose who occupies which network positions improves team performance. Team members are more likely to choose individuals who communicate frequently and those who appear to possess task expertise to occupy

2 We also performed a bootstrapping procedure and sampled, with replacement, from the original 18 observations that received their choice of central member. We drew 50,000 samples, obtained means, and compared differences with the synthetic random condition. The results did not substantively change.

the central network position. For groups that received their choice of who occupies the central network position, choosing someone who communicates frequently explains their superior performance.

To test Hypotheses 1a and 1b, we conducted analysis at the individual level to determine the characteristics that predicted selection to the central network position. We found that both communication activity and App Inventor familiarity predicted selection to the central position, with communication activity being the more robust predictor. We conducted analysis at the group level to test Hypotheses 2, 3a, and 3b. We found that groups receiving their choice of central member performed better than groups not receiving their choice, providing evidence for Hypothesis 2, and that this effect is driven by the ability of groups receiving their choice to place members with high communication activity in the central network position, providing evidence for Hypothesis 3a but not for Hypothesis 3b.

We found that communication activity both predicted selection to the central position and mediated the relationship between choice and performance. This finding suggests that one reason why selection of network positions could improve performance is due to the ability to match member expertise to the requirements of the network position. When groups in this study received their choice of central member, this central member could transfer key task information, organize the work of the group, and delegate sub-tasks, leading to better team performance.

App Inventor familiarity predicted selection of group members to the central position, and thus App Inventor familiarity of the central member differed significantly between the two conditions. However, App Inventor familiarity did not mediate the relationship between the position manipulation and performance. Because the average App Inventor familiarity of the sample was low, it could be the case that, although members could identify when there were differences in ability, actual differences in ability were not sufficient to contribute to group performance. This finding suggests an interesting nuance to the expertise recognition literature. Identifying an expert member is only the first step for groups to benefit from their members' expertise. For groups to tangibly benefit from members' expertise, they must utilize the expert members' skills, and these skills must be at a level high enough to solve the group's task. Bonner and colleagues identified two conditions that can facilitate a group's ability to recognize member expertise: (1) groups need information to judge members' relative competences, and (2) tasks should allow group members to exhibit substantial variation in performance (e.g., Bonner, 2004; Bonner et al., 2007). Our study suggests that while these two conditions may be sufficient for groups to "identify" an expert member, in order for groups to benefit from having an expert member, the skill of this expert member should be sufficiently high.

Participants in our study effectively identified group members' expertise while working on a relatively complex task for a short amount of time (i.e., 15 min). Research on expertise recognition has shown that groups initially focus on diffuse status cues and with experience learn to focus on task-related expertise (Bunderson, 2003). Masking diffuse status cues with computer-mediated communication might have enabled groups to focus their communication around task-relevant content, rather than being distracted by extraneous factors. Taken together, these studies suggest that the salience or availability of diffuse status cues could be an important moderator in how groups' tenure affects their ability to recognize and utilize members' expertise and that impeding the availability of these diffuse status cues could lead groups to focus on communicating task-relevant information, making it easier to identify each member's expertise. Masking diffuse status cues can generate effects similar to the intervention by Bonner and Baumann (2012) which asked members to focus on knowledge that they already know; this enabled members to better judge other members' expertise and facilitated expertise recognition.

We investigated factors other than expertise that might lead to one's selection to the network's central position. In addition to demographic factors like age, race, and gender, we investigated personality characteristics. Self-monitoring has been found to predict whether an individual occupies a brokerage position (Mehra et al., 2001; Sasovova et al., 2010), where an individual connects otherwise unconnected others. In this experiment, the central network position is analogous to a brokerage position, as the central member connects two unconnected alters. We found that an individual's self-monitoring did not predict whether that individual was chosen to occupy the central position. We found similar results for dominance motivation, which assesses an individual's propensity to dominate in social situations.

6. Limitations and future work

In our study, we chose to use positions that differed in their centrality. Centralization captures the extent to which communication ties are concentrated in only one or a few members (Freeman, 1978). Centralization is a dimension of networks that is often analyzed. We studied the most fundamental form of centralization—one member connected to two other members who are not connected to each other. This core form of centralization is the basis for several structural relationships, including bridging a structural hole (Burt, 2004) and spanning a boundary. Given the frequent occurrence of the structure we studied and its importance in different theories, understanding how members were chosen for the central position and the effect of those choices on the group's performance seemed an important endeavor.

Thus, we intentionally chose to constrain participants to communicate dyadically within a centralized communication network. The dyadic structures we examine are at the core of other communication structures. However, dyadic communication, while prevalent, is just one way group members communicate. Broadcast communication, where all members can simultaneously send and receive messages (e.g., group chats and video conferencing), is also used. Though broadcast communication has the potential to enrich decision making by incorporating diverse viewpoints, it also complicates the process. For example, a high volume of ongoing discussions could distract group members, reducing the effectiveness of collective decision making (Diehl and Stroebe, 1987). Especially when managing external relationships, a single point of contact can reduce confusion and miscommunication compared to if multiple group members provide competing or incompatible advice. Our research suggests that group members gain benefits from giving the right person the right role, in our case a communication role. However, in conducting our study in this way, we were not able to speak to questions about broadcast communication, which could be examined in future work.

By informing participants in both experimental conditions that their positions were randomly assigned, we deceived participants about the true manipulation—whether they were given their choice of central member. We did not think that this deception would be harmful to participants. Following the experiment, we debriefed participants in both conditions about the manipulation and revealed to them that position assignment was not random. We chose this design to minimize the chance that the knowledge of receiving one's choice would influence the results. If we had a design where participants knew whether they received their choice or not, the resulting motivational effect of receiving one's choice could have potentially confounded our results. This would complicate our examination of how having a central member who fits well in the central position affects group performance. In essence, two factors would have been affected by the manipulation: explicitly knowing that they received choice and getting their chosen member with the requisite knowledge and skill in the central position. Telling participants that the member was randomly assigned reduced the potential differences between conditions and allowed us to be more confident that effects were due solely to having a member with requisite skill in the position, and not greater motivation of participants because they got their choice.

Despite its benefits, it is vital to consider the potential costs of using deception in experiments. Avoiding harm to participants is, of course, a central concern. In addition, deception may erode participants' trust in experimenters and change their behaviors in subsequent experiments, and thereby negatively impact future data collection involving the same participant pool. For example, Jamison et al. (2008) found more inconsistent participant behavior in subsequent experiments after deception was employed concerning their partners' identities (human vs. computer). However, on average, attrition rates were not affected by deception. At the same time, Rahwan et al. (2022) found that deceiving participants about the study's purpose did not significantly alter their behavior. Thus, while the negative effect of deception may vary depending on its nature and the participant behaviors of interest, we nonetheless strongly recommend future researchers carefully weigh the implications of deception, consider norms about deception for their field, and thoroughly assess its necessity for their research questions.

Follow-on studies to our research can be done without deception. The current study provided evidence that being high in communication activity and having expertise in the technical aspects of the task led to a person being recommended for the central position. In the future, researchers could prescreen individuals on their communication activity and familiarity with the task and then randomly assign members high (or low) in these characteristics to the central position and assess the effect on performance. This design would allow for the researcher to determine the relative impact of member quality and position match on performance, though it could not answer the questions that our study did on group member preferences.

Finally, our findings contrast against purely structural perspectives suggesting that network structures lead to the same performance outcomes regardless of which positions individuals occupy. A well-established literature has argued that the structure of a group's communication network influences performance and that these results are consistent within a given network structure (Shaw, 1964). In contrast, we show that group performance within a network structure is contingent on which individual group members occupy the network positions. The process by which individuals arrive at network positions has implications for group performance and advances recent interest in network formation (Ahuja et al., 2012) and psychology and social networks (Casciaro et al., 2015).

One boundary condition for our theory is that group members must have experience working together to accurately assess member skills for selection to network positions. If group members do not have experience working together, it could hinder their ability to identify members with skills appropriate for the network positions. For example, Yoon and Hollingshead (2010) found that in the absence of team communication, stereotyping was used to coordinate work across expertise areas. This inefficiency diminished and performance improved when communication was permitted. Whether this effect could be mitigated through knowledge repositories such as directories, LinkedIn, or personnel referrals is an interesting question for future research.

Additionally, we only investigated the effects of choice as it pertained to network positions in a single network structure. We did not investigate whether groups perform differently when they can choose their network structures, but we see this as a direction for future research. We expect that groups that can choose their network structure will select structures that fit the group's skills, abilities, and preferred style of work. We also considered only teams that used computer-mediated communication. In teams where members work together face-to-face, additional factors may influence selection into network positions.

7. Conclusion

The Carnegie perspective saw organizational structures as deriving from the cognitive limits of individuals as information processors. We contribute to the Carnegie perspective by showing that the expertise of individual members also affects the development of organizational structures. More specifically, researchers in the Carnegie perspective analyzed how communication networks shape organizational structures and how those structures affect performance (e.g., Guetzkow and Simon, 1955). The Carnegie perspective, however, says little about the qualities of the individuals who occupy network positions—those who form the communication networks that enable work in organizations. As we illustrate, considering the network emergence process contributes to the Carnegie perspective and further, to the literature on social networks. We show that intra-team learning—where team members learn about one another's skills—can facilitate the selection of appropriate members to occupy network positions and thereby improve team performance. When members choose who occupies central network positions, team performance improves. Choosing members who have the most expertise for the requirements of particular positions helps overcome the cognitive limitations of individuals.

A challenge in social network research is determining whether the results are due to the network's structure or due to the processes through which the network was generated and the occupants of

positions determined. Naturalistic studies of networks have been criticized for not accounting for the "endogeneity" of networks, that is, the process through which networks emerge (Manski, 1993). Although there have been calls for networks research to address endogeneity concerns (Ahuja et al., 2012), ours is the first experiment to compare the performance of networks in which members are assigned to a central network position with the performance of networks in which members receive their choice of central member. Our results indicate that allowing groups to endogenously choose who occupies the central position improves group performance. Attending to the endogenous selection process in future studies could help explain inconsistent findings in non-experimental studies. For example, Borgatti and Cross (2003) found that centralization harmed team performance, but Ehrlich and Cataldo (2014) found that network centrality facilitated performance. Our findings suggest that centralized groups in which members received their choices of member to occupy the central position are likely to perform better than groups where members do not choose position occupants. By taking into account endogenous member selection and position assignment processes, one arrives at a more accurate understanding of the effects of various networks (Manski, 1993; Gibson et al., 2021).

Our work also advances research on the recognition of expertise. Previous research had found that with experience working together, team members are able to identity each other's expertise (Littlepage et al., 1997; Bonner, 2004) and further, that placing more weight on experts' opinions improves team decisions (Bonner and Baumann, 2012). We extend the benefits of expertise recognition to choosing members for communication network positions and find that team performance improves when members with the requisite expertise are placed into appropriate positions. Thus, the recognition of expertise by team members provides a micro foundation for the more macro phenomena of communication network performance (Felin et al., 2015).

As our study demonstrates, the individuals occupying network positions and the process by which they arrive at those positions play a significant role in determining team performance. Structure can act as a constraint on how groups interact with one another, but the process of deciding who occupies which role in the structure is an important determinant of performance. The choices that drive the emergence of a network, when made with insight and information of the skills available in the team, help differentiate between good teams and exceptional ones.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Carnegie Mellon University Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

JG, LA, and JK contributed to conception and design of the study. JG collected the data and performed the statistical analysis. All authors wrote sections of the manuscript, contributed to manuscript revision, read, and approved the submitted version.

Funding

This study was supported by the Center for Organizational Learning, Innovation, and Knowledge, the National Science Foundation (Grant No. 1459963), and the Frankfurt School of Finance and Management.

Acknowledgments

We thank the associate editor and the four reviewers for their constructive comments. We also thank Erin Fahrenkopf as well as participants at the INGRoup conference, Academy of Management Meeting, Organization Science Winter Conference, and Laura Patterson for assistance with copy-editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

Ahuja, G., Soda, G., and Zaheer, A. (2012). The genesis and dynamics of organizational networks. *Organ. Sci.* 23, 434–448. doi: 10.1287/orsc.1110.0695

Argote, L. (2013). *Organizational learning: Creating, retaining and transferring knowledge* (Second Edn). Berlin: Springer.

Argote, L., Aven, B. L., and Kush, J. (2018). The effects of communication networks and turnover on transactive memory and group performance. *Organ. Sci.* 29, 191–206. doi: 10.1287/orsc.2017.1176

Baron, R. M., and Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *J. Pers. Soc. Psychol.* 51, 1173–1182. doi: 10.1037/0022-3514.51.6.1173

Balkundi, P., and Harrison, D. A. (2006). Ties, leaders, and time in teams: Strong inference about network structure's effects on team viability and performance. *Acad. Manag. J.* 49, 49–68. doi: 10.5465/AMJ.2006.20785500

Bonner, B. L. (2004). Expertise in group problem solving: Recognition, social combination, and performance. *Group Dynam.* 8, 277–290. doi: 10.1037/1089-2699.8.4.277

Bonner, B. L., and Baumann, M. R. (2012). Leveraging member expertise to improve knowledge transfer and demonstrability in groups. *J. Pers. Soc. Psychol.* 102, 337–350. doi: 10.1037/a0025566

Bonner, B. L., Baumann, M. R., and Dalal, R. S. (2002). The effects of member expertise on group decision-making and performance. *Organ. Behav. Hum. Decis. Process.* 88, 719–736. doi: 10.1016/S0749-5978(02)00010-9

Bonner, B. L., Sillito, S. D., and Baumann, M. R. (2007). Collective estimation: Accuracy, expertise, and extroversion as sources of intra-group influence. *Organ. Behav. Hum. Decis. Process.* 103, 121–133. doi: 10.1016/j.obhdp.2006.05.001

Borgatti, S. P., and Cross, R. (2003). A relational view of information seeking and learning in social networks. *Manag. Sci.* 49, 432–445. doi: 10.1287/mnsc.49.4.432.14428

Bunderson, J. S. (2003). Recognizing and utilizing expertise in work groups: A status characteristics perspective. *Adm. Sci. Q.* 48:557. doi: 10.2307/3556637

Burt, R. S. (2004). Structural holes and good ideas. *Am. J. Sociol.* 110, 349–399. doi: 10.1086/421787

Burt, R. S., and Reagans, R. E. (2022). Team talk: Learning, jargon, and structure versus the pulse of the network. *Soc. Netw.* 70, 375–392. doi: 10.1016/J.SOCNET.2022.05.002

Boyd, R. L., Ashokkumar, A., Seraj, S., and Pennebaker, J. W. (2022). *The development and psychometric properties of LIWC-22*. University of Texas at Austin. Available online at: https://www.liwc.app/ (accessed June 1, 2023).

Casciaro, T., Barsade, S. G., Edmondson, A. C., Gibson, C. B., Krackhardt, D., and Labianca, G. (2015). The integration of psychological and network perspectives in organizational scholarship. *Organ. Sci.* 26, 1162–1176.

Cassidy, T., and Lynn, R. (1989). A multifactorial approach to achievement motivation: The development of a comprehensive measure. *J. Occup. Psychol.* 62, 301–312.

Cross, R., and Prusak, L. (2002). The people who make organizations go–or stop. *Harvard Bus. Rev.* 80, 104–112.

Cyert, R. M., and March, J. G. (1963). *A behavioral theory of the firm*. Hoboken, NJ: Prentice-Hall.

Cyert, R. M., Dill, W. R., and March, J. G. (1958). The role of expectations in business decision making. *Adm. Sci. Q.* 3, 307–340. doi: 10.2307/2390716

Diehl, M., and Stroebe, W. (1987). Productivity loss in brainstorming groups: Toward the solution of a riddle. *J. Pers. Soc. Psychol.* 53, 497–509. doi: 10.1037/0022-3514.53.3.497

Ehrlich, K., and Cataldo, M. (2014). "The communication patterns of technical leaders: Impact on product development team performance," in *Proceedings of the 17th ACM Conference on computer supported cooperative work & social computing*, (Baltimore, MD), 733–744. doi: 10.1145/2531602.2531671

Fang, R., Landis, B., Zhang, Z., Anderson, M. H., Shaw, J. D., and Kilduff, M. (2015). Integrating personality and social networks: A meta-analysis of personality, network position, and work outcomes in organizations. *Organ. Sci.* 26, 1243–1260. doi: 10.1287/orsc.2015.0972

Felin, T., Foss, N. J., and Ployhart, R. E. (2015). The microfoundations movement in strategy and organization theory. *Acad. Manag. Ann.* 9, 575–632. doi: 10.1080/19416520.2015.1007651

Fisher, C. D. (1978). The effects of personal control, competence, and extrinsic reward systems on intrinsic motivation. *Organ. Behav. Hum. Perform.* 21, 273–288. doi: 10.1016/0030-5073(78)90054-5

Freeman, L. C. (1978). Centrality in social networks: Conceptual clarification. *Soc. Netw.* 1, 215–239.

Gibson, B., Hoffman, B., Fleur, C. G. L., and Buchler, N. (2021). Endogeneity and permeation in an organizational communication network. *Soc. Netw.* 66, 65–71. doi: 10.1016/J.SOCNET.2020.12.007

Guetzkow, H., and Simon, H. A. (1955). The impact of certain communication nets upon organization and performance in task-oriented groups. *Manag. Sci.* 1, 233–250. doi: 10.1287/mnsc.1.3-4.233

Hanneman, R. A., and Riddle, M. (2005). *Introduction to social network methods*. Los Angeles, CA: University of California.

Hayes, A. F. (2022). *Introduction to mediation, moderation, and conditional process analysis*. New York, NY: Guilford Press.

Ho, V. T., and Wong, S.-S. (2009). Knowing who knows what and who knows whom: Expertise recognition, network recognition, and individual work performance. *J. Occup. Organ. Psychol.* 82, 147–158. doi: 10.1348/096317908X298585

Humphrey, S. E., Morgeson, F. P., and Mannor, M. J. (2009). Developing a theory of the strategic core of teams: A role composition model of team performance. *J. Appl. Psychol.* 94, 48–61. doi: 10.1037/A0012997

Jamison, J., Karlan, D., and Schechter, L. (2008). To deceive or not to deceive: The effect of deception on behavior in future laboratory experiments. *J. Econ. Behav. Organ.* 68, 477–488. doi: 10.1016/j.jebo.2008.09.002

Katz, N., Lazer, D., Arrow, H., and Contractor, N. (2004). Network theory and small groups. *Small Group Res.* 35, 307–332. doi: 10.1177/1046496404264941

Kim, T. Y., Oh, H., and Swaminathan, A. (2006). Framing interorganizational network change: A network inertia perspective. *Acad. Manag. Rev.* 31, 704–720. doi: 10.5465/amr.2006.21318926

Klusowski, J., Small, D. A., and Simmons, J. P. (2021). Does choice cause an illusion of control? *Psychol. Sci.* 32, 159–172. doi: 10.1177/0956797620958009

Lazer, D., and Friedman, A. (2016). The network structure of exploration and exploitation. *Adm. Sci. Q.* 52, 667–694. doi: 10.2189/asqu.52.4.667

Leavitt, H. J. (1951). Some effects of certain communication patterns on group performance. *J. Abnorm. Psychol.* 46, 38–50.

Lennox, R. D., and Wolfe, R. N. (1984). Revision of the self-monitoring scale. *J. Pers. Soc. Psychol.* 46, 1349–1364.

Lewis, K. (2003). Measuring transactive memory systems in the field: Scale development and validation. *J. Appl. Psychol.* 88, 587–604.

Liang, D. W., Moreland, R., and Argote, L. (1995). Group versus individual training and group performance: The mediating role of transactive memory. *Pers. Soc. Psychol. Bull.* 21, 384–393. doi: 10.1177/0146167295214009

Littlepage, G. E., Robison, W., and Reddington, K. (1997). Effects of task experience and group experience on group performance, member ability, and recognition of expertise. *Organ. Behav. Hum. Decis. Process.* 69, 133–147. doi: 10.1006/obhd.1997.2677

Littlepage, G. E., Schmidt, G. W., Whisler, E. W., and Frost, A. G. (1995). An input-process-output analysis of influence and performance in problem-solving groups. *J. Pers. Soc. Psychol.* 69, 877–889.

Manski, C. F. (1993). Identification of endogenous social effects: The reflection problem. *Rev. Econ. Stud.* 60, 531–542.

March, J. G. (1962). The business firm as a political coalition. *J. Polit.* 24, 662–678. doi: 10.1017/S0022381600016169

March, J. G. (1991). Exploration and exploitation in organizational learning. *Organ. Sci.* 2, 71–87. doi: 10.1287/orsc.2.1.71

March, J. G., and Simon, H. A. (1958). *Organizations*. New York, NY: John Wiley & Sons, Ltd.

Martins, L. L., and Sohn, W. (2022). How does diversity affect team cognitive processes? Understanding the cognitive pathways underlying the diversity dividend in teams. *Acad. Manag. Ann.* 16, 134–178. doi: 10.5465/ANNALS.2019.0109

Mason, W., and Watts, D. J. (2011). Collaborative learning in networks. *Proc. Natl. Acad. Sci. U. S. A.* 109, 764–769. doi: 10.1073/pnas.11100

Mehra, A., Kilduff, M., and Brass, D. J. (2001). The Social networks of high and low self-monitors: Implications for workplace performance. *Adm. Sci. Q.* 46:121. doi: 10.2307/2667127

Mesmer-Magnus, J. R., and Dechurch, L. A. (2009). Information sharing and team performance: A meta-analysis. *J. Appl. Psychol.* 94, 535–546. doi: 10.1037/a0013773

Park, S., Grosser, T. J., Roebuck, A. A., and Mathieu, J. E. (2020). Understanding work teams from a network perspective: A review and future research directions. *J. Manag.* 46, 1002–1028. doi: 10.1177/0149206320901573

Pratto, F., Sidanius, J., Stallworth, L. M., and Malle, B. F. (1994). Social dominance orientation: A personality variable predicting social and political attitudes. *J. Pers. Soc. Psychol.* 67, 741–763. doi: 10.1037/0022-3514.67.4.741

Rahwan, Z., Fasolo, B., and Hauser, O. P. (2022). Deception about study purpose does not affect participant behavior. *Sci. Rep.* 12:19302.

Reagans, R. E. (2022). Mutual learning in networks: Building theory by piecing together puzzling facts. *Res. Organ. Behav.* 42:100175. doi: 10.1016/J.RIOB.2022.100175

Sasovova, Z., Mehra, A., Borgatti, S. P., and Schippers, M. C. (2010). Network churn: The effects of self- monitoring personality on brokerage dynamics. *Adm. Sci. Q.* 55, 639–670. doi: 10.2189/asqu.2010.55.4.639

Savolainen, R. (2007). Filtering and withdrawing: Strategies for coping with information overload in everyday contexts. *J. Inform. Sci.* 33, 611–621. doi: 10.1177/0165551506077418

Shaw, M. E. (1964). Communication networks. *Adv. Exp. Soc. Psychol.* 1, 111–147. doi: 10.1016/S0065-2601(08)60050-7

Simon, H. A. (1957). *Models of man: Social and rational*. Hoboken, NJ: Wiley.

Simon, H. A. (1997). *Administrative behavior*, 4th Edn. New York, NY: Simon and Schuster.

Sparrowe, R. T., Liden, R. C., Wayne, S. J., and Kraimer, M. L. (2001). Social networks and the performance of individuals and groups. *Acad. Manag. J.* 44, 316–325. doi: 10.2307/3069458

Spector, P. E. (1986). Perceived control by employees: A meta-analysis of studies concerning autonomy and participation at work. *Hum. Relat.* 39, 1005–1016. doi: 10.1177/001872678603901104

Stasser, G., and Titus, W. (1987). Effects of information load and percentage of shared information on the dissemination of unshared information during group discussion. *J. Pers. Soc. Psychol.* 53, 81–93. doi: 10.1037//0022-3514.53.1.81

Yetton, P. W., and Bottger, P. C. (1982). Individual versus group problem solving: An empirical test of a best-member strategy. *Organ. Behav. Hum. Decis. Process.* 321, 307–321.

Yoon, K., and Hollingshead, A. B. (2010). Cultural stereotyping, convergent expectations, and performance in cross-cultural collaborations. *Soc. Psychol. Pers. Sci.* 1, 160–167. doi: 10.1177/1948550610362597

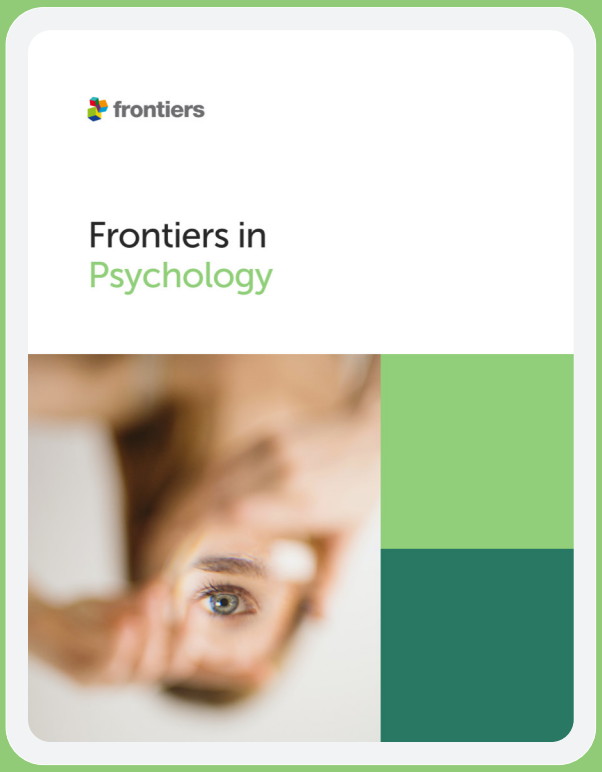
Frontiers in Psychology

Paving the way for a greater understanding of human behavior

The most cited journal in its field, exploring psychological sciences - from clinical research to cognitive science, from imaging studies to human factors, and from animal cognition to social psychology.

Discover the latest Research Topics

See more →



Frontiers

Avenue du Tribunal-Fédéral 34
1005 Lausanne, Switzerland
frontiersin.org

Contact us

+41 (0)21 510 17 00
frontiersin.org/about/contact