

# THE ROLE OF CULTURE IN HUMAN THINKING AND REASONING

EDITED BY: Hiroshi Yama, Niall Galbraith, Jean Baratgin and  
Hirofumi Hashimoto  
PUBLISHED IN: Frontiers in Psychology





# frontiers

## Frontiers eBook Copyright Statement

The copyright in the text of individual articles in this eBook is the property of their respective authors or their respective institutions or funders. The copyright in graphics and images within each article may be subject to copyright of other parties. In both cases this is subject to a license granted to Frontiers.

The compilation of articles constituting this eBook is the property of Frontiers.

Each article within this eBook, and the eBook itself, are published under the most recent version of the Creative Commons CC-BY licence.

The version current at the date of publication of this eBook is CC-BY 4.0. If the CC-BY licence is updated, the licence granted by Frontiers is automatically updated to the new version.

When exercising any right under the CC-BY licence, Frontiers must be attributed as the original publisher of the article or eBook, as applicable.

Authors have the responsibility of ensuring that any graphics or other materials which are the property of others may be included in the CC-BY licence, but this should be checked before relying on the CC-BY licence to reproduce those materials. Any copyright notices relating to those materials must be complied with.

Copyright and source acknowledgement notices may not be removed and must be displayed in any copy, derivative work or partial copy which includes the elements in question.

All copyright, and all rights therein, are protected by national and international copyright laws. The above represents a summary only. For further information please read Frontiers' Conditions for Website Use and Copyright Statement, and the applicable CC-BY licence.

ISSN 1664-8714

ISBN 978-2-83250-348-5

DOI 10.3389/978-2-83250-348-5

## 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](https://frontiersin.org/about/contact)

# THE ROLE OF CULTURE IN HUMAN THINKING AND REASONING

Topic Editors:

**Hiroshi Yama**, Osaka City University, Japan

**Niall Galbraith**, University of Wolverhampton, United Kingdom

**Jean Baratgin**, Université Paris 8, France

**Hirofumi Hashimoto**, Osaka Metropolitan University, Japan

**Citation:** Yama, H., Galbraith, N., Baratgin, J., Hashimoto, H., eds. (2022). The Role of Culture in Human Thinking and Reasoning. Lausanne: Frontiers Media SA.  
doi: 10.3389/978-2-83250-348-5

# Table of Contents

- 04 Editorial: The Role of Culture in Human Thinking and Reasoning**  
Hiroshi Yama, Niall Galbraith, Jean Baratgin and Hirofumi Hashimoto
- 06 Ecological Cognitive Analysis of Chinese Harmonious Discourse**  
Zou Chun-ling
- 16 Effect of Implicit Theory on Effort Allocation Strategies in Multiple Task-Choice Situations: An Investigation From a Socio-Ecological Perspective**  
Keita Suzuki, Naoki Aida and Yukiko Muramoto
- 31 Universality and Cultural Diversity in Moral Reasoning and Judgment**  
Lina Bentahila, Roger Fontaine and Valérie Pennequin
- 43 How the Custom Suppresses the Endowment Effect: Exchange Paradigm in Kanak Country**  
Jean Baratgin, Patrice Godin and Frank Jamet
- 57 Culture as a Moderator of Epistemically Suspect Beliefs**  
Yoshimasa Majima, Alexander C. Walker, Martin Harry Turpin and Jonathan A. Fugelsang
- 73 A Study on the Sufficient Conditional and the Necessary Conditional With Chinese and French Participants**  
Jing Shao, Dilane Tikiri Banda and Jean Baratgin
- 89 Fickle Judgments in Moral Dilemmas: Time Pressure and Utilitarian Judgments in an Interdependent Culture**  
Hirofumi Hashimoto, Kaede Maeda and Kaede Matsumura
- 96 Zhongyong Thinking Style and Resilience Capacity in Chinese Undergraduates: The Chain Mediating Role of Cognitive Reappraisal and Positive Affect**  
Shisi Zhou and Xueping Li
- 107 Potential Influence of Decision Time on Punishment Behavior and its Evaluation**  
Kaede Maeda, Yuka Kumai and Hirofumi Hashimoto



## OPEN ACCESS

EDITED AND REVIEWED BY  
Bernhard Hommel,  
University Hospital Carl Gustav  
Carus, Germany

\*CORRESPONDENCE  
Hiroshi Yama  
yama.hiroshi1204@gmail.com

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

RECEIVED 13 August 2022  
ACCEPTED 16 August 2022  
PUBLISHED 13 September 2022

CITATION  
Yama H, Galbraith N, Baratgin J and  
Hashimoto H (2022) Editorial: The role  
of culture in human thinking and  
reasoning. *Front. Psychol.* 13:1018392.  
doi: 10.3389/fpsyg.2022.1018392

COPYRIGHT  
© 2022 Yama, Galbraith, Baratgin and  
Hashimoto. This is an open-access  
article distributed under the terms of  
the [Creative Commons Attribution  
License \(CC BY\)](#). The use, distribution  
or reproduction in other forums is  
permitted, provided the original  
author(s) and the copyright owner(s)  
are credited and that the original  
publication in this journal is cited, in  
accordance with accepted academic  
practice. No use, distribution or  
reproduction is permitted which does  
not comply with these terms.

# Editorial: The role of culture in human thinking and reasoning

Hiroshi Yama<sup>1\*</sup>, Niall Galbraith<sup>2</sup>, Jean Baratgin<sup>3</sup> and  
Hirofumi Hashimoto<sup>1</sup>

<sup>1</sup>School of Literature and Human Sciences, Osaka Metropolitan University, Osaka, Japan, <sup>2</sup>Faculty of Education Health & Wellbeing, School of Psychology, University of Wolverhampton, Wolverhampton, United Kingdom, <sup>3</sup>Laboratory Cognition Humaine et Artificielle, Université Paris 8, Paris, France

## KEYWORDS

culture, cultural difference, thinking, reasoning, dual-process theory

## Editorial on the Research Topic

### The role of culture in human thinking and reasoning

There have been many studies describing cultural differences in thinking and reasoning. This scientific development is mostly based upon the contrasts between Westerners' analytic cognition and Easterners' holistic cognition (e.g., Nisbett et al., 2001) and/or Westerners' linear thinking and Easterners' dialectical thinking (e.g., Peng and Nisbett, 1999). These studies have come from both social psychologists and cognitive psychologists. Although the former have tried to explain the differences in the frame of social and/or cultural systems, the latter have tried to focus on the cognitive process, which is likely to be influenced by cultural practice. Current studies on the relationship between human thinking and culture from both sides do not necessarily conduct cross-cultural comparisons, but focus on how a culture shapes people's thinking style and how people's thinking and reasoning can be adaptive in each culture.

There have been many explanations for cultural differences in cognition. For example, Miyamoto (2013) identified three levels of cultural differences: distal-level situational factors, proximal-level situational factors, and the psychological level. Cultural differences in thinking and reasoning are said to be at the psychological level. According to her, socio-ecological factors and cultural traditional factors at the distal-level may influence people's thinking and reasoning via proximal-level factors. This idea gives us a basic frame of explanation for cultural differences.

Bentahila et al. reviews the literature on moral systems and human moral judgment which are influenced by history, religious beliefs, social ecology, and institutional regulations. Each factor can be either at the distal-level or at the proximal-level. Zhou and Li reports on the influence of the Chinese traditional thought of Zhongyong on resilience. Chun-ling reports an ecological cognitive analysis of Chinese harmonious discourse. Baratgin et al. report on how Kanak's social norms influence people's responses using Knetsch's exchange paradigm. Shao et al. tested the Sapir-Whorf hypothesis considering the difference between French and Chinese languages—they did not observe the influence of language difference and hence they rejected the hypothesis and argue for cultural universality.

Secondly, it is noteworthy that four papers based on dual-process approaches (e.g., Evans, 2010) are published in this special topic. This approach supposes two kinds of process: The intuitive process and the reflective process. Among the cognitive theories of human reasoning, Yama (2018) argued that the dual-process approach is the most promising to be applied to explanations for cultural differences in thinking and reasoning. Dual-process theories make it possible to discuss the influence of explicit/implicit distinctions in cultural practices pertaining to two kinds of rationality: evolutionary adaptation of the intuitive process and normative rationality of the reflective process. Cultural effects have been regarded as implicit (intuitive) hence it is assumed that people's thinking is influenced by cultural products implicitly.

The paper of Suzuki et al. reports the power of implicit process. In spite of people's unconsciousness of cultural context, it still, in effect, influences people's thinking. This proposal is added to argue that intuitive processes can be rational in a sense. Hashimoto et al. test a dual-process model for cultural content: a moral dilemma. They discuss this in the frame of human adaptation. Meada et al. adopt a dual-process approach to the case of punishment and reward. The paper of Majima et al. shows cultural differences in the use of analytical thinking between Westerners and Easterners.

In what direction are studies on the relation between culture and human thinking headed? As categorized into the explanations for cultural differences and the adoption of dual-process theories in this editorial, we propose two directions. One is to pursue the explanations for contemporary cultural diversity and locate these in the frame of "big human history." In this case, it is necessary for psychologists not only to conduct empirical studies but to access the big data used by historians. The other is to adopt the dual-process approach. This not only gives us the implicit/explicit distinction of cultural influences but introduces the view of human cultural adaptation into research in this field.

## References

- Evans, J. B. T. (2010). *Thinking Twice: Two Minds in One Brain*. Oxford: Oxford University Press. doi: 10.5040/9780755621422
- Miyamoto, Y. (2013). Culture and analytic versus holistic cognition: toward multilevel analyses of cultural influences. *Adv. Exp. Soc. Psychol.* 47, 131–188. doi: 10.1016/B978-0-12-407236-7.00003-6
- Nisbett, R. E., Peng, K., Choi, I., and Norenzayan, A. (2001). Culture and systems of thought: holistic versus analytic cognition. *Psycho. Rev.* 108, 291–310. doi: 10.1037/0033-295X.108.2.291
- Peng, K., and Nisbett, R. E. (1999). Culture, dialectics, and reasoning about contradiction. *Am. Psychol.* 54, 741–754. doi: 10.1037/0003-066X.54.9.741
- Yama, H. (2018). "Thinking and reasoning across cultures," in *The Routledge International Handbook of Thinking and Reasoning*, eds L. J. Bell, and V. A. Thompson (London: Routledge), 624–638.

## Author contributions

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

## Funding

This research was supported by a grant-in-aid from the Japanese Society for the Promotion of Science (No. 18K03010).

## Acknowledgments

We deeply acknowledge the help of the reviewers for the publication of the articles.

## 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.



# Ecological Cognitive Analysis of Chinese Harmonious Discourse

Zou Chun-ling\*

*Department of Foreign Languages, Harbin University of Science and Technology, Harbin, China*

## OPEN ACCESS

### Edited by:

Hiroshi Yama,  
Osaka City University, Japan

### Reviewed by:

Wolfgang Hofkirchner,  
Vienna University of Technology,  
Austria  
Quan-Hoang Vuong,  
Phenikaa University, Vietnam

### \*Correspondence:

Zou Chun-ling  
29563272@qq.com

### Specialty section:

This article was submitted to  
Cultural Psychology,  
a section of the journal  
Frontiers in Psychology

**Received:** 24 May 2021

**Accepted:** 05 October 2021

**Published:** 18 November 2021

### Citation:

Chun-ling Z (2021) Ecological  
Cognitive Analysis of Chinese  
Harmonious Discourse.  
Front. Psychol. 12:713809.  
doi: 10.3389/fpsyg.2021.713809

This study is concerned with cognitively and consciously enacting a new dialectical opposite-unity approach into Chinese harmonious discourse (CHD) analysis in an ecological perspective, which contributed to converting antagonistic thinking between human and nature into an ecological harmonious one cultivated into an unconscious state. The method applied is primarily the theoretical analysis and interpretation, due to the newness of this subject and the lack of corpus data. The motivation of this paper is evoked by the discovery of various cognition dissonances and insufficiencies with the academic development of newly born ecolinguistics. On a micro or specified level, this paper presents a cutting-edge example of an ecologically cognitive approach to the analysis of CHD, based on Chinese dialectical opposite-unity philosophy, to construct a higher-level cognition mechanism into a habitually unconscious thinking state. Such a mechanism has its practical significance in devoting to alleviating the ecological crisis by a change in ways of thinking, mediating cognitive dissonance brought about by the crisis, and improving the one-sided cognition deficiency brought about by ways of antagonistic thinking in order to maintain the ecological harmony. The theoretical significance lies in it demonstrating the cognitive process about how the unconscious ecological harmony cognition is cultivated by the conscious operational opposite-unity cognition procedure, with the ultimate purpose to achieve and maintain a real ecological harmony, under the cross-cultural background.

**Keywords:** Chinese culture, eco-cognition, Chinese discourse, dialectical philosophy, Chinese harmonious discourse, ecological cognitive mechanism, dialectical opposite-unity philosophy

## INTRODUCTION

With the COVID-19 pandemic breaking out globally in early 2020, the problem of ecological crisis has been studying in domains of linguistics, social sciences, psychology, and discourse analysis, etc. Then, countless studies have warned of the disastrous consequences of such a crisis and put forth proposals for global sustainability (e.g., Lenton et al., 2020; Vuong, 2021a). All scholars have been striving to build a new ecology-oriented core value in their respective cultures, it is necessary to incorporate insights from different cultures and disciplines. The study of Quan-Hoang Vuong proposed a solution to the problem of environmental crisis in the form of a new core cultural value centered around environmental protection, in order to enrich and improve the so-called “the eco-deficit culture” (Vuong, 2021b, p. 285), being an important reference for this article.

This article proceeded to assume that the fundamental nature of destructive discourses from the ecological crisis comes from the antagonistic ways of cognition between humans and nature, definitely resulting in “the eco-deficit culture.” Therefore, this article intends to solve the above



thinking problem by emphasizing insights from Chinese culture, philosophy, ecology, cognition, which could shed new light on our reshaping, refreshing the multidisciplinary research of ecological beneficial discourse and promoting its role in our long-term quest to protect ecology, so as to reshape human behaviors and ways of thinking.

This article adopts a Chinese culture and philosophy-based dialectical opposite-unity (DOU) cognition mechanism, which echoes the assertion of Chinese philosopher Laozi, founder of Taoism, who advocates doing nothing that goes against nature. Furthermore, DOU has been seeking to find efficient cultural and cognitive responses to the nowadays ecological destruction and sustainability threats, in order to negotiate the antagonistic cognition and raise human thinking to a higher and harmonious level for protecting nature. Therefore, DOU represents a seemingly cognitive unity and unconsciousness, from thousands of years conscious cultivating the extraction ability of life laws toward Chinese various opposite-unity discourses.

## The Motivation of Eco-Cognition

This paper offers a tentative interpretation of how a DOU cognitive mechanism is developed and used, which fell within the ecologically beneficial approach. Well-spoken or well-written passages can evoke our deepest emotions and elicit all manner of consciousness and could reactions. This is usually taken to be an insurmountable explanatory challenge for ecological approaches to cognitive science (Steffensen, 2018, p. 1), termed as ecological cognition (eco-cognition). In order to propose such an interdisciplinary “ecology + cognition interactivity-based” approach to the analysis of Chinese harmonious discourse (CHD) meaning, this paper presents a cutting-edge example of an ecological cognitive approach to discourse analysis, which is rarely studied throughout ecolinguistics.

By proposing the typical Chinese philosophy of Confucianism, Taoism, and Mohism (CTM), commonly characterized by DOU thinking mechanism as the basis of ecological cognition, this paper attempted to analyze and interpret CHD in an interdisciplinary ecological cognitive perspective, for supplementing discourse theories, and for promoting ecological harmony.

On the one hand, in order to raise an ecological harmonious ethics awareness and self-realization in a deep sense, the concept of “eco-cognition” with an ecologically beneficial goal and with DOU as the mechanism could give an impulse to reconsider harmonious discourse research as a unique and consistent mode of telling ecological stories. Therefore, one of the motivations of the eco-cognition mechanism is concerned with interpreting CHD on a micro and specified level instead of a macro and general one.

On the other hand, some scholars believe that ecolinguistics leads to a new “holistic” worldview, in which “everything is inter-connected, inter-dependent and inter-acting,” looking at ecolinguistics as a dialectical philosophy” (Døør and Madsen, 2007, p. 268). This is an evident marker indicating the research inclination to a dialectical interaction in the ecological study,

echoing Chinese DOU philosophy and cognition, which is the other motivation.

To sum up, as philosophically minded ecolinguists look more profoundly at discourse study on a meta-level, the ecological cognitive problem is unavoidable.

## The Etymology of Eco-Cognition

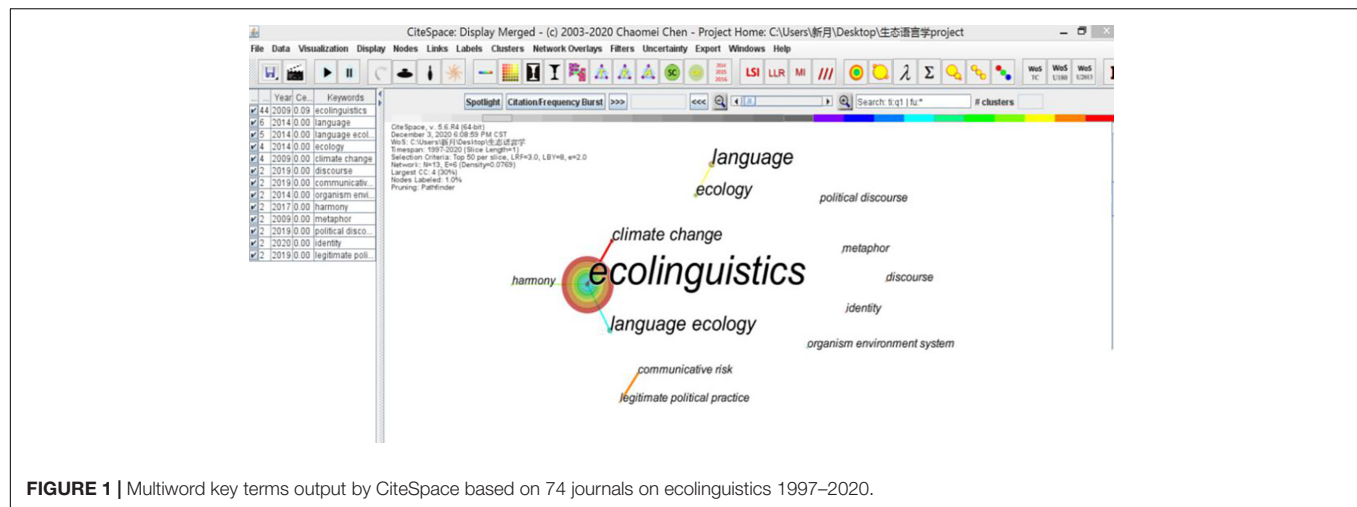
Ecolinguistics, as a transdisciplinary science (or a dialectical philosophy), transcends traditional linguistics and creates an awareness of the interdependency of all things and ideas (Finke, 2014). In this perspective, the prefix “eco” has its far-reaching implication into a dialectical philosophy of interaction and harmony, which echoes the typical Chinese assertion of “dialectical opposite-unity” philosophy from CTM. As such a new dialectical ecological approach is presented, so does a new cognitive approach to the discourse analysis nestling with it, embodying the concept of reconstructing the cognition mechanism into the natural ecosystem.

With the ecological turn, ecocriticism (Garrard, 2014), ecopoetics (Knickerbocker, 2012), ecofeminism (Adams and Gruen, 2014), ecopsychology (Fisher, 2013), ecosociology (Stevens, 2012), political ecology (Robbins et al., 2012), and environmental communication (Cox, 2012) also presented themselves, but no one deals with eco-cognition. Besides the above reason, the terminology rationality of “eco-cognition” is still in that one is reminded that the prefix “eco-” has become increasingly attached to all sorts of descriptors, including eco-tourism, eco-vehicle, eco-houses, and eco-lifestyles, as well as, in this process, has acquired a large number of meanings (Mühlhäusler, 2018, p. 136).

On this level, “eco-” is regarded as a philosophical perspective guiding and improving various research including linguistics and cognition, functioning as the core concept and essential connotation of “eco” disciplines, according to which “eco” is also rationally taken as a philosophical guideline for the cognition research. Additionally, traditional Chinese cognition is always based on philosophy, so the term “eco-cognition” is always a “philosophy + cognition” integration, a Chinese “DOU” philosophy-based cognitive mechanism, specifically. As eco-linguistics has been inviting many analytical perspectives into a nexus or established theoretical core, eco-cognition is one of them with its dialectical approach as the harmonious solution for cognitive dissonance brought about by the one-sided positive discourse or critical discourse.

Thus, “eco-” has become a commonly used prefix to manifest the interdisciplinary and philosophical stance, such as the term “eco-literacy” coined by David Orr and Fritjof Capra for awareness of ecological problems and the role language plays in creating this awareness (Orr, 1992; Capra, 1995). And the terminology of “ecocognition” in this paper is subsequently and rationally coined as the analytical perspective, developing into a higher “DOU” cognitive mechanism used to solve cognitive dissonance exemplified in CHD, in order to cognitively achieve and maintain the ecological harmony in the world. Rather, it belongs to a particular Taoism mode of description and interpretation that draws a higher, subtle,





**FIGURE 1 |** Multiword key terms output by CiteSpace based on 74 journals on ecolinguistics 1997–2020.

and abstract generalization or emergent property across the phenomenological experience of many language users.

## The Function of Eco-Cognition

As mentioned in **Figure 1**, eco-cognition functions primarily as a way to balance the cognitive dissonance in order to achieve ecological harmony both in mind and discourse. The state of cognitive dissonance occurs when people believe that two of their psychological representations are inconsistent with each other. More formally, a pair of cognitions is inconsistent if one cognition follows from the obverse (opposite) of the other (Cooper, 2007, p. 6), which is roughly presented almost throughout Chinese discourses. The inconsistent cognitions are primarily formulated as opposite lexicons and represented as opposite concepts, both as an approach of telling Chinese Taoism. What the eco-cognition can function is to integrate the two opposites into a harmonious unity, that is, a more subtle and abstract construal.

In order to fully understand these opposite units, scholars invite the concepts of “ecologically dialectical philosophy” (Døør and Bang, 1996, p. 19), “deep ecology” (Naess, 1995), and “identity” (Leibniz, 1969), but no one is quite appropriate to illustrate Chinese way of opposite-unity thinking. Chinese harmonious “unity” is an acceptable way of achieving higher-level cognition, Taoism. Pursuing such a higher level cognition has always been the main concern throughout the history of Chinese philosophy, with “dialectical opposite-unity” as the mechanism and operational process, it is traditionally addressed as a yin + yang philosophy of nature, proposed by Chinese Laozi, according to which the research of principles/theories/framework of ethics, behaviors, and discourse are cooperatively developing.

Such a traditional Chinese approach also has its role in mediating the cognitive dissonance and antagonistic thinking characterized by formulation inconsistency, into an ecological harmonious state characterized by unity and consistency. It is an accomplishment not only needs consciously cognitive efforts, but also the appropriate and effective strategies and theories, different from the conventional unconscious, basic, and

embodied cognition. In this perspective, not only the structure, characteristics, and purposes of harmonious discourse should be illustrated, also the corresponding cognitive mechanism.

## SIGNIFICANCES AND OBJECTIVES OF THIS PAPER

In order to make clear the research objectives of this paper, some discourse problems to be solved must be first reviewed.

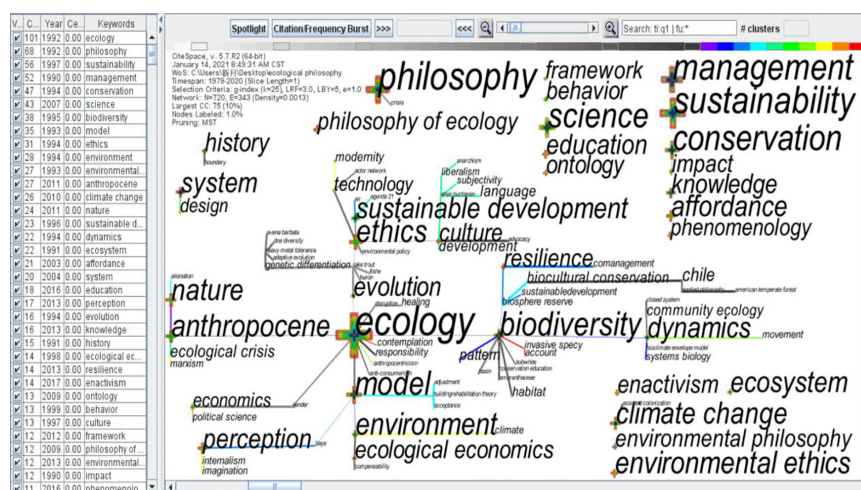
### Literature Review

Ecolinguistics is generally divided into two categories: Haugen’s metaphorical model and Halliday’s non-metaphorical model. “Ecology,” “environment,” “language ecology,” “ecological language,” and “ecologically critical/positive discourse” become the basic concepts of ecological linguistics. Scholars have been developing roughly four strands that differ in how they interpret what the environment of language is. These strands include symbolic ecology, natural ecology, socio-cultural ecology, and cognitive ecology (Steffensen and Fill, 2014), the last of which echoes the assertions of this paper.

For a more accurate literature review, an advanced search was carried out in Web of Science (WOS) with “ecolinguistics” as the keyword, source category as WOS core collection, and literature type as articles in 74 related journals were searched, and the “Keywords” of 74 journals were analyzed by CiteSpace software. Time: 1997–2020.

As mentioned in **Figure 2**, from the above CiteSpace literature, a relatively complete study of dialectical ecological cognition (eco-cognition) of harmonious discourse was ignored, although Marxist and post-Foucauldian “dialectical-relational” critical approach was preliminarily postulated (Fairclough, 2014). The present ecological discourse pieces of research have been developing in two directions:

- (1) ecologically critical discourse analysis (e.g., Haugen, 1972; Fairclough, 1989; Halliday, 1990; Finke, 2014; Van Dijk, 2015);



**FIGURE 2 |** Multiword key terms output by CiteSpace based on 1077 articles on ecological philosophy, 1976–2020.

- (2) ecologically positive discourse analysis (e.g., Martin, 1999, 2004; Dunayer, 2001; Macgilchrist, 2007);
- (3) Both of the two with finding and correcting human-centered ideology resulted in the global ecological crisis as the main concern.

Chinese ecolinguistics is a newly born multidisciplinary research project, beginning from the founding of the Centre for Ecolinguistics at South China Agricultural University initiated by Huang Guowen. This is the first international conference on ecolinguistics in China (November 25–27, 2016, South China Agricultural University, Guangzhou). From then on, ecolinguistics is taken more as a philosophy and a state of mind in which harmony, above all other ideas, is dominant.

On the macro-level, the research of “harmony” invites Chinese linguists to profoundly probe the ecologically beneficial discourse, termed as harmonious discourse. CHD mainly revolves around the balance of the above two discourse categories by way of Chinese DOU philosophy and cognition.

On the micro-level, the majority of Chinese scholars follow Halliday’s systemic-functional way in dealing with ecolinguistics (e.g., Huang, 2017; Wenjuan, 2017; Wang, 2019; He, 2020), in a macro and general way. This paper looks for other micro ways to approach ecolinguistics, especially CHD, integrating cognitive ecology into a single coherent DOU framework, in a micro and specified way. Therefore, there exist disciplinary and perspective differences between the author and other Chinese scholars, by insisting on a cognitive explanatory mechanism to CHD.

Ecolinguistics is supposed to be seen as a unified ecological worldview (cf. Wenjuan, 2017). More work on this can be expected in the next few decades. For this reason, the work of the author in ecological cognitive science has sought to re-describe DOU mechanism associated with discourse meaning as a variety of, or at least as continuous with, Chinese ecological philosophy, with the spirit of CTM as the backbone.

Our conclusion is that the only way to coherently relate ecological and cognitive conceptions of CHD meaning is

to understand the latter as a Chinese philosophy-dependent identification of a hugely heterogeneously opposite class of formulations with a unifying property (unity).

## Research Objectives

Ecological meanings of discourses are inspired by models of cognition as fundamentally interactive (Gibson, 1979), and such an inevitable ecological cognitive interconnection gives rise to the recent work of cognitive linguistics presenting a more or less ecological turn (e.g., Zlatev and Blomberg, 2016). The ecological cognitive mechanism, such as the transfer and construal of ideas, urgently needs Chinese DOU as the explanatory framework. Therefore, the research objectives of this paper were as follows:

- (1) On a macro-level, the interpretation of the CHD in an ecological cognitive perspective;
- (2) on a meso-level, the illustration of the origin, definition, characteristics, and goals of a newly born ecological cognition in a newly born CHD;
- (3) on a micro-level, the explanation of the CHD by Chinese “dialectical opposite-unity” ecological cognitive mechanism, in order to solve some cognitive dissonance and improve the basic cognition to a higher level.

## Research Significance

The most important contribution made by the ecological cognitive approach is that it accounts adequately for the role played by dynamic harmonious discourse patterns in the control of higher-level opposite-unity cognition.

On the one hand, the theoretical significance of this paper is that it did not only contribute to establishing a new relationship between humans and nature but also to the self-improvement of cognitive theories, mechanisms, models, and values onto a higher level.

On the other hand, the practical significance of this paper is that it examined the DOU mechanism of CHD from the perspective of ecological cognition, which was conducive to

providing a rational path for improving the effectiveness of understanding a newly born harmonious discourse, under the cross-cultural background. Such a cognition up-gradation is expected to reduce ecological crisis and achieve real ecological harmony, to some degree.

Ecolinguistics and eco-cognition, in the context of discourse ecology and the interaction between discourse and cognition, embodies the concept of revisiting the discourse and cognition system to the natural ecosystem, developing into an ecologically beneficial model of discourse formulation and cognition mechanisms. Examining the CHD from the perspective of ecological dialectical cognition is conducive to providing an effective path for effectively spreading the Chinese harmony concept and dialectical approaches of cognition.

## CHINESE HARMONIOUS PHILOSOPHY

As discussed above, scholars had sought to classify ecolinguistics not as a science but as a philosophy related to cognition, which echoes the assertion of Chinese philosophy-based cognition, in order to find out more about the world and even may help to improve awareness and life.

### Brief Introduction

Harmonious discourse research comes from the urgent need to balance the critical discourse analysis (CDA) and positive discourse analysis (PDA) presenting themselves in solving the global ecological crisis respectively. The former criticizes those ecologically destructive discourses, and the latter seeks to find out various ecologically beneficial lexicons and expressions. The problem of the two lies in both presenting just one-sided research objectives, motivations, and methods. Either critical or positive stance is not sufficient for achieving real ecological harmony. That is why the harmonious discourse developed to balance the two is proposed, which meanwhile provides a pathway to amend some cognitive dissonance and deficiencies to a more abstract and higher one.

Critical discourse analysis is traditionally based on ideology and power relations. This ideology is explicitly or implicitly Marxist. Ecological discourse analysis (EDA) makes it quite different in that it founds itself on the preservation of life on earth and avoidance of suffering, especially avoidance of anthropocentric. For this purpose, the concept of “harmony” was proposed in discourse analysis. Thus, a new category which was “harmonious discourse” is presented.

As ecological meaning is a property of relations between living organisms and their environments (see Harvey, 2015; Trasmundi and Steffensen, 2016), ecologically harmonious discourse analysis should focus on this “property of relations.” The mentioned Chinese opposite formulations are taken as “relations,” and their unity covering the opposite two is taken as the “property,” used to improve originally opposite relationships or antagonistic ways of thinking to a more harmonious and unified level. Essentially, the Chinese DOU mechanism itself is the representation of ecological meaning. Therefore, it is generally seen as a multifaceted and problems-oriented research domain and communicative

practices. Current global ecological crisis such as the COVID-19 virus, calls for a deeper probe into the theoretical basis and social praxis of “harmonious discourse” recently proposed in China, on a transdisciplinary scale of ecology, cognition, and discourses.

## Chinese Ecological Philosophy as the Basis of Harmonious Discourse

To achieve the first objective of this paper on a macro-level, to interpret the CHD in an ecological cognitive perspective, this paper first introduced the philosophy basis of both CHD and Chinese cognition mechanism, with the interaction and interchangeability of yin + yang Taoism as the essence, with the opposite expressions as the discourse structure.

### Chinese Dialectical Harmonious Philosophy

The advanced search was carried out in WOS with the keyword of “ecological philosophy,” and the source category was the WOS core collection. The literature type of 1077 articles in related journals was searched, and 1,077 articles were analyzed by “keyword” with CiteSpace software. Time: 1976–2020.

As noted above, ecological philosophy presents colorful diversity in different academic fields. For example, the study of Naess (1995) used to propose a theory of “deep ecology” which advocates that the research of humanity is inseparable from that of nature, but it is still insufficient in forming the Marxist-based and Chinese-based ideology characterized by a kind of ecologically dialectical philosophy.

In this case, Chinese dialectical harmonious philosophy could be a valid candidate, with an emphasis on mediating various opposites into a deeper and higher sense of self and life, instead of following the mind/body dichotomy, providing a real place where Eastern philosophy, Western philosophy, and even quantum physics could meet one another.

Chinese ecological philosophy based on the tradition of Chinese culture and history has always been developing metaphysical foundations for establishing and improving harmonious social relationships. “Harmony” is widely acknowledged as the main concept in ecologically beneficial philosophy and discourse, aiming to establish and maintain a harmonious relationship between the environment and human beings. It has been already illustrated in Chinese CTM around which harmonious discourse revolves its main concerns, characterized by thoughtfully subtle implicitness and opposite-unity. Such a deliberate style of discourse is regarded as a deciding factor in keeping harmonious relationships.

### The Nexus of Chinese Harmonious Philosophy and Dialectical Cognition

Chinese Taoism has been coherently taking the world as a whole for thousands of years, and the wholeness contains yin and yang sides. One Yin and one Yang are called Taoism, so as to keep the permanent energy conservation (能量守恒). Taoism has always had its role in guiding Chinese thinking, cognition, communication, education, and maxims in life.

As mentioned in **Figure 3**, according to Chinese cognition, everything has two sides which are yin and yang, and yin + yang constitute a state of Taiji. Yin and yang have been





**FIGURE 3 |** The Interaction and Interchangeability of Dialectical yin + yang Taiji.

always interacting and interchanging in certain conditions, to permanently keep the life and growth in nature. Taoism Taiji is the quintessence of nowadays academic term “interaction,” seeking for developing a new understanding of ecologically beneficial ethics by balancing the two opposite sides into a harmonious state.

The core feature of such a dialectical interactive and interchangeable yin + yang model is that the understanding of yin only through contrasting with yang, and vice versa. These are principles of the whole universe and whole nature. Yin + yang by itself is a dialectical way of thinking, the process of which is through finding the common property of the two opposite concepts to achieve a subtly unified understanding of some ecological principles about life and behaviors. In certain conditions, yin could be converted into yang, and vice versa. Therefore, there always exist Chinese sayings “否极泰来” (when misfortune reaches its limit, good fortune is at hand), “塞翁失马焉知非福” (an old frontiersman loses his horse—a blessing in disguise).

Such yin + yang model constitutes the traditional Chinese philosophy and provides the formulation mode of CHD. The cognitive mechanism of these opposite two is through the process of “dialectical opposite-unity” to achieve the ultimate harmony, by way of “property” induction, refinement, and extraction. On this level, yin and yang are the two sides of a coin, and the two opposites have to be merged into a more abstract property covering the sense of the two, generating a subtle unified understanding in the form of an emergent property. Thus, CHD analysis is first based on and characterized by an ecologically beneficial philosophy with yin + yang dialectical unity, in order not only to superficially present the two extreme possibilities by words but also provide a way of balancing the yin and yang to achieve a more harmonious state of mind.

That is, ecological cognition is balanced and unified by the pros and cons of the same speech event or phenomenon to achieve Chinese Taoism with abstract yin + yang property, so as to realize the typical Chinese natural law of “Tao follows nature” (道法自然) and “harmony between man and nature” (天人合一).

### Chinese Dialectical Philosophy Integrating With Other Disciplines

Similar to Taoism Taiji, nowadays quantum physics featured by its overthrowing the original dualism, reductionism, realism, and locality view of the world, presents a many-dimensional world and possible world view, thus reality being a higher-dimensional space, and the world view is changed thereby. Quantum thoughts

hold that there existing two opposite beliefs in quantum entanglement of oneself which addresses the fundamental nature of reality, and the mind simultaneously accepting both of them, integrating them into a “Chinese yin + yang Taiji.”

From the above, Chinese ancient scholars, ecolinguists and quantum physicists have proposed that human beings have been cooperatively creating their “reality” with the interaction between natural ecology and social ecology, between the opposites into a dialectical unity. In this aspect, the research of CHD and its opposite-unity cognition actually offers new insights into the role of human minds and their quantum entanglement to the rest of the world. Chinese Taoism has some common maxims with twenty-first century quantum physics, integrating to promote researchers to re-define the key notions in linguistics and cognition.

Historically, Chinese Confucianists have always been attaching importance to “benevolence” to other human beings and nature. The law of Confucianism proposes to eliminate ethical evil and promote good and seek to establish and maintain social stability, harmony, and order. As a breakthrough of Chinese Philosophy in governing the country, Chinese Taoism seeks a deeper sense of “eternal rules” of dealing with the world. The representative scholar Lao Zi governs the country with “Taoism” in order to achieve ecological harmony and equality. Chinese Mohism takes “love and mutual benefit” as the ethical principle, with “salvation” as the core. It advocates that humans, nature, and society are inseparable wholeness, and develops the traditional dialectical “argumentation” of epistemology.

The above Chinese eco-cognition based on ecological philosophy is thought to be in the holism of CTM, with particular emphasis on harmony between humans, nature, and society. Thus, harmonious discourse and eco-cognition fall within a unified ecological worldview.

Chinese dialectical philosophy integrating with quantum physics evoke a revolution of ecological philosophy in unifying world views, values, ethics, and other concepts and ideologies into a concept of “Harmonious Coexistence” proposed by Chinese scholars, to make a Chinese contribution to the global ecology.

## CHINESE DIALECTICAL COGNITION AS THE MECHANISM OF HARMONIOUS DISCOURSE

To achieve the second objective of this paper: on a meso-level, the illustration of the origin, definition, characteristics, and goals of a newly born ecological cognition in a newly born CHD, this section is to introduce the terminology of ecological cognition and its fundamental role in harmonious discourse.

### The Dialectical Opposite-Unity of Ecological Cognition

As to the origin of ecological cognition (eco-cognition), Chinese cognition characterized by DOU is generally deemed as a representation and iconicity to Chinese philosophy (相由心生), they have been usually probed interdependently, because of their

common “harmony” perspective and assertion. So ecological cognition in China just means the harmony-oriented and Chinese philosophy-based mechanism of recognizing the world, to develop the ecologically beneficial approaches of constructing cognition models.

The common ground for the discussions of Chinese traditional dialectical cognition as the basis, mechanism, and process of harmonious discourse analysis is an attempt to conceptualize dialectical cognition as a kind of ecologically beneficial cognition with harmony as the core and main concern.

By virtue of a lack of systematic theories and methods in ecolinguistics, it is rational and necessary to integrate other theories, such as cognitive linguistics and philosophy, among others, to make multidisciplinary ecological discourse research. That is the reason for this paper taking ecological cognition and ecological philosophy as the supplement for ecological discourse study. As ecolinguistics is previously seen as a kind of hidden ideology study for protecting life, it has been developing an awareness of the interdependence among things and ideas, which could be further interpreted by Chinese yin + yang interaction and interchangeability.

As to the rationality of the concept of “dialectical” cognition, the Odense school bases its ecolinguistics, explanatory models, on both Marxist and non-Western models of dialectics, e.g., Buddhist philosophy (Bang and Døør, 2007, p. 37–42). They openly admit that Eastern philosophical and religious traditions contain useful information and tools for modern cognitive sciences. The term “dialectics” comes from a traditional and typical Chinese way of thinking, that is DOU, usually used to solve the cognitive dissonance about the deliberate opposite expressions and concepts to achieve a balanced harmony and of improving cognitive competence. Therefore, dialectical opposite unity is both a discourse style and a cognitive mechanism, to provide ecological benefit to all life through the state of harmony.

Thus, mind, ecology, and discourse constitute a necessary three-dimensional interactive unity. The process to develop the dialectical cognition is through the two opposite expressions or concepts, that is yin + yang, to acquire a more highly abstract and subtle property covering the two, establishing a “yin + yang → unity” cognitive mechanism, having its role in developing a harmonious state both in mind and discourses, contributing to an ecologically beneficial cognition construction, termed as “ecological cognition” (eco-cognition).

## The Rationality of Using Eco-Cognition in Harmonious Discourse Study

On the one hand, nowadays cognitive theories attach too much significance to the basic cognitive mechanisms such as image schema, metaphor, metonymy, and cognitive grammar, etc., resulting in some biased views of taking cognition as an unconscious process. Unconscious perspectives are destined to give rise to some cognition deficiencies, muddying the water of consciousness study, preventing the insight into higher cognition from being specified.

These deficiencies have been noticeably found out in two aspects: first, some scholars are programmed to take either a

positive or critical approach as the unilateral final solution to the ecological crisis, especially in EDA, without the consideration of balancing and integrating the two within “harmony.” Such a phenomenon fully implicates that various cognition deficiencies negatively affect the human mind and behavior. Second, few people are capable of merging the two opposite concepts into one more abstract and subtle covering property, due to their habitually unconscious intention of trying to save their cognitive efforts. So they just understand the discourse meaning as they are, incapable of consciously analyzing, inducing, extracting, and refining the possible emergent property covering the two opposites, fully manifesting the cognition unconsciousness. Chinese DOU could be a candidate to solve the above problems.

Meanwhile, nowadays physical Quantum theories attach an increasing significance to consciousness, studied within the non-matter, energetic framework, echoing to Chinese subtle and abstract property covering the opposites for meaning unity. And Sills and Lown (2008) use an innovative and paradigm-crossing term from Buddhism namely, “the mind-body,” which is related to the human as the cognitive-physiological whole. These two schools believe that consciousness cannot be found totally in the physiological brain, it is announced by the integration of the ecological whole world. All of the above intend to prove that it is time for cognitive functions of humans to generate epistemological shifts and turns from the original ontology to a holistic underlying, superordinate, subtle, and abstract property, refining or extracting the identity (同一) or unity (统一) about cognitive construal toward the simultaneous happenings.

Besides, Anna Bączkowska (2013) believes that “all living systems including man are phylogenetically (and ontogenetically) optimally designed and capable of harmonious and creative functioning within the reality they are functioning in,” according to which “harmony” is equipped by its distinctive “holistic and conscious” function in construing and constructing reality. Hence, the establishment of ecological cognition mechanism is effectively committed to solving problems of cognition deficiency and cognition unconsciousness, promoting them into a higher cognition, with ecologically beneficial cognition (eco-cognition) as the initiator and harmonious discourse as the output-based on such a function.

To sum up, by virtue of the cognition deficiency and unconsciousness, and based on a holistic theory proposed by quantum and ecologists, the main function of eco-cognition is to meet the requirement of a new multidisciplinary scientific research as cognitive tools and methods to recalibrate the philosophical, cognitive and socio-cultural perspectives of ecological harmonious discourse, creating a new ecologically beneficial holistic cognitive mechanism by DOU process, proposing a new harmonious cognitive mechanism to deal with the ecological crisis.

Such a new interactive wholeness world view substitutes the dualism and reductionism of the classical science, and directly turning the linguistic study breaking through the ontology limit into an epistemological one, shifting the ideology, values, and behavior into a dialectical yin + yang Taiji spiral recycle, renovating the basic cognition to an improved and upgraded level, to altogether build a new model of reality.

## THE ANALYSIS OF CHINESE HARMONIOUS DISCOURSE BY ECOLOGICAL COGNITION MECHANISM

To accomplish the third objective of this paper which was on a micro-level, the explanation of CHD by Chinese “DOU” ecological cognitive mechanism, in order to solve some cognitive dissonance and lift the basic cognition onto a higher level, this section presents ecological cognitive DOU mechanism in CHD.

Chinese harmonious discourse is characterized by the opposite expressions with reversible order, but with identical meaning characterized by property unity. For example, “否极泰来” (when misfortune reaches its limit, good fortune is at hand), the reversible order “泰极否来” still tells the same law and property, representing the same sense with “否极泰来” with the meaning of everything going to the opposite if it reaches the extreme, based on the opposite-unity mechanism. Thus, the Chinese mediocre spirit is proved to be an acceptable life state to achieve real ecological harmony.

The effectiveness of the above ecological cognitive mechanism lies in its operational principle: opposites in expression(formulation) and unity in conceptualization by an emergent property. This is because Chinese discourses universally function as an initiator of consciousness toward some particular states, practices, and principles about life, ethics, values, thoughts, and behaviors, advocated by Taoism, Confucianism, or Mohism. In the process of pursuing the promotion of human nature, thoughts, behaviors, and ethics, the conscious process of induction, deduction, refinement, and extraction of property are habitually cultivated. Chinese have been successively and conventionally digging a deeper sense for discourses and speeches, whenever and wherever possible. Therefore, whether or not expression orders are reversible, they just tell the same story(sense) by retrieving the same subtle and abstract property as the higher-level cognition.

Deep ecologists insist that their philosophy is not a branch of environmental ethics, but something “deeper,” but the deeper aspects are not clarified. That is where the above Chinese CTM-based DOU philosophy functions. In the new context of quantum holistic worldview and Chinese philosophical wholeness combined, discourse analysis and their corresponding cognitive process are to be regarded as a mutually supported and mutually converted Taiji yin + yang or cause + effect perpetual recycle. Therefore, CHD is different from the general discourse studies which primarily focus on a linguistic level.

### The Etymology of Chinese Harmonious Discourse

Chinese harmonious discourse is a deliberate balance between critical and positive discourse biases, proposing the most important analyzing factor in ecological discourse, which is “harmony.” There exist two research tendencies in discourse studies seeking to solve the ecological crisis: CDA and PDA, the

former is “an approach to language study which theorizes the instrumentality of language in creating and sustaining power and inequality in social actions, identities and relations” (Hart et al., 2020, p. 1). Several critical schools of CDA can be identified, characterized mainly by the theoretical and methodological frameworks that underpin their analyses (Hart and Cap, 2014; Wodak and Meyer, 2016).

Most ecological scholars hold a critical view toward the destructive discourse resulting in the ecology crisis. In order to reduce the number of destructive discourses and to increase that of positive discourses to achieve ecological harmony, scholars have been developing PDA. “A positive style of discourse analysis that focuses on hope and change, by way of complementing the deconstructive exposé associated with critical discourse analysis” (Martin, 1999, p. 29). To accomplish the positive purpose, scholars focus on the study of words correctness (Dunayer, 2001; Schultz, 2001), language use, framework construction (Macgilchrist, 2007), and storytelling (Robertson, 2014; Stibbe, 2015), in order to renovate discourses to enact a better world.

Through identifying the stereotypes of linguistic patterns in positive discourses, scholars intend to inspire respect and care for the natural world through finding out the positive features in discourse expressions. But PDA is also criticized that “One danger of (PDA), however, would be that of the enterprise turning into a form of propaganda on behalf of the status quo” (Flowerdew, 2008, p. 204).

The above two discourse studies fail to provide an appropriate solution to the nowadays ecological crisis, due to the lack of cognition in an ecological harmonious way. Critical and positive discourses, in their essence, are understood as both still holding the critical attitude in an ideal world, leading to their staying within a narrow research scope and only proposing ecological slogans such as peaceful co-existence and interdependence. Their just paying lip service to the wholeness world view and interactive model of ecolinguistics is insufficient in the micro and operational research of harmony philosophy, theory explanation, and social praxis, which is incapable of solving the ecology crisis caused by anthropocentric, economic development, and post-industrial civilization. CHD is expected to make some amendments to the above deficiencies, by the DOU mechanism.

The concept of CHD is the traditional native Chinese discourse theory (Huang, 2017; Wang, 2019; He, 2020, etc.), which could be used as an approach to balance and combine the critical and positive discourse, and to comprehensively demonstrate the whole dimensions of ecologically canonical events. Through evoking the deeper and higher cognition, we are in turn possible to develop and improve life insights of Taoism. The operational or specified way is that two opposite words (expressions)enact a conscious sense and connotation unity on the deep, subtle and superordinate level to acquire an abstract property.

Similar to the above, some scholars take consciousness as an emergent property of brains, which could be analyzed and interpreted by the Chinese eco-cognition mechanism, for it involves the conscious and deliberate cognition of the whole world in order to contribute to upgrading cognitive competence to a higher level.

## The Analysis of Chinese Harmonious Discourse by Ecological Cognition Mechanism

Both the “critical” and “positive” methods of discourse research all present a sort of one-sided bias, unqualified in establishing a dialectical wholeness in comprehending discourse, that is why CHD is presented and focused. The Chinese way of constructing a harmonious state, no matter in harmonious discourse or ecological cognition, is through the mechanism of the “property unity” covering the opposites, that is Yin + Yang → unity, integrating into a polished Taiji wholeness of construal.

As no corpus evidence could be provided due to the newness of CHD analysis, especially in the perspective of ecological cognition, this paper mainly adopts a theoretical analysis and interpretation. In general, the discourse realization process is represented by the Chinese convention of Yin + Yang, represented by Yin property + (matching, comparing, integrating) Yang property → Taoism (interaction + interchangeability) → dialectical emergent property(unity), both highlighting the concept of “harmony” as the deep-core sense in Chinese discourse. For example:

最明亮时总是最迷茫，最繁华时也是最悲凉。

(林语堂《京华烟云》)

The brightest is always the most confused, the most prosperous is also the most sad.

(Lin Yutang's smoke in Beijing)

The above “brightest” (yang) and “confused” (yin) and “prosperous” (yang) and “sad” (yin) constitute the opposite expression, deliberately juxtaposed to elicit different kinds of cognitive involvement (matching, comparing, and integrating), put together to acquire an emergent property (unity) or sense in the process of the deeper digging of their Taoism abstract property. Foregrounding two opposite words with the same importance certainly enacts a fundamental mediation to the cognitive dissonance from the opposites, effectively resulting in a third subtle, abstract, superordinate, emergent, balance-oriented property of a covering sense of these two words.

The instantiation of the operation of Taoism is clearly shown in the above utterance. Taoism, as a Taiji dialectical way of conscious thinking, is a complex thing, which cannot be decomposed into a simple group of simple components without destroying its essence. Thus, such unity is characterized by non-localized and *ad hoc* psychological quantum entanglement features, the understanding of which could only be the result of insight from dynamic nature and society. Put it in another word, the developing process of everything implicitly entails its opposite result, which reminds and implicates a necessity of cautious speech and behavior in a modest way, which is the optimal approach of achieving harmony.

Such a mechanism of cognition not only contributes to the ecological protection of life but also to the upgrading of intelligence. The research of newly born dialectical ecological cognition aims to consciously illustrate and evoke the harmony

discourses, perspectives, concepts, and behaviors, which is capable of maintaining the ecology in a peaceful cycle.

Chinese dialectical harmonious way of discourse formulation has been devoting to the revision of the unilateral ideas about nature and society, acquiring a radical innovation in our reconstructing our recognition toward nature and reality, on a higher cognitive level. Chinese is always harmonious with every creature in the world, respecting nature and other human beings, which helps to solve the ecological crisis.

## CONCLUSION

Chinese harmonious discourse is possible to bring about an overt cognitive turn toward the inner insight, illocutionary sense, and emergent property, which has its role in altering the structure, strategy, and mechanism of discourse analysis, for the purpose of holding the whole ecology in a balanced, interactive and harmonious state, avoiding the ecological crisis brought about by all kinds of extremes, and adjust the behaviors to the changing environment of nature and society. The two opposites not only represent the interaction between static and dynamic states in life but also direct oneself to compare the two and probe deeper self and nature.

This harmony-oriented opposites-unity mechanism requires that the cognitive subjects mentally co-operate as a cognitive multiagent, evoking a more profound understanding toward ecological relationships, possible to enforce their cognitive agency and to improve their cognitive competence and thinking from an antagonistic way to harmonious way. The dialectical discourse and cognition mechanism are bound to stimulate a quite different mode of mental involvement, highlighting a state of unconscious property-extraction originating from a deliberate consciousness.

Dialectical ecological cognition is one of the most effective strategies for establishing linguistic and psychological interactivity. Foregrounding the process of intermingling opposite meanings within harmonious discourse mode may act as an innovative attempt to represent the fluidity of dialectical consciousness → unconsciousness → consciousness + unconsciousness intersections, contributing to “community of common destiny for all human beings” advocated by China.

## AUTHOR CONTRIBUTIONS

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

## FUNDING

This work was supported by the Foundation of Ministry of Education of the People's Republic of China (The Cognitive Models Construction study of Chinese Discourse, 20YJA740066) as one of research results, and one of research results of Chinese Social Science Foundation (Research on Stanley Carville's literary thought and translation of his works) in 2019 (19BWW002).



## REFERENCES

- Adams, C., and Gruen, L. (2014). *Ecofeminism: feminist intersections with other animals and the earth*. London: Bloomsbury. doi: 10.5040/9781501388323
- Bączkowska, T. (ed.) (2013). *Towards an Ecology of Language, Communication and the Mind*. Bern: Peter Lang.
- Bang, J. C., and Døør, J. (2007). *Language, Ecology, and Society: A Dialectical Approach*. London: Continuum.
- Capra, F. (1995). *The Web of Life*. New York, NY: Harper Collins.
- Cooper, J. (2007). *Cognitive Dissonance Fifty Years of a Classic Theory*. London: Sage.
- Cox, J. (2012). *Environmental communication and the public sphere*, 3rd Edn. London: Sage.
- Døør, J., and Bang, J. (1996). *Language, Ecology and Truth – Dialogue and Dialectics*. Max Niemeyer Verlag.
- Døør, J., and Madsen, D. B. (2007). “Food for Thought—Metabolism and Metaphors,” in *Sustaining Language: Essays in Applied Ecolinguistics*, eds A. Fill and H. Penz (Wien: LIT Verlag), 267–278.
- Dunayer, J. (2001). *Animal Equality: Language and Liberation*. Derwood, MD: Ryce Pub.
- Fairclough, N. (1989). *Language and Power*. London: Longman.
- Fairclough, N. (2014). “Semiotic aspects of social transformation and learning,” in *An Introduction to Critical Discourse Analysis in Education*, ed. R. Rogers (New Jersey: Lawrence Erlbaum), 225–235.
- Finke, P. (2014). The ecology of science and its consequences for the ecology of language. *Lang. Sci.* 41(Part A), 71–82. doi: 10.1016/j.langsci.2013.08.008
- Fisher, A. (2013). *Radical ecopsychology: psychology in the service of life*, 2nd Edn. Albany, NY: State University of New York Press.
- Flowerdew, J. (2008). “Critical discourse analysis and strategies of resistance,” in *Advances in Discourse Studies*, eds V. Bhatia, J. Flowerdew, and R. H. Jones (London: Routledge).
- Garrard, G. (ed.) (2014). *The Oxford handbook of ecocriticism*. Oxford: Oxford University Press. doi: 10.1093/oxfordhb/9780199742929.001.0001
- Gibson, J. J. (1979). *The Ecological Approach to Visual Perception*. Boston: Houghton Mifflin.
- Halliday, M. A. K. (1990). ‘New ways of meaning: The challenge to applied linguistics’. *J. Appl. Linguist.* 6, 7–36.
- Hart, C., and Cap, P. (eds) (2014). “Introduction,” in *Contemporary Critical Discourse Studies*, eds C. Hart and P. Cap (London: Bloomsbury Academic), 1–15.
- Hart, R. P., Levenson, J. L., Sessler, C. N., Best, A. M., and Rutherford, L. E. (2020). “Cognitive Test for Delirium (CTD),” in *A Compendium of Tests, Scales and Questions*, ed. L. Robyn (London: Psychology Press), 51–53.
- Harvey, M. I. (2015). Content in languaging: Why radical enactivism is in compatible with representational theories of language. *Lang. Sci.* 48, 90–129. doi: 10.1016/j.langsci.2014.12.004
- Haugen, E. (1972). “The Ecology of Language,” in *The Ecology of Language: Essays by Einar Haugen*, ed. A. S. Dil (Stanford: Stanford University Press), 325–339.
- He, W. (2020). Disciplinary Nature of Ecolinguistics and Ecostylistics. *J. Univers. Sci. Technol. Beijing* 1, 1–7.
- Huang, G. (2017). From systemic functional linguistic to ecolinguistics. *Foreign Lang. Educat.* 5, 1–7.
- Knickerbocker, S. (2012). *Ecopoetics: the language of nature, the nature of language*. Amherst, MA: University of Massachusetts Press.
- Leibniz, G. W. (1969). *philosophical papers and letter*. Dordrecht: D.Reidel press.
- Lenton, T. M., Rockström, J., Gaffney, O., Rahmstorf, S., Richardson, K., Steffen, W., et al. (2020). Climate tipping points too risky to bet against. *Nature* 575, 592–595. doi: 10.1038/d41586-019-03595-0
- Macgilchrist, F. (2007). Positive discourse analysis: contesting dominant discourses by reframing the issues. *Crit. Approac. Discour. Anal. Across Discipl.* 1, 749–794.
- Martin, J. (2004). Positive discourse analysis: Power, solidarity, and change. *Rev. Canaria Estud. Ingleses* 49, 179–200.
- Martin, J. R. (1999). ‘Grace: The logogenesis of freedom’. *Discour. Stud.* 1, 29–56. doi: 10.1177/1461445699001001003
- Mühlhäusler, P. (2018). “What Creolistics Can Learn From Ecolinguistics”. in *The Routledge Handbook of Ecolinguistics*, eds A. F. Fill and H. Penz (London: Routledge), 135–148. doi: 10.4324/9781315687391-10
- Naess, A. (1995). “The shallow and the long range, deep ecology movement,” in *The Deep Ecology Movement: An Introductory Anthology*, eds A. Drengson and Y. Inoue (Berkeley: North Atlantic Books), 3–10.
- Orr, D. (1992). *Ecological Literacy: Education and the Transition to a Postmodern World*. New York, NY: SUNY Press.
- Robbins, T. W., Gillan, C. M., Smith, D. G., de Wit, S., and Ersche, K. D. (2012). Neurocognitive endophenotypes of impulsivity and compulsivity: towards dimensional psychiatry. *Trends Cogn. Sci.* 16, 81–91. doi: 10.1016/j.tics.2011.11.009
- Robertson, M. (2014). *Sustainability Principles and Practice*. London: Routledge. doi: 10.4324/9780203768747
- Schultz, B. (2001). “Language and the natural environment,” in *The Ecolinguistics Reader: Language, Ecology, and Environment*, eds A. Fill and P. Mühlhäusler (London: Continuum Press).
- Sills, L., and Lown, J. (2008). ‘The field of subliminal mind and the nature of being’. *Eur. J. Psychother. Counsel.* 10.1, 71–80. doi: 10.1080/13642530701869318
- Steffensen, S. V. (2018). Ecological meaning, linguistic meaning, and interactivity. *Cognit. Semiot.* 5, 1–21. doi: 10.1515/cogsem-2018-0005
- Steffensen, S. V., and Fill, A. (2014). ‘Ecolinguistics: The state of the art and future horizons’. *Lang. Sci.* 41, 6–25. 2013. 08.003 doi: 10.1016/j.langsci.2013.08.003
- Stevens, P. (2012). Towards an ecosociology. *Sociology* 46, 579–595. doi: 10.1177/0038038511422586
- Stibbe, A. (2015). *Ecolinguistics: Language, Ecology and the Stories We Live By*. Abingdon, NY: Routledge. doi: 10.4324/9781315718071
- Trasmundi, S. B., and Steffensen, S. V. (2016). Meaning emergence in the ecology of dialogical systems. *Psychol. Lang. Commun.* 20, 154–181. doi: 10.1515/plc-2016-0009
- Van Dijk, T. A. (2015). “Critical discourse analysis,” in *The Handbook of Discourse Analysis*, 2nd Edn, Vol. II, eds D. Tannen, H. E. Hamilton, and D. Schiffrin (Malden, MA: Wiley Blackwell). doi: 10.1002/9781118584194.ch22
- Vuong, Q.-H. (2021a). On the environment-destructive probabilistic trends: A perceptual and behavioral study on video game players. *Technol. Soc.* 5, 1–6. doi: 10.1016/j.techsoc.2021.101530
- Vuong, Q.-H. (2021b). The semiconducting principle of monetary and environmental values exchange. *Econom. Bus. Lett.* 10, 284–290. doi: 10.17811/eb1.10.3.2021.284-290
- Wang, S. (2019). A Critical Framing Analysis of Ecological Discourse: exemplified by Transforming Our World: the 2030 Agenda for sustainable development. *Foreign Lang. China* 5, 59–67.
- Wenjuan, Z. (2017). ‘Ecolinguistics: Towards a new harmony’. *Lang. Sci.* 62, 124–138. doi: 10.1016/j.langsci.2017.04.004
- Wodak, R., and Meyer, M. (eds) (2016). *Methods in Critical Discourse Studies*. London: Sage.
- Zlatev, J., and Blomberg, J. (2016). Embodied intersubjectivity, sedimentation and non-actual motion expressions. *Nordic J. Linguist.* 39, 185–208. doi: 10.1017/S0332586516000123

**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.

**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.

Copyright © 2021 Chun-ling. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.



# Effect of Implicit Theory on Effort Allocation Strategies in Multiple Task-Choice Situations: An Investigation From a Socio-Ecological Perspective

Keita Suzuki, Naoki Aida<sup>†</sup> and Yukiko Muramoto<sup>\*</sup>

Department of Social Psychology, Graduate School of Humanities and Sociology, The University of Tokyo, Tokyo, Japan

## OPEN ACCESS

### Edited by:

Hirofumi Hashimoto,  
Osaka City University, Japan

### Reviewed by:

Sheyla Blumen,  
Pontifical Catholic University of Peru,  
Peru  
Asuka Komiya,  
Hiroshima University, Japan

### \*Correspondence:

Yukiko Muramoto  
yukikom@i.u-tokyo.ac.jp

### <sup>†</sup>Present address:

Naoki Aida,  
Chuo University Junior and Senior  
High School, Tokyo, Japan

### Specialty section:

This article was submitted to  
Cognition,  
a section of the journal  
Frontiers in Psychology

**Received:** 30 August 2021

**Accepted:** 08 November 2021

**Published:** 03 December 2021

### Citation:

Suzuki K, Aida N and  
Muramoto Y (2021) Effect of Implicit  
Theory on Effort Allocation Strategies  
in Multiple Task-Choice Situations: An  
Investigation From a Socio-Ecological  
Perspective.  
Front. Psychol. 12:767101.  
doi: 10.3389/fpsyg.2021.767101

Implicit theories refer to two assumptions that people make about the malleability of one's ability. Previous studies have argued that incremental theorists (who believe that ability is malleable) are more adaptive than entity theorists (who believe that ability is fixed) when facing achievement setbacks. In the present research, we assumed that the adaptive implicit theory would be different when people could choose from a wider range of tasks. It was hypothesized that incremental theorists would sustain their efforts in the first task even when it was difficult, whereas entity theorists would try to find the most appropriate task. In a pair of laboratory experiments, participants had to maximize their outcomes when allowed to choose a task to engage in, from two options. When participants were allowed to practice the two tasks (Study 1), incremental theorists tended to allocate their effort solely to the first task, whereas entity theorists tended to put equal effort into both. When participants were informed that they could switch from the assigned task (Study 2), incremental theorists tended to persist in the first task regardless of its difficulty, whereas entity theorists tended to switch more quickly if the task was difficult. These results supported our hypothesis of two effort allocation strategies and implied that, in certain situations, entity theorists could be more adaptive than incremental theorists. Based on these findings, we conducted a social survey on the difficulty of switching tasks with a real-life setting as an environmental factor that determines the adaptive implicit theory (Study 3). It was revealed that the academic performance of incremental and entity theorists was moderated by the difficulty of switching tasks in their learning environment at school. Cultural differences in implicit theories may be explained by differences in the difficulty of switching tasks in education and career choices in each society.

**Keywords:** implicit theory, mindset, task engagement, educational environment, socio-ecological approach

## INTRODUCTION

How do people maintain motivation when facing difficulties in their daily lives? This has been a significant question for psychologists to answer. Previous studies have argued that an individual's motivation toward achievement is shaped by implicit theories that are beliefs about the malleability of one's ability (Dweck, 1986, 1999, 2006; Dweck and Leggett, 1988; Dweck et al., 1995). The belief

that human attributes are malleable is called incremental theory (or growth mindset) and that human attributes are fixed is called entity theory (or fixed mindset; Dweck, 1986, 1999, 2006).

Previous studies have argued that incremental theorists are more adaptive than entity theorists during achievement setbacks (Dweck, 2006). Specifically, when facing difficulties, the former are likely to sustain their efforts toward the mastery of the task, while the latter tend to react helplessly. In this research, we assume that the adaptive implicit theory would be different when people can choose from a wider range of tasks. We predict that both theorists will adopt different strategies, which will lead to different consequences regarding their motivation and achievement. Before presenting our research perspective and hypotheses in detail, we review previous studies on implicit theories.

## Effects of Implicit Theories on Motivation in a Single-Task Situation

Dweck and Leggett (1988) described major patterns of learners' adaptive and maladaptive behavior and proposed a model that accounts for these patterns in terms of underlying implicit theories. Incremental theorists have learning goals that make them aim for progress and improve their abilities. They tend to show "adaptive" mastery-oriented responses, such as seeking out challenging tasks and making efforts during a difficulty. However, entity theorists have performance goals that make them aim to obtain a positive evaluation of their abilities. Therefore, they tend to show mastery-oriented responses when the confidence is high, but when facing difficulty, they tend to show "maladaptive" helpless responses characterized by an avoidance of challenge and deterioration of performance.

Many empirical studies have revealed that when participants practice a task, incremental theorists practice longer than entity theorists and, therefore, get higher scores in subsequent tasks (Cury et al., 2008). Moreover, when given negative feedback, incremental theorists evoke less anxiety than entity theorists (Plaks and Stecher, 2007).

Such a trend was observed in real learning situations and laboratory settings. For instance, a longitudinal survey in a junior high school in New York showed that students with incremental theory tended to have an upward trajectory in grades in mathematics, while those with entity theory showed a flat trajectory (Blackwell et al., 2007). Hong et al. (1999) surveyed university students and found that entity theorists showed less interest in taking a remedial course even when they got a poor grade in a standardized examination. Rickert et al. (2014) reported that the stronger high school students believed in the entity theory, the more they show self-handicapping and procrastination behaviors. Nussbaum and Dweck (2008) reported that when incremental theorists fail in a test, they choose to compare their scores with the upper portion of the scale, while entity theorists compare with the lower portion of the scale to salvage their pride. Students holding the incremental theory are more resilient than those who hold the entity theory and therefore are able to buffer the negative impact of academic difficulties on their well-being (Zeng et al., 2016).

Based on these findings, researchers have reached the consensus that incremental theory is more adaptive than entity

theory in learning situations (e.g., Dweck and Leggett, 1988; Aronson et al., 2002; Robins and Pals, 2002; Good et al., 2003; Plaks and Stecher, 2007). Dweck (2006) recommends that parents and teachers foster the former in students.

## Significance of Investigating a Multiple-Task Situation

Previous studies have mostly dealt with situations in which individuals engage in a specific task. This is reasonable if the main purpose of implicit theory research is to investigate the psychological process to overcome difficulties in learning situations. Dweck (2017) noted that her initial research question was: "Why do some children relish challenges and thrive in the face of the setbacks, while others who are just as skilled fear challenges and fall apart when they hit setbacks? (p. 139)." Many researchers aim to clarify the adaptive implicit theory to improve an individual's ability to overcome difficulties and achieve a specific task.

However, in our daily lives, we often have to choose from multiple-task options that require different kinds of abilities. For example, choosing a major in college, a postgraduate plan, and a job. Considering the ubiquity of the multi-optional situations, it is also important to investigate how incremental and entity theorists behave in such situations.

We assume that when there are multiple-task options, entity theorists will not feel helpless and that the difference in strategies of the two theorists will stand out. Specifically, entity theorists, based on their belief in the fixedness of ability and performance goals, will take an aptitude exploration strategy in which they aim to choose the task they could perform best. As for incremental theorists, based on their belief in the changeability of ability and learning goals, they will take a "task mastery strategy" to improve their required ability in any task they engage in. The task mastery strategy could be inefficient in some cases of the multi-optional situation, because after choosing, they may miss the opportunity to find another task they can perform better. For example, excessively strong intrinsic motivation in a specific task reduces motivation for other tasks and the overall performance (Shin and Grant, 2019). We will discuss the positive aspects of entity theorists, which might have been dismissed in previous studies, by focusing on multi-optional situations.

A previous study indirectly supports our prediction regarding different strategies of incremental and entity theorists in multi-optional situations. Park and Kim (2015) asked participants, after working on a difficult task, to choose a follow-up task from two options. The results showed that when participants believed that a follow-up task measures the same ability as the task they failed in, incremental theorists performed better than entity theorists. However, when they believed that the follow-up task measures an ability unrelated to that need for the initial task, entity theorists showed higher performance than incremental theorists.

## Present Research

The present research aims to examine how implicit theories operate in situations involving a choice. We hypothesized that,

when incremental theorists have to choose between two tasks, they will put effort solely on the first task they access and attempt to master it rather than dividing their time between the two (task mastery strategy). When entity theorists face the choice, they will try to find out which they are best suited for and will put effort to master the chosen task (aptitude exploration strategy). We tested these hypotheses through a pair of laboratory experiments, in which participants were required to maximize their outcomes when they could choose the task to engage in out of two options (Studies 1 and 2).

The task mastery strategy is effective in gaining proficiency in the selected task. However, as mentioned above, when there are multiple-task options, the learners who take this strategy may strive to master the selected task and ignore others. They may be unsure of the benefits of each task and miss the chance to achieve greater success. In this situation of multiple-task options, the aptitude exploration strategy, in which the learners explore the available information, determine which task has the most benefits, and focus their efforts on that task, is more reasonable.

This reasoning suggests that the implicit theory that leads to superior performance will be different depending on whether there are multiple options. We conducted a social survey and asked respondents about the educational environment in their middle school and how it affected their academic performance (Study 3). We hypothesize that incremental theorists perform better when they have fewer task options, while entity theorists perform better when they have more task options in school.

By considering the educational environment, we are able to discuss about implicit theories from a socio-ecological perspective. Psychological research with a socio-ecological perspective focuses on delineating how the mind and behavior are affected by socio-ecological factors, including physical, societal, and interpersonal environments (Oishi and Graham, 2010; Oishi, 2014). The core idea of this perspective is that human's cognition, emotion, and behavior are shaped as tools for adaptation to a given environment. According to Dweck and Leggett (1988), adaptation for learners means staying motivated without feeling helpless in the face of obstacles and making an achievement (see also Elliot and Church, 1997; Elliot and Dweck, 1988). We explore what kind of implicit theory is advantageous for learners to make such an adaptation in a particular educational environment and discuss the possibility that individuals' implicit theories are determined by the socio-ecological factors surrounding them.

There is also practical significance in considering socio-ecological factors as determinants of adaptive implicit theories. Recent meta-analyses report weak effects of implicit theories on academic achievement (Costa and Faria, 2018; Sisk et al., 2018). It has also been pointed out that educational interventions designed to induce students to develop incremental beliefs have different outcomes in different social contexts (Walton and Yeager, 2020). These suggest the importance of investigating factors that may moderate the relationship between implicit theories and academic achievement. We will hopefully provide a new perspective on the recent findings by examining the moderative effect of the educational environment.

## STUDY 1

Study 1 aimed to investigate the effort allocation strategies of incremental and entity theorists. Participants were presented with two tasks that measure different fictitious abilities. Then, they had to select one and perform their best. Before selecting the task, participants were provided with an opportunity to practice it. In this phase, participants were randomly assigned to one of the two tasks. The total number of practice trials was 20. The participants could switch tasks, but after doing so, they were not allowed to practice the first task again. Participants were not informed about the other task.

In such an experimental setting, we predicted that incremental theorists would adopt a task mastery strategy. Specifically, they would continue engaging in the first task longer than entity theorists to improve the ability required in the task assigned. However, entity theorists would adopt the aptitude exploration strategy and switch earlier than incremental theorists to observe both tasks. Our working hypothesis is as follows.

*H1-1: Entity theorists switch the task earlier than incremental theorists.*

Incremental theorists might aim to improve their abilities required in the first task, while entity theorists might aim to determine which task suits them by observing both tasks equally. To clarify this point, we set the following hypotheses:

*H1-2: Incremental theorists tend to engage in the first task until the end of practice trials.*

*H1-3: Entity theorists tend to switch the task in the middle of practice trials (10 out of 20).*

## Method

### Participants

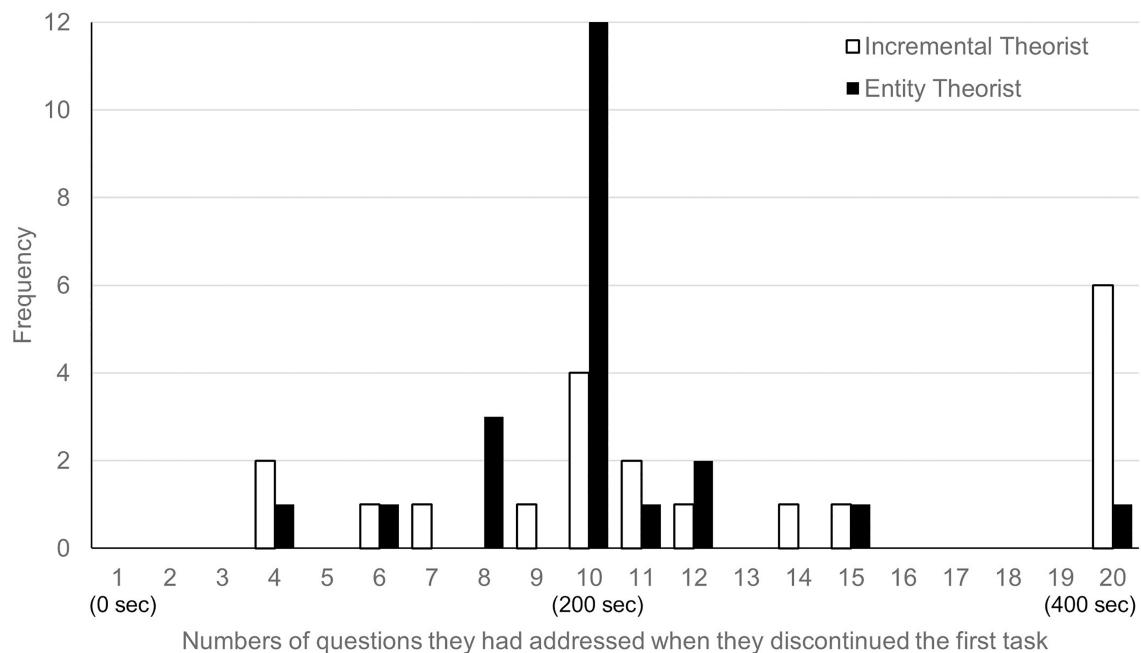
The participants were 42 Japanese undergraduate and graduate students (25 men, 17 women,  $M_{Age} = 21.24$ ,  $SD_{Age} = 1.46$ ) from the University of Tokyo. The experiment was conducted one at a time. The study was reviewed and approved by the Ethics Committee of the Department of Social Psychology, The University of Tokyo, before its commencement. The participants were informed that participation was voluntary and that they could quit at any time.

### Procedure

#### *Measuring Implicit Theory*

First, each participant was presented with a questionnaire comprising three items to measure implicit theory (Hong et al., 1999) and several filler questions. The three implicit theory questions were: "You have a certain amount of intelligence, and you really cannot do much to change it." "Your intelligence is something about you that you cannot change very much." "You can learn new things, but you cannot really change your basic intelligence." The Japanese translation was based on Oikawa (2005), with slight modifications. The participants answered





**FIGURE 1 |** Histogram of the number of questions incremental and entity theorists had addressed when they discontinued the first task.

each question on a six-point scale. A higher score indicates a stronger entity theory mindset. The filler questions comprised 10 items of the self-esteem scale (Rosenberg, 1965), and two questions on rational thinking that we composed. Responses to the filler questions were not analyzed.

### Task Instruction

The participants were informed that the test was designed to measure their competence and that their performance would affect their reward for participation. They were then given the following briefing regarding the procedure: (1) the test features two possible tasks, one measuring “social sensitivity” and another measuring “metaphysical reasoning” (2) participants could freely choose the task to undertake, and (3) they would have an opportunity to sample both the tasks in a preliminary practice trial.

### The Practice Trial

The participants were instructed to flip a coin to determine which task (on “social sensitivity” or on “metaphysical reasoning”) they would undertake first. However, unknown to the participants, it was predetermined that all would undertake the same task; thus, the outcome of the coin toss only determined a false label. The participants were told that the practice test would last for 20 trials. During these trials, they could switch from the first to the second task at any time, but after switching to the second task, they could not switch back. The participants were also allowed to remain in the first task. To avoid a situation where they felt that their efforts in the practice test would be wasted, the participants were advised that it would help in improving their scores in the actual test.

After the briefing, the participants undertook a practice test. The tasks were based on the Japanese version of the Remote Associates Test (RAT; Terai et al., 2013). Each question in the RAT presents three kanji characters. Although seemingly unrelated to each other, each character will form the first half of a two-character word when paired with a common fourth character. The person being tested must find the fourth character related to the three stimulus characters. Due to this design, it was unclear to the participants that the test was related to social sensitivity or metaphysical reasoning. The practice test consisted of 20 questions that exhibited a relatively low correct answer rate (<30%) in study of Terai et al. (2013) with 41 university students. This manipulation was intended to differentiate the task mastery strategy and the aptitude exploration strategy. If the first task is easy, entity theorists might continue to work on the first task because they might judge that they have an aptitude for the task, making it difficult to distinguish between the two strategies. To avoid this situation, we set the questions to be relatively difficult.

The procedure for the practice test was as follows: First, after the question number flashed on the screen for 1 s, the three stimulus characters appeared for 10 s. Within this time, the participants wrote down the fourth common character on the relevant field of their answer sheet. If they could not work out the answer, they left it blank. After 10 s, the correct character appeared on the screen for 9 s. Each question lasted for 20 s. When the 20 s were up, the next question appeared automatically. To enable the participants to see their progress in the first task, the screen presented the question and the number of questions completed.

The participants were instructed that they could move to the second task by pressing a key, which indicated completion. The second task was not prepared; when the participant pressed the end-task key, or if they reached 20 trials, the practice trial ended. The actual test did not take place. Finally, the participants provided their feedback in an ex post facto questionnaire. They were then debriefed and released. We recorded the number of questions that participants had engaged in (i.e., switching timing) as our main dependent variable.<sup>1</sup>

## Results

### Descriptive Statistics

The reliability coefficient for the three items of the Implicit Theory Scale (6-point scale) was adequate at  $\alpha=0.92$ . We averaged the scores for the three items to provide an implicit theory score (the higher the value, the stronger the entity mindset).

The average implicit theory score among the 42 participants was 3.16, with a standard deviation of 0.99, indicating that the sample leaned slightly toward the incremental theory.

### Effects of Control Variables

First, we tested the effects of participants' age and gender on the switching timing. Since the upper limit of the switching timing was 20, we conducted a tobit regression analysis (a model to analyze censored data) in which age and gender were independent variables, and switching timing was the dependent variable. The results indicated that age ( $\beta=-0.159$ ,  $p=0.309$ ) and gender ( $\beta=-0.063$ ,  $p=0.684$ ) did not affect switching timing. Therefore, we excluded both from further analyses.

### Hypothesis Testing 1-1: Do Incremental Theorists Engage in the First Task Longer Than Entity Theorists?

To test hypothesis 1-1, we conducted a tobit regression analysis with implicit theory (continuous variable) as the independent variable and switching timing served as the dependent variable.<sup>2</sup> Although the results were showing the trend along with H1-1, the main effect ( $\beta=-0.258$ ,  $p=0.092$ ) was not significant.

### Hypothesis Testing 1-2, 3: Do Incremental Theorists Remain in the First Task Throughout and Do Entity Theorists Switch the Task in the Middle of the Practice Trial?

To visually determine the relationship between the distribution and implicit theory, we divided the participants into two groups based on their average implicit theory scores ( $M=3.16$ ) and

showed the distribution for each group (**Figure 1**). The figure shows that four incremental theorists, compared to 12 entity theorists, discontinued the first task at the midpoint of 10 trials. However, six incremental theorists, compared to one entity theorist, continued the task until the end. These results are consistent with our expectations.

To test hypotheses 1-2 and 1-3, we coded a new binary variable of whether the participant switched the task in the middle (no=0, yes=1) and whether the participant remained in the first task (no=0, yes=1) as dependent variables. Logistic regression analysis revealed that the more the participants held the entity theory, the less likely they were to continue the task until the end ( $b=-1.18$ ,  $OR=0.31$ ,  $p=0.027$ ), which supports H1-2. However, there was no significant relationship between the participants' entity belief and their likelihood of switching the task in the middle ( $b=0.67$ ,  $OR=1.95$ ,  $p=0.070$ ). Although the latter result did not support H1-3, **Figure 1** implies that entity theorists tended to switch their task around the middle of the trial. Therefore, we coded a new binary variable of whether the participant switched the task in the third quintile (i.e., whether the switching timing was from 9 to 12; no=0, yes=1) and conducted an additional analysis. Logistic regression analysis revealed that the more the participants held the entity theory, the more likely they were to switch the task in the third quintile ( $b=0.82$ ,  $OR=2.26$ ,  $p=0.027$ ).

## Discussion

Study 1 aimed to test the hypotheses that incremental theorists adopt a task mastery strategy and that entity theorists adopt an aptitude exploration strategy. The effect of the participants' implicit theories on their task-switching timing did not reach statistical significance, which was contrary to H1-1. However, supporting H1-2, the more the participants held incremental beliefs, the more likely they were to take the strategy of continuing the first task till the end. This implies that the incremental theorists intended to improve their ability to solve RAT. On the other hand, the participants' entity beliefs did not predict the likelihood of taking the strategy of switching the task right in the middle of the trials, which did not support H1-3. However, the result of our additional analysis revealed that those with entity beliefs were more likely to switch the task "near the middle" of the trials. Entity theorists might have intended to observe which task was more suitable for them, although they did not predetermine dividing the opportunity to engage in each of the two tasks equally. Of course, it should be noted that the criteria we used in the additional analysis (i.e., third quintile) were somewhat arbitrary. Comprehensively, these results imply the existence of the two effort allocation strategies.

In Study 1, the participants had to make two choices: first, when and whether to switch tasks during the practice trial and second, which task to choose in the main trial. This experimental setting was useful in understanding that most entity theorists changed their tasks not because they felt helpless, but to determine their aptitude. In real life, however, we do not always have multiple options before choosing a task. We are

<sup>1</sup>The post-task questionnaire contained items on the participants' intentions, feelings, and reactions during and after the practice trials. The items measured the participants' kanji knowledge, vocabulary, and experiences of being evaluated by parents and others, and of extracurricular activities. Those details are beyond the objective of this article, as these items were not used in the analyses.

<sup>2</sup>Throughout the studies,  $b$  represents the coefficients and  $\beta$  represents the standardized coefficients. Standardized coefficients of the tobit regression analysis were calculated by HAD (Shimizu, 2016).

often faced with the choice to continue the current task or to switch to a new task without complete knowledge about the new task. In Study 2, we asked participants to engage in the main trials without a practice phase and observe whether and when they would switch.

There is also a limitation. As the difficulty of the task was fixed in Study 1, we were not able to observe how entity theorists would identify their aptitude and react to the task accordingly. If they perceive their aptitude for the first task, they might continue without changing the task. Moreover, although we intended to make the task difficult to differentiate the two strategies, the difficulty might have been perceived differently between participants. It is possible that the difficulty of the task acted as an important moderator variable, leading to the weak results of Study 1. To overcome this limitation, we modified the experimental paradigm in Study 2 to compare the behavior of incremental and entity theorists with different levels of task difficulty.

## STUDY 2

To continue further investigation of the effort allocation strategies of incremental theorists and entity theorists, we modified the experimental paradigm of Study 1. First, in Study 2, participants engaged in the main trials from the beginning without participating in practice trials. As in Study 1, participants were assigned to one of the tasks and asked to solve them one by one. They had the choice to switch to another task. Second, unknown to the participants, there were two kinds of difficulties (Easy vs. Hard) in the first task to which they would be randomly assigned. This manipulation was designed to compare how incremental and entity theorists react when the task is difficult and when it is not. Third, we assessed the alternative explanation that entity theorists switch tasks earlier due to helplessness when faced with a difficult task.

We predicted that incremental theorists would not change their switching timing depending on the difficulty because they believe in the malleability of their ability. Therefore, they would try to improve their ability by engaging in the task regardless of the difficulty. However, entity theorists would change their switching timing depending on the difficulty because they believe in the fixedness of their ability, and, therefore, they would try to engage in the task if they can perform well. Consequently, they would engage in the first task longer when it is easy. Our working hypotheses are as follows.

*H2-1:* Incremental theorists do not change their switching timing depending on the difficulty of the task.

*H2-2:* Entity theorists engage in the first task longer when it is easy compared to when it is hard.

## Method

### Participants

A total of 49 Japanese undergraduate students (31 men, 18 women,  $M_{\text{Age}} = 20.14$ ,  $SD_{\text{Age}} = 0.71$ ) from the University of Tokyo

participated in the experiment. Since it was conducted as a part of a research method course in psychology, participants did not receive monetary reward and went through the experiment simultaneously in the same room. The study was reviewed and approved by the Ethics Committee of the Department of Social Psychology, The University of Tokyo, before its commencement. The participants were informed that participation was voluntary and that they could quit at any time. The participants were informed that the participation or the score would not affect their course grade.

### Procedure

#### *Measuring Implicit Theory*

First, participants were presented with a questionnaire comprising three items to measure implicit theory (Hong et al., 1999) and several filler questions. The Japanese translation was based on Oikawa (2005), with slight modifications.<sup>3</sup> The filler questions comprised 17 items of the Goal Orientation Scale (Mitsunami, 2010). Responses to the filler questions were not analyzed. The reliability coefficient for the three items of the Implicit Theory Scale (6-point scale) was adequate at  $\alpha = 0.94$ . We averaged the scores for the three items to provide an implicit theory score (the higher the value, the stronger the entity mindset).

#### *Task Instruction*

First, the participants were informed that the test was designed to measure their ability for abstract thinking and that two different kinds of tasks, one measuring their “social sensitivity” and another their “metaphysical reasoning ability” were prepared.

Next, they were instructed on how the experiment proceeds: (1) participants will receive two booklets that contain two different tasks, (2) each participant will be assigned to a task, (3) during the trials, participants will be able to change tasks anytime, but after switching, they will not be allowed to switch back (they could also remain in the first task throughout), (4) the experiment will end when they solve 20 questions, regardless of the task they choose, and (5) their grade will be calculated by the total number of correct answers in both tasks. They were encouraged to obtain as many correct answers as possible.

#### *Content of the Task*

Half of the participants were led to believe that their first task measured “social sensitivity,” and the other half believed that their first task measured “metaphysical reasoning ability.” However, it was predetermined that all participants performed the same task: the Japanese version of RAT (Terai et al., 2013). Although the task was identical to that used in Study 1, the difficulty was manipulated. Specifically, based on the accuracy rate reported in Terai et al. (2013), we selected the 20 highest accuracy-rate trials for the easy task and 20 lowest accuracy-rate trials for the hard one. Participants were randomly assigned to either; however, they were not informed of this.

<sup>3</sup>The translation of the word “intelligence” was slightly different from the items used in Study 1.



The second task was the Japanese version of the anagram test, which was randomly selected from Aoyagi and Oashi (1990). The accuracy rate was ranged from easy to hard versions of the first task. However, the information of the second task was not provided until the participants chose to switch tasks.

### Main Trial

After the instruction, all participants were asked to immediately start the first task. First, participants were given 60 s to read the instructions of the RAT. Then, they were instructed to move on to the questions. Participants were given 15 s to solve one question and 30 s to check the answer, and so, each trial lasted for 45 s. The timing of the page turn was dictated by the experimenter, so they could not turn it even if they solved the question or finished checking their answers within the assigned time. If participants wanted to switch their task, they had a 30-s answer-checking period to do that. The entire task ended when the total number of questions reached 20. If the participants did not switch their task, their switching timing was measured as 20.

### Post-task Questionnaire

After the trials, the participants were asked to answer the post-task questionnaire. Several items included a measure of helplessness ("During the task, I felt helplessness"). Since the experiment was not incentivized by monetary rewards, we also measured the participants' intention to get good scores (Performance intention: "I intended to get good scores") as a control variable. Each item was measured using a 6-point Likert scale.<sup>4</sup>

## Results

### Descriptive Statistics

Table 1 shows the mean scores and standard deviations of the main variable used in the following analysis. The average implicit theory score among the 49 participants was 4.18 with a standard deviation of 1.21, indicating that the sample leaned slightly toward the entity theory. Most participants continued the first task longer and till the end, which was the most frequent pattern.

### Effects of Control Variables

First, we tested the effects of the participants' age and sex on switching timing. Since the upper limit was 20, we conducted a tobit regression analysis with age and gender as independent variables, and the switching timing served as a dependent variable. The results indicated that neither age ( $\beta = 0.186$ ,  $p = 0.266$ ) nor gender ( $\beta = -0.162$ ,  $p = 0.210$ ) affected the switching timing. Therefore, we excluded both from further analyses.

### Hypothesis Testing 2-1, 2: How Do Incremental and Entity Theorists Behave Differently to Easy and Hard Tasks?

To test hypothesis 2-1 and 2-2, we conducted a tobit regression analysis with the implicit theory, difficulty of the task (Easy = 0, Hard = 1), and their interaction as the independent variables, with switching timing being the dependent variable.<sup>5</sup> Performance intention was added to the analysis as a covariate. Neither the main effect of implicit theory ( $\beta = -0.244$ ,  $p = 0.110$ ) nor difficulty ( $\beta = -0.075$ ,  $p = 0.590$ ) were significant. A significant interaction between implicit theory and task difficulty was found ( $\beta = -0.344$ ,  $p = 0.026$ ). Simple slope analysis<sup>6</sup> (Figure 2) revealed that among incremental theorists ( $-1$  SD), the main effect of task difficulty ( $\beta = 0.273$ ,  $p = 0.221$ ) was not significant. Among entity theorists ( $+1$  SD), the main effect of difficulty of the task ( $\beta = -0.424$ ,  $p = 0.035$ ) was significant, suggesting that entity theorists switched earlier than incremental theorists, which supported H2-1 and H2-2.

### Additional Analysis: Did Helplessness Affect Entity Theorists?

We conducted a regression analysis with implicit theory, difficulty of the task and their interaction as independent variables, and helplessness as dependent variables. Neither the main effect of implicit theory ( $\beta = -0.037$ ,  $p = 0.800$ ) nor the difficulty of the task ( $\beta = 0.221$ ,  $p = 0.131$ ) were significant, and the interaction of these variables was also not ( $\beta = 0.175$ ,  $p = 0.248$ ). This suggests that entity theorists did not switch because they felt helpless.

## Discussion

In Study 2, we tested the hypotheses that incremental theorists do not change their switching timing depending on the difficulty of the task, and that entity theorists engage in the first task longer when the task is easier. The results supported these hypotheses, indicating that entity theorists changed their reactions depending on whether they thought they had the aptitude for the task which strengthens our prediction that they tend to adopt an aptitude exploration strategy. However, incremental theorists did not change their reactions depending on the difficulty but consistently tried to face it. This result strengthens our prediction that incremental theorists tend to adopt a task mastery strategy.

Additionally, the results indicated that entity theorists' task choice strategy was not due to their helplessness in a difficult task. There was no difference between incremental and entity theorists in their evoked helplessness. This is different from the findings of previous studies (e.g., Dweck and Leggett, 1988), which emphasized the helplessness felt by entity theorists when faced with difficulty. They might not feel helpless when there are alternative task options because they can utilize their aptitude exploration strategy. The difference between the present research

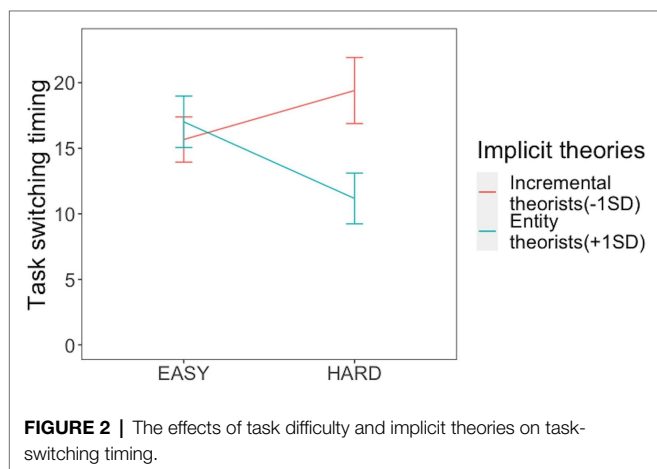
<sup>4</sup>As in Study 1, we will provide the information of the other post-task questionnaire in the **Supplementary Material**.

<sup>5</sup>In Study 2, we mean-centered the variables to avoid the problem of multicollinearity, which we should consider while introducing interaction as an independent variable (Aiken and West, 1991).

<sup>6</sup>Simple slope analysis was conducted through the website of Preacher et al. (2006; quantpsy.org).

**TABLE 1** | The descriptive statistics of the main variables used in Study 2.

	EASY (N = 25)		HARD (N = 24)		ALL (N = 49)	
	M	SD	M	SD	M	SD
Implicit theory	4.09	1.35	4.29	1.06	4.18	1.21
Switching timing	14.64	5.05	13.67	4.46	14.16	4.74
Performance intention	4.64	1.55	4.62	1.10	4.63	1.33
Helplessness	2.08	1.32	2.71	1.55	2.39	1.46



and most previous studies comes from the presentation of different situations in which there are alternative task options.

It should be noted that, in Study 2, we were not able to evaluate whether each of the two strategies was adaptive or not based on the performance of the participants. This was because the results would vary arbitrarily depending on how the researcher set the difficulty level of the second task. Also, although Dweck and Leggett (1988) assumed that learners who can make adaptive responses in the face of difficulty would have higher achievement, it would not necessarily be seen in an individual test score, but rather, would appear in more comprehensive academic performance. Therefore, in Study 3, we conducted a social survey and asked participants to indicate their academic performance, which would reflect the consequence of their cumulative use of the task mastery or aptitude exploration strategies.

## STUDY 3

In Study 1 and 2, we investigated effort allocation strategies in a multiple-task situation. The results implied that incremental and entity theorists adopt the task mastery strategy, and the aptitude exploration strategy, respectively. Additionally, Study 2 suggested that when there are multiple-task options, entity theorists could avoid helpless responses as well as incremental theorists. Comparing these results with previous studies on a single-task situation shows that preferable implicit theory may depend on whether task-switching is possible in a learning environment.

A previous study claimed that when there is only one task, incremental theorists would be more adaptive because they can utilize their task mastery strategy, while entity theorists are unable to use the aptitude exploration strategy because they have no other task to explore. However, when there are multiple-task options, incremental theorists might stick to a difficult task (as seen in Study 2), which might cause opportunity costs. In Study 3, we aim to investigate how environmental factors related to task-switching moderate the advantage of incremental and entity theories in real-life settings.

In Studies 1 and 2, we dealt with the factor as a binary variable (i.e., a single or multiple-task situation) in a laboratory setting. In Study 3, we focus on the task-switching difficulty in a learning environment, which is defined by the number of task options, the external force to make individuals engage in a specific task, and the cost of switching.

School education, including school policies and curricula, might provide a good example. In Japan, some schools force all students to work on a standard curriculum, while other schools allow individual students to choose courses and subjects. In the former, students who have fallen behind in their studies often face pressure to catch up with the majority in the specific curriculum. We assume that students with incremental theory would be better at achieving in such an environment. However, in schools with a flexible curriculum, students with entity theory may utilize their aptitude exploration strategy and achieve results without feeling helpless.

To investigate the moderating effect of the task-switching difficulty, we conducted a social survey that asked the participants' educational experience. We used the uniformity of education of the participants as an indicator of task-switching difficulty and their academic performance as an indicator of the consequence of having a specific implicit theory. The working hypotheses are as follows.

**H3-1:** When the uniformity of education in school is high, students with the incremental theory perform better than those with the entity theory.

**H3-2:** When the uniformity of education at school is low, students with the entity theory perform better than those with the incremental theory.

Specifically, we asked respondents to recall and rate the uniformity of the classes and instructions they received at a junior high school, and examined how these measures moderate the impact of implicit theories on their academic performance. Academic

performance was measured by asking respondents about their grades in junior high school and their high school level.

Prior to testing our hypotheses, we investigated two issues to confirm the findings of Study 1 and 2. First, we measured the respondents' aptitude exploration behavior and tested the correlation between implicit theories and the behavior to confirm the ecological validity of Study 1 and 2. Second, in order to confirm that entity theorists do not show helpless responses when they have multiple-task options, we measured the participants' satisfaction with school life and analyzed how it was affected by implicit theories and uniformity of education.

## Method

### Participants

A total of 500 Japanese adults (250 men, 250 women,  $M_{Age} = 26.63$ ,  $SD_{Age} = 2.22$ ) who were registered as monitors of Cross Marketing Inc. participated in the survey. The participants' age was restricted between 22 and 29 years to minimize generational differences in the educational experience. The study was reviewed and approved by the Ethics Committee of the Department of Social Psychology, The University of Tokyo, before its commencement. Participants were informed that participation was voluntary and that they could quit at any time.

### Questionnaire

Study 3 was conducted as part of a research project on the educational environment of elementary, junior high, and high schools in Japan, where the first two are compulsory, with many students taking high school entrance exams. Therefore, to test our hypotheses, we focused only on the participants' learning environment in junior high school and used their high school's rank as a performance indicator. Below, we specify the items used to examine the hypotheses. The details of the questionnaire and supplementary analysis are available in the **Supplementary Material**.

### Implicit Theory

The participants indicated their entity or incremental beliefs that they had endorsed in their school days on a 6-point Likert scale ("In junior high school, I believed that ability is something about you that you cannot change very much").

### Uniformity of Education at Junior High School

The participants indicated the uniformity of education on a 6-point Likert scale ("At my junior high school, all students were expected to learn at the same pace." or "At my junior high school, delayed learning made school life uncomfortable." or "At my junior high school, many classes involved memorizing textbook content."). Since the reliability coefficient for the three items was adequate ( $\alpha = 0.82$ ), we calculated the uniformity of the class score by averaging the scores of the three items.

### Academic Performance

The participants indicated their relative ranking of academic records within their school grade on a 5-point Likert scale.

A lower number indicated a higher ranking; therefore, we reversed the score in the analysis. Those who did not specify their ranking of academic records were excluded from the analysis.

As another indicator of school performance, participants indicated their high school's relative ranking on a 5-point Likert scale.<sup>7</sup> A lower number indicated a higher ranking; therefore, we reversed the score in the analysis. Those who did not specify their high school level were excluded. The participants indicated whether they went through entrance exams or interviews. For those who did not take an entrance exam, the high school's ranking does not necessarily indicate their academic performance. Therefore, they were excluded from the analysis.

### Aptitude Exploration Behavior

The participants indicated the extent to which they had engaged in aptitude exploration behavior on a 5-point Likert scale ("In junior high school, I tried to find and develop my talents, not just in my studies").

### Satisfaction With School Life

The participants indicated the extent to which they were satisfied with their school life on a 5-point Likert scale ("Overall, I was satisfied with my junior high school experience").

### Demographic Variables

The participants indicated their age, gender, and their parents' educational qualification (which was dummy coded into binary variables that indicate whether they graduated from university). Those who did not specify their parents' educational attainment were excluded from the related analysis. Participants indicated their economic status in their school days on a 5-point Likert scale.

## Results

### Descriptive Statistics

The descriptive statistics are listed in **Table 2**. Both the academic record and the high school's ranking of participants were significantly correlated with their parents' educational attainment and economic status. Therefore, to assess the robustness of our analysis, we tested two models, with and without covariates.

The participants' implicit theory was significantly correlated with their aptitude exploration behavior ( $r = 0.255$ ,  $p < 0.001$ ), which implies that the stronger the participants endorsed entity beliefs, the more likely they took on aptitude exploration behavior.

### Interaction Effect of Implicit Theories and Uniformity of Education on Satisfaction With School Life

We conducted a regression analysis with satisfaction with school life as the dependent variable (**Table 3**). The interaction

<sup>7</sup>In Japan, it is common that students enter high school through entrance exams or interviews unless they are in combined junior high and high school. The relative ranking of high schools is made public by indicating the likelihood of success as a deviation value.

**TABLE 2 |** The descriptive statistics of the variables used in Study 3.

	<i>N</i>	<i>M</i>	<i>SD</i>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>
1. Implicit theories	500	3.36	1.21	0.415**	−0.120*	−0.126**	0.255**	0.022	−0.054	−0.043	−0.012	−0.067	0.023
2. Uniformity of the class	500	3.67	0.97	–	0.009	0.012	0.280**	0.130**	0.009	−0.020	0.045	−0.003	0.031
3. Academic record	452	3.18	1.21		–	0.506**	0.200**	0.197**	0.194**	0.099*	0.168**	0.025	−0.002
4. Ranking of the high school	449	2.77	1.14			–	0.184**	0.276**	0.201**	0.133**	0.234**	0.065	−0.092*
5. Aptitude exploration behavior	500	3.15	1.20				–	0.290**	0.071	0.087	0.127**	0.005	−0.018
6. Satisfaction with school life	500	3.20	1.32					–	0.034	0.026	0.201**	0.071	−0.035
7. Educational attainment dummy (Father; 1 = Graduated university)	410	0.52	0.50						–	0.401**	0.168**	0.050	−0.078
8. Educational attainment dummy (Mother; 1 = Graduated university)	436	0.26	0.44							–	0.140**	0.014	−0.092 <sup>†</sup>
9. Economic status	500	2.99	1.01								–	0.018	−0.063
10. Age	500	26.6	2.24									–	0.038
11. Gender	500	–	–										–

\*\* $p < 0.01$ ; \* $p < 0.05$ ; <sup>†</sup> $p < 0.10$ .

between implicit theories and uniformity of education was significant (Model 0-1:  $\beta = -0.133$ ,  $p < 0.001$ , Model 0-2:  $\beta = -0.161$ ,  $p < 0.001$ ). We conducted a simple slope analysis (Figure 3). Among the participants whose uniformity of education was high (+1 SD), when the demographic variables were controlled, the main effect of implicit theories was significant (Model 0-1:  $\beta = -0.065$ ,  $p < 0.312$ , Model 0-2:  $\beta = -0.146$ ,  $p < 0.019$ ), suggesting that the more the participants endorse incremental theory, the more satisfied they were with their school life with highly uniform education. Among the participants whose uniformity of education was low (−1 SD), the main effect of implicit theories was significant (Model 0-1:  $\beta = 0.178$ ,  $p < 0.002$ , Model 0-2:  $\beta = -0.157$ ,  $p < 0.021$ ), suggesting that the more the participants endorse the entity theory, the more satisfied they were with their school life with non-uniform education.

### Hypothesis Testing 3-1, 2: Does Uniformity of Education in Junior High School Moderate the Effect of Implicit Theory on Academic Performance?

To test hypotheses 3-1 and 3-2, we conducted a regression analysis with the academic record as the dependent variable (Table 3). The interaction between implicit theories and uniformity of education was significant (Model 1-1:  $\beta = -0.094$ ,  $p < 0.004$ , Model 1-2:  $\beta = -0.098$ ,  $p < 0.008$ ). We conducted a simple slope analysis (Figure 4). Among the participants whose uniformity of education was high (+1 SD), the main effect of implicit theories was significant (Model 1-1:  $\beta = -0.237$ ,  $p < 0.001$ , Model 1-2:  $\beta = -0.220$ ,  $p < 0.001$ ), suggesting that the more the participants endorse the incremental theory, the higher the relative rank of their academic record. Among the participants whose uniformity of education was low (−1 SD), the main effect of implicit theories was not significant (Model 1-1:  $\beta = -0.048$ ,  $p < 0.433$ , Model 1-2:  $\beta = -0.032$ ,  $p < 0.640$ ).

We conducted a parallel analysis with the high school's ranking as the dependent variable (Table 3). Both models, with and without covariates, revealed that the interaction between implicit theories and the uniformity of the class was significant (Model 2-1:  $\beta = -0.164$ ,  $p < 0.003$ , Model 2-2:  $\beta = -0.138$ ,  $p < 0.001$ ). We conducted a simple slope analysis using Model 2 (Figure 5). Among the participants whose uniformity of education was high (+1 SD), the main effect of implicit theories was significant (Model 2-1:  $\beta = -0.239$ ,  $p < 0.001$ , Model 2-2:  $\beta = -0.257$ ,  $p < 0.001$ ), suggesting that the more the participants endorse the incremental theory, the higher the high school's ranking, which supported H3-1. Among the participants whose uniformity of education was low (−1 SD), the main effect of implicit theories was not significant (Model 2-1:  $\beta = -0.089$ ,  $p < 0.180$ , Model 2-2:  $\beta = -0.001$ ,  $p < 0.989$ ). This does not support H3-2. An identical pattern was obtained with the analysis in which the academic record and the ranking of the high school served as the dependent variable, which supports only H3-1.

## DISCUSSION

Study 3 aimed to investigate how adaptive implicit theory is determined by the task-switching difficulty in a learning environment. To achieve this goal, we conducted a social survey measuring the uniformity of education at school as an indicator of task-switching difficulty and academic achievement as an indicator of performance.

The results supported H3-1, suggesting that in an environment where task-switching is difficult, endorsing incremental theory is more adaptive. However, the results did not support H3-2 but suggested that in an environment where task-switching is easy, incremental and entity theorists performed to the same extent. Although the results did not show the advantage of entity theory in an environment where task-switching is easy, it is important to know that entity theorists can achieve the same level of achievement as incremental theorists depending on the educational environment. It should be noted that our hypotheses were based on the assumption that individuals with entity beliefs were more likely to engage in aptitude exploration behavior than those with incremental beliefs; this correlation was confirmed in Study 3, consistent with the results of Study 1 and 2. Moreover, individuals with entity beliefs tended to be more satisfied with their school life in a non-uniform educational environment, while those with incremental beliefs showed the opposite tendency. This result, along with the findings from Study 2, suggests that entity theorists' feeling of helplessness may be reduced when alternative task options are available. Overall, the results imply that the task-switching difficulty is a boundary condition that determines the advantage of incremental and entity theories.

In future research, it is necessary to measure other aspects of the task-switching difficulty. For example, a single or multiple-track system, a variety of course curricula, and the freedom to choose your favorite subjects might be other aspects of task-switching difficulty. Entity theorists could be adaptive to the learning environment with high freedom of choice. Further investigation is needed to measure and test the effects of other dimensions of task-switching difficulty.

## GENERAL DISCUSSION

### Summary

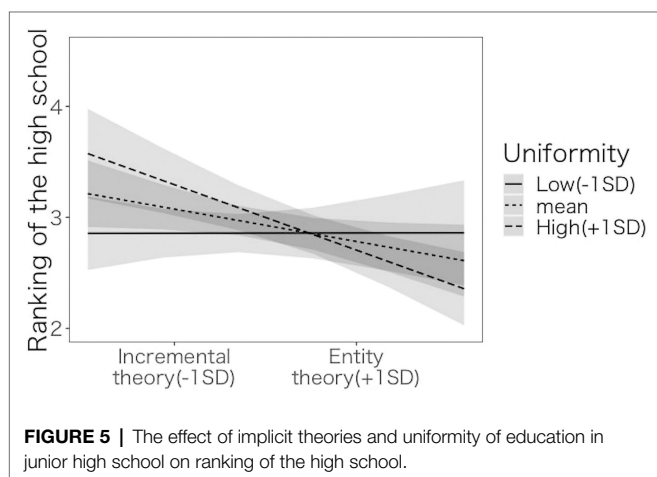
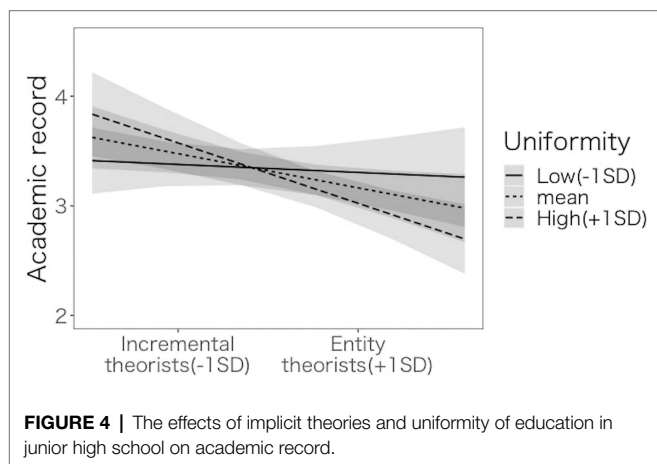
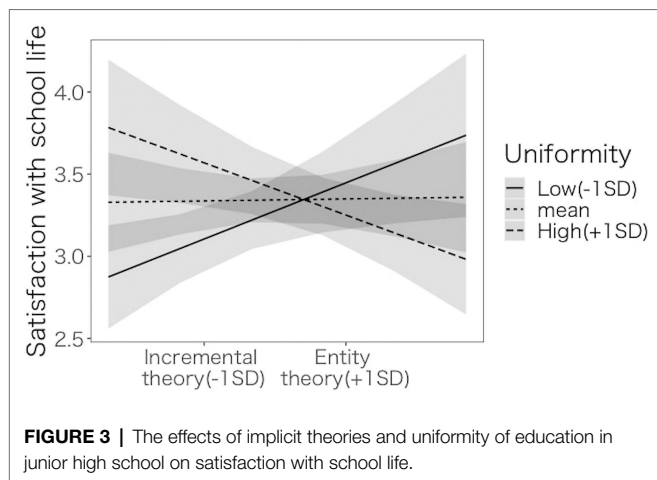
The study aimed to investigate effort allocation strategies of incremental and entity theorists according to the learning environment. In Studies 1 and 2, we focused on their strategies in situations with multiple choices of tasks and tried to compare the results with those of previous studies on situations with no choices of tasks. We predicted that incremental theorists, based on their belief in the malleable nature of their ability, would adopt the task mastery strategy and allocate all their efforts to master a specific task regardless of whether they had a choice. In contrast, we predicted that entity theorists, based on their belief in the fixed nature of ability, would use the aptitude exploration strategy to choose the most suitable task and then put their effort into it. To test these hypotheses,

**TABLE 3 |** Results from regression models on the ranking of high school and the academic records.

Independent variables	Model 0-1		Model 0-2		Model 1-1		Model 1-2		Model 2-1		Model 2-2	
	Satisfaction with school life (N = 500)		Satisfaction with school life (N = 410)		Academic record (N = 449)		Academic record (N = 410)		Ranking of the high school (N = 370)		Ranking of the high school (N = 304)	
	$\beta$	$t$	$\beta$	$t$	$\beta$	$t$	$\beta$	$t$	$\beta$	$t$	$\beta$	$t$
Implicit theories	-0.043	-0.89	-0.012	-0.23	-0.142	-2.84**	-0.124	-2.29*	-0.164	-2.95**	-0.121	-1.95†
Uniformity of education	0.118	1.68*	0.049	0.88	0.093	0.89	-0.023	-0.43	0.093	1.68†	0.060	0.95
Implicit theories × Uniformity of education	-0.133	-4.31**	-0.161	-4.31**	-0.094	-2.85**	-0.098	-2.64**	-0.074	-2.04*	-0.138	-3.12**
<i>Covariates</i>												
Educational attainment dummy (Father; 1 = Graduated university)			0.000	0.02			0.155	2.95**			0.165	2.83**
Educational attainment dummy (Mother; 1 = Graduated university)			-0.014	-0.27			-0.004	-0.09			-0.012	-0.22
Economic status			0.140	2.89**			0.133	2.66**			0.131	2.39*
Age			0.045	0.92			-0.023	-0.42			-0.023	-0.41
Gender			-0.036	-0.78			-0.015	-0.32			-0.125	-2.30*

In Model 0-2, participants who did not specify either of their parents' educational attainment were excluded. In Model 1-1, participants who did not specify their ranking of academic records were excluded. In Model 1-2, from the sample used in Model 1-1, participants who did not specify either of their parents' educational attainment were excluded. Model 1-1 and 2-1 do not have covariates and Model 1-2 and 2-2 have covariates. Values are standardized coefficients with  $t$ -values. In Model 2-1, participants who indicated that they did not experience an exam or an interview and those did not specify their high school's ranking were excluded. In Model 2-2, from the sample used in Model 2-1, participants who did not specify their parents' educational attainment were excluded. \*\* $p < 0.01$ ; \* $p < 0.05$ ; † $p < 0.10$ .





in Study 1, we provided the participants with an opportunity to sample and practice two tasks before choosing the one to engage in and observed how incremental and entity theorists switched from the assigned task. The results revealed that incremental theorists tended to practice the first task longer

than entity theorists; specifically, they tended to practice the assigned task throughout. However, entity theorists tended to switch tasks in the middle of the practice. In Study 2, we observed how incremental and entity theorists switched their tasks when they could not practice and started with trials directly related to their grades. We also manipulated the difficulty of the first task. The results revealed that while incremental theorists did not change their switching timing depending on the difficulty, entity theorists engaged in the first task longer when the task was easier. Additionally, there was no difference in helplessness evoked between incremental and entity theorists, which means that entity theorists' strategy was not driven by a feeling of helplessness, as claimed in previous studies.

Based on these findings in laboratory settings, we predicted that the choice of implicit theory would depend on whether an individual can switch tasks easily in a learning situation. In Study 3, we focused on the task-switching difficulty in a real-life setting and conducted a social survey to investigate the advantage of incremental and entity theories depending on learning environments. It was found that, in the case of respondents who had studied in junior high schools with highly uniform education, incremental theorists were more satisfied with their school life, performed better in junior high school, and also went on to higher-ranked high schools. However, in the case of those from junior high schools with more selective education styles, entity theorists were more satisfied with their school life, while there was no difference between the academic performance of incremental theorists and entity theorists. We also confirm that holding entity beliefs was correlated with aptitude exploration behavior in a real educational setting as well, which suggests that the findings of Study 1 and 2 are ecologically valid.

## Relationship Between Implicit Theories and Learning Environments

In summary, the results support our hypotheses about the different effort allocation strategies between incremental and entity theorists. In a learning environment where they are allowed to choose a task out of many options, entity theorists tend to perform at least as well as incremental theorists. When there are multiple-task options, their aptitude exploration strategy may be an effective way to achieve a high outcome. This is a positive aspect of entity theorists, which has not been focused on in previous studies on a single-task situation. However, the present findings do not contradict previous studies nor imply that having an entity theory is desirable. Rather, the adaptive implicit theory may depend on whether they can choose a task from a wider range of tasks. In a situation where an individual aims to master one specific task, holding incremental theory might be effective because the available strategy is restricted to the task mastery strategy. Conversely, in a situation where there are sufficient task options and opportunities to switch, entity theory might be as effective as incremental theory, because it is more likely to find the task you can perform well. The significance of the present research is that by comparing the way tasks are provided in educational



situations, it is possible to treat the environmental factor as a determinant of individuals' beliefs about abilities.

## Implication for Cultural Difference on Implicit Theories

The present study had several limitations. First, although participants in Studies 1 and 2 were encouraged to perform well, they were not given incentives. Therefore, it is difficult to interpret their intention with a particular strategy. A follow-up experiment should be conducted with incentives for high performance. Second, in both experiments, participants had only one chance to switch their tasks. Some might have felt it was risky to engage in a new task with no information. In future research, we should consider controlling for individual differences to avoid uncertainty. Third, in Study 3, we only asked respondents to recall their past school experiences. Longitudinal surveys should be conducted to further investigate the effects of learning environments and implicit theories on performance.

Despite these limitations, the present research suggests a possible explanation for cultural differences in prevailing implicit theories. It is known that Japanese people are more likely to hold an incremental theory than American people (Heine et al., 2001; Church et al., 2012). This could be due to differences in the task structures of the two countries. Life in Japan features many situations in which people do not have a wide range of alternatives; for instance, the public school system in Japan is highly standardized, in which all students learn the same subjects and are evaluated using the same criteria. Similarly, regarding university admissions, they seldom consider an applicant's abilities in areas beyond their entrance exam score. In other words, in Japan, the scholastic ability is assessed in a more one-dimensional manner compared to the United States (US; Tsukada, 1993; Arai, 2003). Under this system of educational evaluation, those who are mastery-oriented and direct their efforts toward a given task will more likely succeed. In contrast, many schools in the United States adopt the premise that ability varies and provide multiple curricula in which each student might excel (Tsuneyoshi, 1992, 2008). Under the United States system, exploring one's aptitude in various spheres is a more reasonable attitude. In fact, it has been found that the correlation between implicit theories and academic performance differs among several countries (Costa and Faria, 2018; Jia et al., 2021). A different social system could make different implicit theories more adaptive in the culture. The relation between the ways in which tasks are provided in education and implicit theories might be deep. Therefore, it

is necessary to investigate the relationship between educational environments and individual beliefs from a socio-ecological perspective.

## 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 human participants were reviewed and approved by The Research Ethics Committee of the Department of Social Psychology, The University of Tokyo. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

This work was conceived and designed by KS (Study 2 and 3) and NA (Study 1), under the supervision of YM. KS analyzed all data. KS and YM interpreted the results and wrote the manuscript. All authors contributed to the article and approved the submitted version.

## FUNDING

This work was supported by JSPS Grant-in-Aid for Scientific Research (C), Nos. 15K04024 and 19K03189 for YM.

## ACKNOWLEDGMENTS

We thank Ikutaro Masaki, Shuma Iwatani, and other members of our research laboratory for their valuable comments on earlier versions of this paper.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2021.767101/full#supplementary-material>

## REFERENCES

- Aiken, L. S., and West, S. G. (1991). *Multiple Regression: Testing and Interpreting Interactions*. Newbury Park, CA: Sage.
- Aoyagi, H., and Oashi, O. (1990). The reexamination of validity of the helplessness scale and an attempt to measure directly the cognitive component. *Waseda Stud. Hum. Sci.* 3, 29–36.
- Arai, K. (2003). A comparative study of educational assessment systems in Japan and the United States. *Jpn. J. Educ. Sociol.* 72, 37–52. doi: 10.11151/eds1951.72.37

- Aronson, J., Fried, C. B., and Good, C. (2002). Reducing the effects of stereotype threat on African American college students by shaping theories of intelligence. *J. Exp. Soc. Psychol.* 38, 113–125. doi: 10.1006/jesp.2001.1491
- Blackwell, L. S., Trzesniewski, K., and Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: a longitudinal study and an intervention. *Child Dev.* 78, 246–263. doi: 10.1111/j.1467-8624.2007.00995.x
- Church, A. T., Willmore, S. L., Anderson, A. T., Ochiai, M., Porter, N., Mateo, N. J., et al. (2012). Cultural differences in implicit

- theories and self-perceptions of traitedness: replication and extension with alternative measurement formats and cultural dimensions. *J. Cross-Cult. Psychol.* 43, 1268–1296. doi: 10.1177/002202211428514
- Costa, A., and Faria, L. (2018). Implicit theories of intelligence and academic achievement: A meta-analytic review. *Front. Psychol.* 9:829. doi: 10.3389/fpsyg.2018.00829
- Cury, F., Da Fonseca, D., Zahn, I., and Elliot, A. (2008). Implicit theories and IQ test performance: a sequential mediational analysis. *J. Exp. Soc. Psychol.* 44, 783–791. doi: 10.1016/j.jesp.2007.07.003
- Dweck, C. S. (1986). Motivational processes affecting learning. *Am. Psychol.* 41, 1040–1048. doi: 10.1037/0003-066X.41.10.1040
- Dweck, C. S. (1999). *Self-Theories: Their Role in Motivation, Personality, and Development*. Philadelphia: Psychology Press.
- Dweck, C. S. (2006). *Mindset: The New Psychology of Success*. New York, NY: Random House.
- Dweck, C. S. (2017). The journey to children's mindsets—and Beyond. *Child Dev. Perspect.* 11, 139–144. doi: 10.1111/cdep.12225
- Dweck, C. S., Chiu, C., and Hong, Y. (1995). Implicit theories and their role in judgments and reaction: a world from two perspectives. *Psychol. Inq.* 6, 267–285. doi: 10.1207/s15327965pli0604\_1
- Dweck, C. S., and Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychol. Rev.* 95, 256–273. doi: 10.1037/0033-295X.95.2.256
- Elliot, A. J., and Church, M. A. (1997). A hierarchical model of approach and avoidance achievement motivation. *J. Pers. Soc. Psychol.* 72, 218–232. doi: 10.1037/0022-3514.72.1.218
- Elliot, E. S., and Dweck, C. S. (1988). Goals: an approach to motivation and achievement. *J. Pers. Soc. Psychol.* 54, 5–12. doi: 10.1037/0022-3514.54.1.5
- Good, C., Aronson, J., and Inzlicht, M. (2003). Improving adolescents' standardized test performance: an intervention to reduce the effects of stereotype threat. *Appl. Dev. Psychol.* 24, 645–662. doi: 10.1016/j.appdev.2003.09.002
- Heine, S. J., Kitayama, S., Lehman, D. R., Takata, T., Ide, E., Leung, C., et al. (2001). Divergent consequences of success and failure in Japan and North America: an investigation of self-improving motivations and malleable selves. *J. Pers. Soc. Psychol.* 81, 599–615. doi: 10.1037/0022-3514.81.4.599
- Hong, Y., Chiu, C., Dweck, C. S., Lin, D., and Wan, W. (1999). Implicit theories, attributions, and coping: a meaning system approach. *J. Pers. Soc. Psychol.* 77, 588–599. doi: 10.1037/0022-3514.77.3.588
- Jia, L., Lim, C. H., Ismail, I., and Tan, Y. C. (2021). Stunted upward mobility in a learning environment reduces the academic benefits of growth mindsets. *Proc. Natl. Acad. Sci. U. S. A.* 118:e2011832118. doi: 10.1073/pnas.2011832118
- Mitsunami, M. (2010). Influence of achievement motive and goal orientation on learning behavior: difference in cognitive strategies. *Jpn. J. Educ. Psychol.* 58, 348–360. doi: 10.5926/jjep.58.348
- Nussbaum, A. D., and Dweck, C. S. (2008). Defensiveness versus remediation: self-theories and modes of self-esteem maintenance. *Pers. Soc. Psychol. B.* 34, 599–612. doi: 10.1177/0146167207312960
- Oikawa, M. (2005). Participants' theories of intelligence and pursuit of nonconscious goals. *Jpn. J. Educ. Psychol.* 53, 14–25. doi: 10.5926/jjep1953.53.1\_14
- Oishi, S. (2017). Socioecological psychology. *Annu. Rev. Psychol.* 65, 581–609. doi: 10.1146/annurev-psych-030413-152156
- Oishi, S., and Graham, J. (2010). Social ecology: lost and found in psychological science. *Perspect. Psychol. Sci.* 5, 356–377. doi: 10.1177/1745691610374588
- Park, D., and Kim, S. (2015). Time to move on? When entity theorists perform better than incremental theorist. *Pers. Soc. Psychol. B.* 41, 736–748. doi: 10.1177/0146167215578028
- Plaks, J. E., and Stecher, K. (2007). Unexpected improvement, decline, and stasis: a prediction confidence perspective on achievement success and failure. *J. Pers. Soc. Psychol.* 93, 667–684. doi: 10.1177/0146167215578028
- Preacher, K. J., Curran, P. J., and Bauer, D. J. (2006). Computational tools for probing interaction effects in multiple linear regression, multilevel modeling, and latent curve analysis. *J. Educ. Behav. Stat.* 31, 437–448. doi: 10.3102/10769986031004437
- Rickert, N. P., Meras, I. L., and Witkow, M. R. (2014). Theories of intelligence and students' daily self-handicapping behaviors. *Learn. Individ. Differ.* 36, 1–8. doi: 10.1016/j.lindif.2014.08.002
- Robins, R. W., and Pals, J. L. (2002). Implicit self-theories in the academic domain: implications for goal orientation, attributions, affect, and self-esteem change. *Self Identity* 1, 313–336. doi: 10.1080/15298860290106805
- Rosenberg, M. (1965). *Society and Adolescent Self-Image*. Princeton: Princeton University Press.
- Shimizu, H. (2016). An introduction to the statistical free software HAD: suggestions to improve teaching, learning and practice data analysis. *J. Media Inf. Com.* 1, 59–73.
- Shin, J., and Grant, A. M. (2019). Bored by interest: how intrinsic motivation in one task can reduce performance on other tasks. *Acad. Manag. J.* 62, 415–436. doi: 10.5465/amj.2017.0735
- Sisk, V. F., Burgoyne, A. P., Sun, J., Butler, J. L., and Macnamara, B. N. (2018). To what extent and Under which circumstances are growth mind-sets important to academic achievement? Two meta-analyses. *Psychol. Sci.* 29, 549–571. doi: 10.1177/0956797617739704
- Terai, H., Miwa, K., and Asami, K. (2013). Development and evaluation of the Japanese Remote Associates Test. *Jpn. J. Psychol.* 84, 419–428. doi: 10.4992/jjpsy.84.419
- Tsukada, M. (1993). Kyoiku ni okeru “kou” to “shi” no nichibei hikaku no kokoromi (An approach to Japan-US comparison of “public” and “private” in education). *Jpn. J. Educ. Sociol.* 52, 55–71. doi: 10.11151/eds1951.52.55
- Tsuneyoshi, R. (1992). *Ningenkeisei no nichibei hikaku: kakureta karikyuramu (A Comparison of Socialization in Japan and the United States: The Hidden Curriculum)*. Tokyo: Chuokoron Shinsha.
- Tsuneyoshi, R. (2008). *Kodomotachi no mittsu no “kiki”: kokusai hikaku kara miru nihon no mosaku (The Three Crises of the Children: Investigation Through Comparison between Japan and the United States)*. Tokyo: Keisou Syobou.
- Walton, G. M., and Yeager, D. S. (2020). Seed and soil: psychological affordances in contexts help to explain where wise interventions succeed or fail. *Curr. Dir. Psychol. Sci.* 29, 219–226. doi: 10.1177/0963721420904453
- Zeng, G., Hou, H., and Peng, K. (2016). Effect of growth mindset on school engagement and psychological well-being of Chinese primary and middle school students: the mediating role of resilience. *Front. Psychol.* 7:1873. doi: 10.3389/fpsyg.2016.01873

**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.

Copyright © 2021 Suzuki, Aida and Muramoto. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.



# Universality and Cultural Diversity in Moral Reasoning and Judgment

Lina Bentahila\*, Roger Fontaine and Valérie Pennequin

Laboratory PAVEA, EA 2114, Department of Psychology, University of Tours, Tours, France

## OPEN ACCESS

### Edited by:

Hirofumi Hashimoto,  
Osaka City University, Japan

### Reviewed by:

Tim Marsh,  
Macquarie University,  
Australia  
Di You,  
Alvernia University,  
United States

### \*Correspondence:

Lina Bentahila  
lina.bentahila@etu.univ-tours.fr

### Specialty section:

This article was submitted to  
Cultural Psychology,  
a section of the journal  
Frontiers in Psychology

**Received:** 25 August 2021

**Accepted:** 10 November 2021

**Published:** 13 December 2021

### Citation:

Bentahila L, Fontaine R and  
Pennequin V (2021) Universality and  
Cultural Diversity in Moral Reasoning  
and Judgment.  
Front. Psychol. 12:764360.  
doi: 10.3389/fpsyg.2021.764360

Many theories have shaped the concept of morality and its development by anchoring it in the realm of the social systems and values of each culture. This review discusses the current formulation of moral theories that attempt to explain cultural factors affecting moral judgment and reasoning. It aims to survey key criticisms that emerged in the past decades. In both cases, we highlight examples of cultural differences in morality, to show that there are cultural patterns of moral cognition in Westerners' individualistic culture and Easterners' collectivist culture. It suggests a paradigmatic change in this field by proposing pluralist "moralities" thought to be universal and rooted in the human evolutionary past. Notwithstanding, cultures vary substantially in their promotion and transmission of a multitude of moral reasonings and judgments. Depending on history, religious beliefs, social ecology, and institutional regulations (e.g., kinship structure and economic markets), each society develops a moral system emphasizing several moral orientations. This variability raises questions for normative theories of morality from a cross-cultural perspective. Consequently, we shed light on future descriptive work on morality to identify the cultural characteristics likely to impact the expression or development of reasoning, justification, argumentation, and moral judgment in Westerners' individualistic culture and Easterners' collectivist culture.

**Keywords:** universal moral, moral judgment, moral reasoning, cross-cultural research, WEIRD and non-WEIRD societies

## INTRODUCTION

Morality plays a fundamental role in the functioning of any human society by regulating social interactions and behaviors. The concept of morality denotes a set of values, implicit rules, principles, and long-standing, and shared cultural customs, drawn on the opposition between Good and Evil to guide social behavior (Haidt, 2007). Morality often means having to make the decision "What should I do?" by linking mental states (emotions, reasoning, and desire) and the subsequent action(s). Moral principles thus define the guidelines as to what an individual should do, or is allowed to do, both toward others and themselves, and this is in relation to socially constructed beliefs (Matsumoto and Juang, 2013). It is a common heritage that an individual acquires during their development, across different social environments. Consequently, morality is connected to culture. The notion of culture should be looked at according to the definition of Hong (2009), who describes it as "a network of understanding, made up of opinion-based routines, of feelings and interactions with other people, as well as a body of affirmations and essential ideas on aspects of life." The individual's environment

establishes shared cultural knowledge, which brings about affective, cognitive, and behavioral consequences on morality. This link leads us to ask ourselves: to what extent does culture impact upon human morality? More specifically, are there cultural patterns of moral cognition in Westerners' individualistic culture and Easterners' collectivist culture?

In this review, we are going to discuss the current formulation of moral theories that attempt to explain cultural factors affecting moral judgment and reasoning. The distinction will be to contrast the cognitive-developmental and the social interactional approaches to the later spectrum of approaches that address intercultural variation in moral judgment. We will present in detail cross-cultural studies on moral judgment, which will allow us to better understand universal and societal aspects of morality. Finally, we will consider cultural models of moral cognition by identifying specific moral justification and argumentation in Westerners' individualistic culture and Easterners' collectivist culture.

## GOING BEYOND A DEVELOPMENTAL APPROACH OF MORALITY TO ACCOUNT FOR INTERCULTURAL MORAL VARIATIONS

Numerous theories have shaped the concept of morality and its development by embedding it in the field of social systems and values of each culture.

The scientific psychological study of morality can primarily be traced to the influential moral constructivist theory of Piaget (Piaget and Gabain, 1965; Piaget, 1985) and theory on the development of moral reasoning of Kohlberg (1976). Those theories are shaped by a philosophic heritage, strengthened by a liberal and individualistic vision of morality, backed by the works of Kant (1765), Mill (1863/2002), and Rawls (1971). For these authors, morality is universal as it is based on rationality which, by definition, is shared by individuals everywhere. Both Piaget and Kohlberg have developed stage theories that show different reasoning about moral issues depending on the level of moral development. Kohlberg (1976) developed his stage theory of moral development based on work of Piaget (1932) and he conceptualized three levels of moral development, and each level contains two substages. First, the pre-conventional stage precedes understanding and acceptance of social conventions. It refers to heteronomous morality, whereby the individual obeys the rules for fear of being punished. Second, the conventional stage refers to autonomous morality and represents conformity to expectations and conventions of society and authority. Finally, comes the post-conventional stage, in which the individual formulates and accepts general moral principles, which are implicit to the rules, and whereby the individual independently faces social approval. The stages and substages of Kohlberg's theory of moral development are shown in **Table 1**. The focal point of their research is to question whether the same stages of development can be found in all cultures (Piaget, 1977;

**TABLE 1 |** The stages and substages of Kohlberg's theory of moral development.

<b>Pre-conventional stage</b>	
Individuals obey the rules for fear of being punished.	<i>Substage 1: Obedience and punishment</i> <i>Substage 2: Individualism and exchange</i>
<b>Conventional stage</b>	
Individuals conform to expectations and conventions of society and authority. They avoid blame and seek social approval.	<i>Substage 3: Good interpersonal relationships</i> <i>Substage 4: Maintaining social order</i>
<b>Post-conventional stage</b>	
Individuals formulate and accept general moral principles. Rights of others can override obedience to laws and rules.	<i>Substage 5: Social contract and individual rights</i> <i>Substage 6: Universal principles</i>

Kohlberg, 1981). A meta-analysis of 45 intercultural studies across 27 countries (Snarey, 1985) examined the universal affirmation of Kohlberg's theory. The hypothesis, according to which the development stages are invariable, was well supported when there was an accurate adaptation of the content and when the language of the interview matched that of the subject. The transversal and longitudinal results indicate the presence of the pre-conventional stage and the conventional stage in all of the studied cultures. Additionally, a more recent study (Gibbs et al., 2007) compared 75 studies across 23 countries and suggests that the first two stages of Kohlberg's theory are universal.

A significant criticism concerning this theory was put forward by Bukatko and Daehler (2003); it fails to address the measuring of moral values specific to the cultures. Kohlberg is neither interested in the content of morality, nor in the specific values which emerge from it. His concern is rather in the structure of moral development, by looking at how thoughts and reasonings are transformed throughout the different stages. Nevertheless, understanding the values of each culture is necessary to apprehend the development of moral reasoning. For instance, the beliefs of the Afar people in Ethiopia valorize polygamy with shared spouses, which play an essential role in their society, whereas this practice is considered as a moral transgression in Western countries. Further still, people from Asian cultures react differently to moral dilemmas compared to those who come from Western cultures. Indeed, Asian societies focus more on maintaining a harmonious social order (Dien Winfield, 1982). The development of moral reasoning theory does not account for these observations, while intercultural research shows that values and moral principles can influence moral structure.

Research has equally examined social interactional differences and similarities in terms of morality through the lens of the social domain theory (Turiel, 1983). This shows that morality is firmly rooted in the social systems and values of each culture. Turiel defines three domains; the moral domain, containing rules which protect and regulate the rights or the well-being of individuals. The conventional domain is linked to the understanding of social conventions and the rules which control social interactions. A third, the personal domain, determines



personal decisions and choices (Bukatko and Daehler, 2003). Turiel's work suggests that all individuals are able to get along, no matter their culture, even if they have a difference of opinion, for the reason that they can recognize the differences between the three domains and use the same distinctive criteria (Tostain, 1999). He, therefore, assumes that all individuals split morality into the same three domains. However, this is far from being always the case. Induced abortion is a striking example. Some believe that this is a personal choice, a private decision, whereas others, notably due to religious reasons (it is God who gives life, and it is He who taketh away), view it as a moral transgression. In this sense, the limits with Turiel's model are that it leaves aside the issue of beliefs and ideas that supports how individuals assemble such content and pushes it into only one of the three domains. Other research reveals that the difference between morality and social conventions could not be as universal as the domain theory suggests. Study of Shweder et al. (1987) comparing Indian and American children, and study of Haidt et al. (1993) comparing individuals from Brazil and the United States, indicate that the moral domain is defined in a much broader sense in India and Brazil. Concerns regarding purity, spiritual degradation, and moral expectations of loyalty toward one's social group, are the concerns that also arise within the moral domains. They observed that actions and rules considered as personal choices or social conventions by Western society are more "moralized" in India or Brazil. As such, Indians and Brazilians assimilate their conventions with a universal morality. The distinction put forward by Kohlberg and Turiel between morality and convention is therefore not applicable to these populations. Finally, Turiel and Kohlberg are doubly in agreement here. As Universalists, they believe that the framework of morality is the same in its outlines everywhere. As formalists, they are not sufficiently interested in the content of morality and believe that the subjects, whatever culture they may be, can agree insofar as they refer to the same moral reasoning (Tostain, 1999).

Kohlberg's view predominated for the past several decades but recent theoretical developments in social and cultural psychology (Shweder et al., 1997; Haidt and Joseph, 2004; Curry, 2016) built on an evolutionary approach suggest that our behavior can be explained by internal psychological mechanisms. From that standpoint, the relevant internal mechanisms are adaptations and products of natural selection. Hence, rudimentary moral intuitions, such as harm aversion and reciprocity, go back to the very beginnings of human history. Moral evolved long before the emergence of our kind and serve the adaptive function of facilitating cooperation within groups and against enemies. Indeed, this evolutionary framework focuses on motivational orientations rooted in evolved unconscious emotional systems developed by experiences that predispose someone to react to an act or events in a particular way. It is suggested that evolutionary adaptations of species appear to regulate behaviors and promote individual welfare. As such, the moral principles of an individual are relative to the culture they belong to. According to cultures, the notions of Good and Evil are differently defined and lead to different values and principles. The same action could very

well be considered as a serious moral transgression in some cultures and as a simple social misdemeanor in others (Shweder et al., 1987). From this perspective, morality is extended beyond intercultural differences. Each society has a moral system, dependent upon its beliefs, ideologies, and views of the world (Jensen, 2011). The history of societies has shown, for instance, that divorce, induced abortion, or more recently same-sex marriages, are perceived by some as a direct breach of morality, and thus must be avoided at all costs. Not everybody, therefore, has the same idea of the domains to which morality can be applied (Skitka et al., 2005). Haidt (2007) suggests the term "moral community" to characterize each group that shares the same values and moral norms; these groups also share the same ideas about how to enforce them.

Several models have been conceived to come up with a broader, and more structured, approach to morality. Shweder and Sullivan (1990) and Shweder et al. (1997), who carried out a series of ethnographic studies, mainly in the United States and India, noticed that moral judgments of Indians draw on social rules which are difficult to apply universally, and which are founded on social and religious rules. In the United States, on the other hand, moral judgments draw on more liberal social rules, founded upon individual rights, justice, and the principle of avoiding harm. From these results, Schweder talks about moral pluralism and develops a moral taxonomy which he considers to be universal with three main types of ethics "the big three" (three ethics approach). He defines them as three essential morals, each one conveying a particular vision of morality. Cultures differ from each other morally, depending upon the importance allocated to each one of the three ethics. The ethics of Autonomy aims to protect the individual, their liberty, their rights, to help them satisfy their needs, and to achieve their goals. The ethics of Community aims to protect the integrity of the group, its structure, its organization, its reputation, as well as the roles and the status of its members. The ethics of Divinity insists upon protecting the soul and the spirit, as well as all the spiritual aspects of the individual and their natural environment (Shweder et al., 1997). Several studies have looked at the use of the three ethics in India, Brazil, Japan, the Philippines, and the United States (Haidt et al., 1993; Rozin et al., 1999; Vasquez et al., 2001; Jensen, 2015). Generally, a pattern is noticed whereby Western countries more frequently use the ethics of Autonomy than the other two ethics, while Eastern countries present arguments based on Autonomy and Community. For Schweder, the Western hemisphere, taking into account its individualistic references, resonates with the ethics of Autonomy, while the Eastern societies, given the fact that they are based simultaneously on interdependence among individuals and beliefs of divine or natural law, mainly advocate the ethics of Community and ethics of Divinity. The limit of Kohlberg's theory and Turiel's differences between morality, convention, and the personal domain is that it restricts morality to the ethics of Autonomy by insisting upon justice and individual rights. This is limiting from an intercultural perspective, as they falsely reduce the moral field to values favored by Westerners. Thus, according to ideological contingencies, perhaps a historical interpretation



would permit us to understand that each society only expresses a part of this universal morality. Depending upon their vision of the world, the individual could conform to either one, or all, of these three ethics, but to varying degrees.

Haidt and Joseph (2004) broadened the approach of the “big three” in terms of morality in their moral foundation theory. The motivation at the heart of their work is that most of the research in moral psychology concentrates on two aspects: Good/Evil or reciprocity/justice but does not take into account the cultural differences observed in the other moral domains. For example, among Westerners, emphasis is put upon compassion and fairness, whereas Easterners regard obeying authority, loyalty toward the group, and matters of purity as justifiable moral concerns (Graham et al., 2011). The moral domain was widened to include these concerns. Consequently, the common ground of all cultures is composed of five main moral principles, each one being characterized by an adaptive function having emerged over time (Graham et al., 2009; Haidt and Kesebir, 2010). These founding moral principles correspond to five psychological mechanisms underlying moral activity and behavior (Graham et al., 2009). The principle of not doing harm (Care/Harm) prohibits all forms of suffering caused voluntarily to others and underpins the values linked to protection of the people. The principle of equity (Fairness/Cheating) aims to regulate exchanges and relationships between individuals by means of the idea of reciprocity. The principle of loyalty (Loyalty/Betrayal) refers to maintaining cohesion at the heart of the group, by means of valuing the links which unite the individual to their group. The principle of authority (Authority/Subversion) is based on maintaining the hierarchical structure at the heart of the group *via* the respect of status, societal roles, and associated duties. The principle of purity (Sanctity/Degradation) aims to protect the individual from contamination of their bodies, but also their spirits, by means of valorizing self-control and spirituality. Those theorists recently tentatively added a sixth foundation, Liberty/Oppression, which refers to reactance and resentment toward those who limit one’s freedom (Graham et al., 2013). Because the majority of the research conducted to date has focused on the original five foundations, our discussion will focus on those. Characteristics of the five founding moral principles are shown in **Table 2**.

Graham et al. (2011) examined the intercultural differences of the moral foundations of participants coming from Eastern cultures of South Asia, East Asia, and South-East Asia, and of participants coming from the Western cultures of the United States, the United Kingdom, Canada, and

Western Europe. Overall, participants from Eastern cultures obtained higher scores when considering principles of loyalty and purity compared to Western participants. According to the same authors, the differences center around loyalty and purity, which are justifiable when one considers the cultural differences in terms of collectivism (Triandis, 2001) and the link between purity and religious practice, in particular in South Asia (Shweder et al., 1997). Graham et al. (2011) suggest representing these five founding principles as five markers on a “moral equalizer scale,” with varying levels depending on the moral systems. It is, therefore, the prioritization of moral values stemming from these principles, which differentiates cultures and individuals. Throughout these analyzes, it is conceivable that a pluralist universalism has its place, meaning that we can simultaneously take account of universal moral concerns (such as the worry of personal integrity, dignity, right to life, and, more generally, human rights) and also of specific beliefs of each culture. These new guidelines show once again what Kohlberg neglected, namely the role that specific life experiences of individuals and cultural representations can play in the formation of morality.

Graham et al. (2009) then describe the principles of non-harm and equity as the individualizing foundation, because they are all linked to individual rights and that the individual is at the center of moral values. This foundation strengthens the groups and institutions by linking individuals to roles and duties to constrain their imperfect nature. It is vital as it permits some cultures to get rid of egoism by directly protecting the individual and by teaching to respect the rights of others. The moral foundation theory affirms that this foundation is particularly widespread in Western societies. They emphasize the importance of personal rights, justice, and caring about the well-being of individuals (Vauclair et al., 2014). Nowadays, we refer to them as being individualistic societies known as Western, Educated, Industrialized, Rich, and Democratic (WEIRD; Henrich et al., 2010; Atari et al., 2020). The traits of an individualistic culture are autonomy, personal success, and the pursuit of uniqueness.

Nevertheless, cultures do not limit their value to that of protecting the individual. For this reason, Graham et al. (2009) defined the binding foundation, corresponding to three other principles (authority, loyalty, and purity) that put people together as groups (Doğruyol et al., 2019). This foundation restricts the liberty of individuals in favor of promoting the interests of the group (Vauclair and Fischer, 2011; Vauclair et al., 2014). Above all, the function of morality is social; it contributes to the definition of a shared ideal to ensure a harmonious group life. Morality regulates individuals’ egoism by encouraging them to adopt behaviors that facilitate cooperation (Haidt and Kesebir, 2010). One mainly finds this foundation within Eastern societies, associating it to collectivist cultures, labeled non-WEIRD (known as oriental, less educated, less industrialized, quite poor, and non-democratic). Their modes of social organization are possibly close to those observed in the distant past in traditional societies. Collectivist cultures extol interdependence among individuals, conformity, and emphasize the needs of the group above the pursuit of individual goals.

**TABLE 2 |** The five founding moral principles and their characteristics.

Moral Foundations	Characteristics
<i>Non-harm</i>	Benevolence, kindness, sympathy, and compassion
<i>Equity</i>	Reciprocity, trust, and respect of individual’s rights
<i>Loyalty</i>	Commitment, loyalty, and patriotism
<i>Authority</i>	Obedience, discipline, and submission
<i>Purity</i>	Chastity, devotion, piety, and cleanliness

Empirical results support the theory of division of the individualizing and binding foundations between individualistic and collectivist cultures (Graham et al., 2009, 2011). These foundations establish the moral system based on the idea that all intuitions and feelings induce judgments and moral arguments. Thereby, individuals, throughout their experiences and developments, rely more on one or another of these foundations and moral principles. Dependent on history, religious beliefs, social ecology, and institutional rules (like the structure of kinship or the economic markets), each society develops a moral system. This defines several moral guidelines among which one can find reciprocity of the group, protection, support given to others, and defense of the unity of the group but also self-preservation (Graham et al., 2016). Maxwell (2011) acknowledges the idea according to which cultural context can make one or several foundations salient, sometimes even antagonistic. It is therefore important to take into account these prototypical foundations when evaluating the moral identity of cultures. However, it should not be assumed that just because of their singular experiences, or their culture, individuals live in completely different moral universes. Morality does not get reduced to one cultural moral or social status; in effect, there are universal moral concerns. The inter-individual heterogeneity has to be considered as individuals do not passively comply with social constraints and dominant portrayals of their culture (Lloyd, 1992; Spiro, 1993). An individual cannot be in agreement with these traits. They can be confronted with multiple representations that span different cultures and against which they can choose to distance themselves.

There are more recent expansions of the evolutionary approach, such as the theory of Morality-as-Cooperation (Curry, 2016) that explains that morality is a collection of biological and cultural solutions to the problems of cooperation recurrent in human social life. This theory predicts seven well-established types of cooperation; helping family, helping group, exchange, resolving conflicts through hawkish and dovish displays, dividing disputed resources, and respecting prior possession. From this framework, seven types of morality were found; obligations to family, group loyalty, reciprocity, bravery, respect, fairness, and property rights. This theory provides more detailed coverage of the moral domain whereas moral foundation theory (Haidt and Joseph, 2004) proposes only five. Indeed, there is no foundation dedicated to kin or reciprocal altruism, or hawkish displays of dominance such as bravery or property rights. Nevertheless, the theory of Morality-as-Cooperation neglects the role of disgust in moral reactions, found in the principle of purity in the moral foundation theory. A recent study tested the Morality-as-Cooperation theory with the following hypotheses: those cooperative behaviors are considered morally good whatever the culture they appear in, and these seven moral values are universal (Curry et al., 2019). To test this prediction, they investigated the moral valence of these seven cooperative behaviors in an ethnographic record of 60 societies. The ethnographic coverage was drawn from six regions of the globe (Sub-Saharan Africa, Circum-Mediterranean, East Eurasia, Insular Pacific, North America, and South America). The research found, first, that these behaviors were always considered

morally good. Second, these morals were observed in the majority of the societies. There were no societies in which any of these behaviors were considered morally bad. And third, these morals were observed with equal frequency across all regions of the world; they were not the exclusive preserve of Western societies. They finally conclude that cooperation is always and everywhere considered moral with those seven cooperative behaviors which may be universal moral rules. This survey shows cross-cultural regularities with moral values that exhibit a multifactorial structure, varying on these seven dimensions.

As we have just seen, social and cultural structures (beliefs, symbols, and practices) shape morality in human societies. To this effect, the transgressive nature of an act strongly depends on an individual's moral system and the moral principles that he valorizes the most. The moral norms (specifically culturally) of an individual are anticipated and expressed over the course of judgment and reasoning. It would be premature to assume that all psychological processes, even basic ones, are immune to experience and culture (Wang et al., 2016), even more so when one focuses on high-level processes such as moral reasoning and judgment. The cultural characteristics susceptible to having an impact upon the expression or the development of reasoning, argumentation, and moral judgment among WEIRD and non-WEIRD populations, should be defined. To do so, we will be looking at the cognitive processes which underpin morality in these societies.

## COGNITIVE PROCESSES WHICH UNDERPIN THE EMERGENCE OF MORAL SYSTEMS IN WEIRD AND NON-WEIRD SOCIETIES

The leading theories on moral judgment attempt to specify precisely the role that cognitive and emotional processes play in the elaboration of this type of judgment. Their focus is on knowing to what degree the moral or immoral nature established takes its origin from a logical and controlled reasoning, or an automatic and unconscious intuition.

Can reflecting on a moral question change one's mind? Are societies amenable to moral reasoning? For decades, the field of moral psychology with Piaget's and Kohlberg's cognitive-developmental theories and Turiel's social domain theory emphasized the role of reasoning in moral judgment. For them, the answer is "yes" because moral development is intricately connected to cognitive development, and subsequently, to the development of the capacities of reasoning. These models draw from a Kantian approach to morality. For Kant (1765), to know if an act is moral, one should question one's reasons, and by reasoning, reach the conclusion that the action can be established as a universal law of nature. Generally speaking, moral reasoning can be considered as a systematic and reflected approach that allows individuals to make moral decisions. The process of moral reasoning consists of three steps: the first is the definition of the situation, the second is the analysis of

the situation, and the third is the making of the decision (Lyons, 1983). Moral reasoning includes justifications made for and during a moral action (Royal and Baker, 2005; Smetana, 2006). Individuals would thus be influenced by a controlled cognitive process, which is a conscious mental activity through which one evaluates a moral judgment. Moral reasoning is linked to the development of controlled processes, but they are compromised by cognitive biases, in particular, that of egocentricity (Fontaine and Pennequin, 2020). The moral level of an individual would depend upon their capacities of reasoning, and as such, non-WEIRD societies would have a lesser moral development compared to WEIRD societies (for a synthesis, see Snarey, 1985). This is because Western societies are founded upon a philosophical tradition that puts the focus on debating and reasoning. The latter plays a pivotal role in institutions, whether it will be concerning education, justice, or even politics (Lloyd, 1992; Peng and Nisbett, 1999). Institutionalization of education theoretically means that individuals within WEIRD societies are naturally programmed to reason in an abstract manner. Furthermore, middle- or higher-class parents in Western societies have numerous arguments with their children and wait for them to offer explanations (Mercier, 2016). All of these factors suggest that reasoning is a particularly valorized cognitive ability in Western societies and that it is conceivable that their moral level is therefore higher. Their particular cultural context seems to create conditions that favor the development of moral reasoning abilities and a motivation to enter into argumentative activities. Several empirical data do however throw doubt upon these theses.

First of all, Shweder et al. (1997) exhibit that conventional responses from individuals in non-WEIRD societies do not represent a simple upholding of their tradition (based on religious beliefs and original myths), but more likely conform to an alternative post-conventional abstract reasoning based on different premises. Their analysis, based on interviews, shows that Easterners' collectivist culture does not refer to individual rights (based on the premise that the subject is autonomous and free) as do Westerners' individualistic culture. To this effect, Easterners organize their lives around an idea instead: the expression of self, based on interdependence between individuals, and that the place and the obligations each one has in society grant access to a morally acceptable life. Their beliefs are based on the premise that certain traditions allow a superior moral order to be obtained. This moral order is, for instance, described within religious societies in holy texts and bestows an ultimate meaning to human life. If one refers to Schweder's three ethics, regarding the ethics of Autonomy, the ideas relative to individual rights are comparatively less widespread in the morals of Eastern societies. Among the latter, moral discourses uphold the duties, not intending to protect individual's rights, but by upholding the social order or for religious reasons (Hwang, 2015). For example, according to Islam, life on Earth is short and temporary, whereas life after death is eternal and perpetual. Those who dedicate themselves to charity will go to Heaven, whereas those who commit sins will go to Hell. Among Buddhists, one must adhere to five principles: do not kill, steal, lie, be lascivious, and do not

eat meat. The violation of one of these principles can lead to automatic retribution from Karma in the next life. This type of moral discourse falls within the model of the Easterners' moral systems, which implies the ethics of the Community or the ethics of Divinity, rather than the ethics of Autonomy.

Next, intercultural studies have observed that the difference concerning the moral level of the two kinds of societies is linked to the fact that individuals from collectivist cultures resort more often to conventional type arguments, whereas individuals from individualistic cultures rely more willingly on abstract principles (Tostain, 1999). Two interpretations will be highlighted to explain this difference. The first, equally shared by Kohlberg, is to say that individuals from Eastern societies have a lifestyle that impedes their moral development. For example, less education, rigid social structures, or even archaic beliefs which constrain an individual to access autonomy of reasoning, hinder one to develop a true morality of rights and principles. This explanation is refutable because as we have seen, moral judgments can be justified in different ways. WEIRD societies are more likely to call for abstract principles to justify a moral judgment (see Kohlberg's post-conventional stage). The second explanation is to consider that there is an ethnocentric bias. The alleged universal morality of Kohlberg's theory is typically a Western trait. They attempt to show that there are other morals, equally as sophisticated, but based on different principles, stemming from a different vision of relationships between the person and the society.

Empirical facts bring out the limits of the traditional rationalist theories, which give a predominant role to reasoning in moral judgment. More recent research critiques and emphasizes the strength and importance of emotionally based moral intuitions. With the framework of the social intuitionist model, Haidt (2001) proposes a set of casual "links" connecting three psychological processes: intuition, judgment, and reasoning. As a matter of fact, it operates a model in which judgment is not the product of conscious reasoning but a product of intuitionist cognitive processes that are automatic and unconscious. This approach builds upon the dual-process theory (Wason and Evans, 1974; Evans, 1989; Stanovich and West, 2008). It proposes that multiple independent but interacting processing systems underlie thought, judgment, and decision-making. Two types of different rationalities characterized by two systems exist. The System 1; namely the heuristic system, is influenced by the beliefs of the individual. It allows one to think, speak, reason, make a decision, and act adaptively to meet one's objectives without looking for consistency. The System 2; namely the analytical system, allows one to think, speak, reason, and make a decision according to a hypothetic-deductive approach. In the social intuitionist model, moral judgment is therefore predominantly intuitive, firstly linked to the heuristic system. It leads the individual to evaluate if the action of a person is acceptable or not from a moral point of view. The "post-hoc reasoning" posits (contrary to traditional rationalist models) that one's reasoning is driven primarily by one's judgment, rather than the other way around. According to social intuitionist theorists, an individual knows immediately if his judgment unearths a morally acceptable or unacceptable

act. An intuition that he calls “gut-feeling” is sensed quickly and is full of affect without the individual necessarily being aware of the reasons that have led him to such a judgment. This explains the reason why some people do not know how to spontaneously explain their judgments. Reasoning, a conscious, intentional, and controlled process through System 2, only happens “retrospectively,” once the person has to justify an action in a conscious manner (Hauser et al., 2007). For that to occur, he will then refer explicitly to moral intuitions which guided his judgment.

Haidt (2003) discusses innate and universal moral intuitions guiding moral judgments. He identifies five categories of intuitions (corresponding to the five moral principles) that individuals inherit, produced by means of natural selection at work throughout human evolution. These intuitions are developed according to an individual’s background and culture. This model includes processes of social influences linked to the formulation of moral reasoning or judgment. To this effect, throughout one’s development, an individual is influenced by several members of a group. By verbalizing them, these individuals can trigger the emergence of certain intuitions which are conducive to beliefs, values, and ideologies of the group. As such, they can influence the moral judgment of the person. For this reason, some intuitions are able to develop and expand, and others are inhibited. This explains why WEIRD and non-WEIRD societies do not judge and justify in the same way. Everybody has areas of moral concern developed by evolution, in which some intuitions are more predominant than others. Haidt even suggests that there is a critical period during childhood, beyond which the categories of non-developed intuitions are subsequently eternally forgotten.

An individual’s spirit has a morally diversified content that is specific to social experiences. Children actively form their moral understanding in a cultural context that uses stories to shape and guide the development of their particular moral principles (Haidt and Joseph, 2008). For instance, according to the culture, the definition of a human being varies. It depends upon these definitions whether one opts to grant, or not, rights to individuals throughout a moral judgment. If one poses the question: “is induced abortion morally acceptable?” some societies do consider it to be acceptable as the fetus is not yet perceived as a complete human being. They justify their thinking on the basis that the fetus has not experienced social acknowledgment, a rite of passage, etc. Other societies which abide by respecting the individual, consider this act to be unacceptable and justify their thinking by the motive that the fetus is a human being who has the right to life, and thus see this act as murder. Moral judgment happens based on moral intuitions, linking up the perception of a model in the social world (often a value or a vice) to an appraisal. These are the elements of rapid mental structuring and are specific to a domain that strongly influences moral judgment (Haidt, 2001). To this effect, if the five intuitions are innate, individuals simply learn which event, in their culture, counts as an act of prejudice or injustice. For example, over recent years, Western societies (notably Americans) have become sensitive regarding the topic of sexual abuse of children, to

such an extent that they are appalled by social behaviors which are completely normal in other parts of the world. These include the idea of making children sleep in the same bed as a parent of the opposite sex until halfway through their childhood (Shweder et al., 1995), or kissing genitalia of little boys as a sign of affection, as is done in some countries in the Middle-East. With regard to this moral concern, these Western societies then react quickly, automatically, and using emotions.

Each society, therefore, has immediate implicit reactions to stories of moral violations created by their beliefs, values, and social ideologies (Haidt, 2001). Emotional reactions, such as anger or guilt, can sway judgments and moral behaviors. Neurological and behavioral data back up the idea that emotions are essential for moral judgments. Huebner et al. (2009) suggested that moral judgment is moderated by a fast and unconscious process that acts upon causal-intentional representations. Individuals are sometimes able to know that an act is not correct, without having the capacity to explain why this is so (Haidt, 2001). We are therefore led to believe that moral reasoning is only one of the factors, certainly not the strongest, which influences judgments and moral behaviors. According to Matsumoto and Juang (2013), culture can affect emotions in many ways. Human beings are born with a range of basic emotions. These are universally expressed among all humans by facial expressions. However, culture creates rules, directives, and norms which regulate these emotions and influence the system of basic emotions to maintain social coordination. For example, individuals from collectivist cultures tend to include emotions in the evaluation of their social values, whereas individuals from individualistic cultures are likely to include emotions in their evaluation of the environment. Studies have revealed that moral violations are perceived as more or less severe depending upon the current emotional state of a person (Greene and Haidt, 2002; Greene et al., 2009; Horberg et al., 2011). Emotions amplify moral judgment, and each society expresses emotions differently depending on the moral concern in question. In the thesis of Alqahtani (2018) which compares a Saudi population representing a collectivist culture with a British population representing an individualistic culture, one can see that the two groups did not experience the same emotions during moral violations of the moral foundations (see theory of Haidt and Joseph, 2004). As a matter of fact, in the Saudi population, the non-harm and equity foundations triggered resentment. The loyalty foundation triggered sadness, resentment, and apathy. The authority foundation triggered resentment and apathy. Last, the purity foundation triggered disgust. Within the British sample, the non-harm foundation triggered anger. The equity foundation triggered anger and disgust. The loyalty foundation triggered sadness, anger, and apathy. The authority foundation triggered anger and apathy. Last, the purity foundation triggered disgust. Emotion has a link with environmental conditions; it can thus create a moral judgment as a result of a motivational process, such as values, beliefs, needs, and objectives (Blasi, 1999).

Haidt’s model is the first to have highlighted the place of intuitions and the role of these associated emotions in moral judgment. He is, nevertheless, the object of several critics.



Approaching morality from the intuitionist perspective leads to consider conscious moral reasoning secondary to automatic and unconscious in moral judgment. It is also considered that the rational discourse of morality has no relevant impact on moral decision-making and solution-finding. In his reaction to Haidt's emotional reductionism, Lind (2016) explains that moral judgment can be strengthened if moral reasoning is trained and re-trained repeatedly. Instincts, emotions, and intuitions may be an evolutionary legacy in the human mind, arising unconsciously. However, with experience, human beings learn and develop conscious tools to understand their natural impulses and navigate them (Nowak, 2016). Evolution has endowed humans with moral emotions (including empathy), but they need more advanced instruments to deal with the demanding social contexts in which decisions are required. Following intuitions and emotions is not enough; this is why moral reasoning matters, especially in social contexts. For Lind (2016), moral judgment competence is to be defined as "an ability to apply a certain moral orientation in a consistent (manner, as trained, developed, and trustworthy moral subjects) and differentiated manner in varying social situations."

Haidt's model does not explain the process at the origin of moral intuitions, by giving an extremely limited role to controlled processes (Mikhail, 2007; Waldmann et al., 2012). In fact, Haidt and Kesebir (2010) only touch upon the use of the heuristic system among implied cognitive processes during a moral judgment. They do not provide any further explanation detailing the cognitive processes underpinning moral intuitions. To plug this gap, Mikhail (2007) developed a model describing the different mental processes, which drive all moral intuitions. He thus describes three steps. The first process consists of developing a structured representation of the situation, integrating its timeline, its causal chain, the intentions of its contributors, its moral properties, and all of the implicit pertinent elements. The second process involves forming a structured description of the situation by linking all of the characteristics together to carefully separate the desired effects from any collateral effects. The third process consists of applying a certain tacit understanding, principles, and specific rules to the situation, to determine its moral acceptability. Mikhail, having been inspired by the works of Chomsky (1957) and Rawls (1971), suggests that this knowledge takes the shape of a universal moral grammar which gives the individual a form of stability and systematicity within their moral intuitions. He considers that morality has at its center a nucleus of rules or innate principles. This moral grammar allows the individual, over the course of his development, to integrate into the value system of his environment to internalize specific moral principles of his cultural universe (Mikhail, 2011). Societies have a unique and universal moral competence that emerges from underlying, subjacent, and unconscious cognitive processes.

To test the confirmation of the existence of a universal moral grammar, Hauser et al. (2007) bring experimental elements to the fore by evoking judgments and arguments of people confronted by the tram dilemma (Foot, 1967; Thomson, 1976). They posed a dilemma presented under the guise of two

different versions to 5,000 subjects coming from 18 WEIRD and non-WEIRD countries, including young people and adults (13–70 years of age), men and women, religious people and atheists, as well as varying levels of education.

In the first version, the moral dilemma was presented as follows: *A tram is moving at a high speed on its track. Five workers are carrying out repairs on the track. On another track, onto which the tram could be redirected, a sole laborer is working. An employee from the tram company who is near the railway switch point and who understands the situation, could or could not, redirect the tram. If he does so, he would avoid the death of five workers and if he does not, he would avoid the death of one sole laborer. Does he have the moral right to redirect the tram onto the other track?*

In the second version, the dilemma is presented in the following manner: *A tram is moving at high speed on its track. Five workers are carrying out repairs on the track. John, who is passing on a bridge above the track, understands that he could stop the tram by throwing something big down onto the track. A pedestrian carrying a big bag is walking next to him. If he were to push him onto the track, he would instigate the stopping of the tram and would save the lives of the five workers. But consequently, the life of the pedestrian would be sacrificed. But if he does not do it, he would avoid the death of only one sole worker. Does he morally have the right to push the pedestrian off the bridge?*

Faced with the first version, 89% of the subjects judged the action of redirecting the tram to be morally acceptable. On the other hand, faced with the second version, 11% of the subjects judged the fact of pushing the pedestrian onto the track to be morally acceptable. In both cases, moral reasoning has a universal character because the results are independent of the level of study, religion, and culture. These results suggest the existence of a universal moral grammar (Hauser et al., 2007).

As we saw, the social intuitionist model offered by Haidt gives a limited place to controlled processes in moral reasoning (Paxton and Greene, 2010). Hence, these authors propose an alternative dual-process model according to which intuitions and reasoning are equal. Moral reasoning would occur more frequently. Its function is not only to justify moral judgment but also to counteract the primary intuition. To this end, several studies have shown that an individual engages within extensive moral reasoning when they become aware that their moral judgment could be deemed as being incorrect, and that they look to go beyond an implicit negative attitude (Paharia et al., 2009). The context (notably cultural) in which an individual finds themselves can push them to be particularly rational or to re-evaluate their emotional reactions. This model shows that the individual can be sensitive to arguments presented to them, that they then integrate them into their reasoning, and following that, they will judge the moral acceptability of a situation differently. Moral judgment thus seems to be the product of both automated and controlled processes. It is the temporality of these processes that differs. Automated processes include processing emotional information and doing this quickly, whereas controlled processes include slower reasoning, giving the person time to have consciously obtained abstract information and evaluated it systematically. According to the argumentative



theory (Paxton et al., 2012; Mercier, 2016), reasoning comes *ex post* to justify moral decisions which happen instinctively. These authors explain that the two situations of the dilemma are independently examined without seeking coherence. In this situation, the choice made by an individual is the one that is the easiest to justify in relation to mainly unconscious moral principles. During moral reasoning, each person is thus motivated by their moral system. Here, reasoning has an ecological function as individuals are led to defend an opinion that is influenced by society and conformity, acting as a means of persuasion.

## SOCIAL JUSTIFICATION AND ARGUMENTATION IN WEIRD AND NON-WEIRD SOCIETIES

Justification processes are a uniquely human phenomenon. In almost every form of social exchange, humans constantly justify their behaviors to themselves and others. Moral choices can be justified in different ways. To explain a practice, one can invoke public opinion (“the majority of people find this practice good”), customs in the culture (“we have always done it this way”), an eminent authority (“our leader or God commands us to do this”), or principles resulting from personal reflection (“it is not good to make others suffer”; Tostain, 1999). Science, laws, moral dictates, religions, and philosophical beliefs can be seen as large-scale justification systems that provide individuals guidelines for socially acceptable or unacceptable behavior (Henriques, 2011). Henriques (2011) introduces the justification hypothesis to provide a framework for understanding human beliefs and values with a cultural level process. The justification hypothesis is part of a larger theoretical framework called the Tree of Knowledge System developed by Henricue. Justifications can be associated with what Dawkins (1989) calls a meme, which is a unit of cultural evolution. We can clearly envisage the evolution of such systems. There are three key elements of evolution: variation (different justifications are offered), selection (certain justifications are better at legitimizing action than others), and retention (selected justifications are stored and repeated; Schaffer et al., 2008). From those elements, new justifications systems emerge through the course of human evolution.

The justification hypothesis answers the question of why there is such a variety of types of justification systems. Henriques (2011) explains that WEIRD societies have distinct systems of justification. Religion is separated from the law, the government, Science, and all other cultural institutions. On the other hand, non-WEIRD societies do not necessarily distinguish religious worldviews, explanations of natural phenomena, and prescriptions for social conduct in their systems of justification. This can explain why moral justification, which involves a value, a principle, and a judgment, is not the same between WEIRD and non-WEIRD societies. Schaffer et al. (2008) argues forcefully for the utility of conceptualizing religion as a large-scale justification system. The individuals follow different fundamental purposes serving as differentiating forces in the justification

systems. As such, the core of culture relies on the presence of large-scale justification systems to coordinate and justify human moral's opinions and behaviors.

Arguments are the substantive reasons put forward to justify one's moral choice or behavior. The power of argumentation during moral debates is not the same for all cultures. In fact, the nature or the types of arguments accepted or rejected varies depending on the social and cultural context (Mercier, 2016; Mercier et al., 2016). Members of WEIRD societies have attributed more value to argumentation in their institutions for a long time, whether it be regarding science, rights, or politics (Peng and Nisbett, 1999). They put relatively less emphasis on saving social harmony (Kim and Markus, 1999; Oetzel et al., 2001) than non-WEIRD cultures. This permits them consequently to have more confrontational and open debates (Mercier et al., 2015). Furthermore, in WEIRD societies, individuals are confronted by a variety of choices and views of the world. In such cultures, one can expect to defend one's choices; since it is probable one will encounter people who make different choices (Schwartz, 2004).

As a rule, members of Eastern societies have much fewer choices: much fewer religions to choose from, much fewer products to buy, much fewer professions to choose from, much fewer people to visit, etc. (Levi-Strauss, 1966). This relative lack of choice results in a lighter burden of justification. Individuals from Easterners' cultures, therefore, need to resort less to argumentation to justify their judgments or moral choices. They have less appreciation for argumentation and can be more reticent to engage themselves in moral debates on subjects, such as euthanasia, induced abortion, religion, divorce, education, etc. In fact, they adhere more strongly to their moral beliefs, and this often demonstrates the power of the institutions that they valorize and their impenetrability toward demonstrations and logical arguments. Furthermore, these societies attribute a symbolic value to their moral decisions, so that it is without a doubt more important to make a socially acceptable decision than an intrinsically correct decision. To this end, the links between the individuals are strong and as such, a person should priorities the interests of their group, in the opinions and beliefs they hold (Triandis, 2011). Norms, obligations, and duties linked to the objectives, the safety, and the harmony of the group guide the moral decisions of individuals.

However, we could envision a universality concerning the role of argumentation, no matter the culture. In this perspective, individuals would be confronted with the myside bias. The Argumentative theory describes it as a bias whereby individuals overwhelmingly produce arguments defending their preferred opinions (Mercier, 2010). Consequently, reasoning rarely allows individuals to rectify their erroneous intuitions. The myside bias can lead to over-confidence regarding moral choices (Koriat et al., 1980). This bias can be a cognitive response to a specific cultural environment in which argumentation is valorized and where it is particularly important to be capable of defending one's point of view. As predicted, these characteristics are adaptative and frequently present among adults in WEIRD populations (Mercier and Sperber, 2017), but they are equally noticed in a culture that differs in many ways to WEIRD cultures,

such as among the K'iche people in Guatemala (Castelain et al., 2015), and there is no solid proof of their absence in other cultures.

Argumentation has an adaptive function because it greatly facilitates communication. Thereby, a second characteristic of the myside bias can be highlighted: the capacity to reasonably evaluate other's arguments, by rejecting the weak and accepting those which are sufficiently strong (Hahn and Oaksford, 2007). Sufficiently strong arguments can prevail and make an individual change their mind on an opinion. But during a moral judgment, the latter can be put at stake in the framework of a debate, as the (heuristic) intuition is too powerful and reasoning remains insensitive to all counter suggestions. It is like an impenetrable model (Fodor, 2008). Above all, reasoning remains motivated by the needs and the moral motivations of the individual.

## CONCLUSION

Morality is a necessary parameter in the functioning of all societies. It defines an ideal to strive for as well as limits one should not transgress. It guides the social behaviors of individuals and plays a part in maintaining cooperation and cohesion at the heart of societies. Recent socio-cognitive research brings to light an intuitive, universal, and emotional character of moral judgment. It also highlights the essential role of reasoning in enabling argumentation or inhibiting moral intuitions. Indeed, reasoning allows individuals to mobilize moral principles that may be used to override moral intuitions. The tendency to control one's biased intuitions has become widespread due to social influences. Moral reasoning thus has a significant role in moral judgment, including the suspension of moral intuitions

in the presence of justificatory reasons. This effect depends critically on the strength of the involved arguments, knowing that the types of arguments accepted or rejected vary according to the social and cultural context.

The moral system is organized around major principles. Depending on the culture to which one belongs those principles take on a different weighting. Heterogeneity accrued in societies implies the creation of a consequent number of groups that differ in their values and moral perspectives. This variability raises numerous concerns for moral science on the topic of norms, such as the objective criteria according to which one can assert that an action or a specific practice is moral or not. On a descriptive level, this variability offers numerous possibilities for moral psychology to identify the background, the sources, and the structures of moral lives of societies.

## AUTHOR CONTRIBUTIONS

LB wrote the article and made a substantial contribution to the concept of the article. RF and VP revised the article critically for important intellectual content. All authors contributed to the article and approved the submitted version.

## ACKNOWLEDGMENTS

We thank the members of the laboratory "Psychologie des Ages de la Vie" for support. We would also like to express our gratitude to Thibaud Martinez for his comments on the earlier draft of this paper and to three reviewers for their comments on the manuscript.

## REFERENCES

- Alqahtani, A. (2018). The effect of psychological factors on morality. The role of culture and moral foundations. [University of Plymouth]. Available at: <http://hdl.handle.net/10026.1/11815> (Accessed, 2021).
- Atari, M., Graham, J., and Dehghani, M. (2020). Foundations of morality in Iran. *Evol. Hum. Behav.* 41, 367–384. doi: 10.1016/j.evolhumbehav.2020.07.014
- Blasi, A. (1999). Emotions and moral motivation. *J. Theory Soc. Behav.* 29, 1–19. doi: 10.1111/1468-5914.00088
- Bukatko, D., and Daehler, M. W. (2003). *Child Development: A Thematic Approach*. 4th Edn. Houghton Mifflin and Company.
- Castelain, T., Bernard, S., Van der Henst, J.-B., and Mercier, H. (2015). The influence of power and reason on Young Maya Children's endorsement of testimony. *Dev. Sci.* 19, 957–966. doi: 10.1111/desc.12336
- Chomsky, N. (1957). *Syntactic Structures*. Paris: Mouton, 116.
- Curry, O. S. (2016). "Morality as cooperation: A problem-centred approach," in *The Evolution of Morality*. eds. T. K. Shackelford and R. D. Hansen (Springer International Publishing), 27–51.
- Curry, O., Mullins, D., and Whitehouse, H. (2019). Is it good to cooperate? Testing the theory of morality-as-cooperation in 60 societies. *Curr. Anthropol.* 60, 47–69. doi: 10.1086/701478
- Dawkins, R. (1989). *The Extended Phenotype*. Oxford University Press.
- Dien Winfield, R. (1982). The injustice of human rights. *Philos. Soc. Critic.* 9, 81–96. doi: 10.1177/019145378200900105
- Doğruyol, B., Alper, S., and Yilmaz, O. (2019). The five-factor model of the moral foundations theory is stable across WEIRD and non-WEIRD cultures. *Personal. Individ. Differ.* 151:109547. doi: 10.1016/j.paid.2019.109547
- Evans, J. S. B. T. (1989). *Bias in Human Reasoning: Causes and Consequences*. Hillsdale, New Jersey, United States: Lawrence Erlbaum Associates, Inc., 145.
- Fodor, J. A. (2008). "The modularity of mind: An essay on faculty psychology," in *Reasoning: Studies of Human Inference and Its Foundations*. eds. J. E. Adler and L. J. Rips (Cambridge, England: Cambridge University Press), 878–914.
- Fontaine, R., and Pennequin, V. (2020). "Dual models argumentative theory and moral reasoning," in *Adapting Human Thinking and Moral Reasoning in Contemporary Society*. eds. H. Yama and V. Salvano-Pardieu (IGI Global), 1–29.
- Foot, P. (1967). The problem of abortion and the doctrine of the double effect. *Oxford Rev.* 5, 5–15.
- Gibbs, J. C., Basinger, K. S., Grime, R. L., and Snarey, J. R. (2007). Moral judgment development across cultures: revisiting Kohlberg's universality claims. *Dev. Rev.* 27, 443–500. doi: 10.1016/j.dr.2007.04.001
- Graham, J., Haidt, J., Koleva, S., Motyl, M., Iyer, R., Wojcik, S. P., et al. (2013). "Moral foundations theory: the pragmatic validity of moral pluralism," in *Advances in Experimental Social Psychology*. Vol. 47. eds. P. Devine and A. Plant (Academic Press), 55–130.
- Graham, J., Haidt, J., and Nosek, B. A. (2009). Liberals and conservatives rely on different sets of moral foundations. *J. Pers. Soc. Psychol.* 96, 1029–1046. doi: 10.1037/a0015141
- Graham, J., Meindl, P., Beall, E., Johnson, K. M., and Zhang, L. (2016). Cultural differences in moral judgment and behavior, across and within societies. *Curr. Opin. Psychol.* 8, 125–130. doi: 10.1016/j.copsyc.2015.09.007
- Graham, J., Nosek, B., Haidt, J., Iyer, R., Koleva, S., and Ditto, P. (2011). Mapping the moral domain. *J. Pers. Soc. Psychol.* 101, 366–385. doi: 10.1037/a0021847
- Greene, J., Cushman, F., Stewart, L., Lowenberg, K., Nystrom, L., and Cohen, J. (2009). Pushing moral buttons: The interaction Between personal force and

- intention in moral judgment. *Cognition* 111, 364–371. doi: 10.1016/j.cognition.2009.02.001
- Greene, J., and Haidt, J. (2002). How (and where) does moral judgment work? *Trends Cogn. Sci.* 6, 517–523. doi: 10.1016/S1364-6613(02)02011-9
- Hahn, U., and Oaksford, M. (2007). The rationality of informal argumentation: A Bayesian approach to reasoning fallacies. *Psychol. Rev.* 114, 704–732. doi: 10.1037/0033-295X.114.3.704
- Haidt, J. (2001). The emotional dog and its rational tail. *Psychol. Rev.* 108, 814–834. doi: 10.1037/0033-295X.108.4.814
- Haidt, J. (2003). “The moral emotions,” in *Handbook of Affective Sciences*. eds. R. J. Davidson, K. R. Scherer and H. H. Goldsmith (Oxford University Press), 852–870.
- Haidt, J. (2007). The new synthesis in moral psychology. *Science* 316, 998–1002. doi: 10.1126/science.1137651
- Haidt, J., and Joseph, C. (2004). Intuitive ethics: how innately prepared intuitions generate culturally variable virtues. *Daedalus* 133, 55–66. doi: 10.1162/0011526042365555
- Haidt, J., and Joseph, C. (2008). “The moral mind: how five sets of innate intuitions guide the development of many culture-specific virtues, and perhaps even modules,” in *The Innate Mind, Volume 3: Foundations and the Future*. Vol. 3. eds. P. Carruthers, S. Laurence and S. Stich (Oxford University Press), 367–391.
- Haidt, J., and Kesebir, S. (2010). “Morality,” in *Handbook of Social Psychology*. Vol. 2. 5th Edn. eds. T. Fiske, D. T. Gilbert and G. Lindzey (John Wiley and Sons, Inc.), 797–832.
- Haidt, J., Koller, S. H., and Dias, M. G. (1993). Affect, culture, and morality, or is it wrong to eat your dog? *J. Pers. Soc. Psychol.* 65, 613–628. doi: 10.1037/0022-3514.65.4.613
- Hauser, M., Cushman, F., Young, L., Kang-Xing Jin, R., and Mikhail, J. (2007). A dissociation between moral judgments and justifications. *Mind Lang.* 22, 1–21. doi: 10.1111/j.1468-0017.2006.00297.x
- Henrich, J., Heine, S. J., and Norenzayan, A. (2010). The weirdest people in the world? *Behav. Brain Sci.* 33, 61–83. doi: 10.1017/S0140525X0999152X
- Henriques, G. (2011). “The justification hypothesis,” in *A New Unified Theory of Psychology*. ed. G. Henriques (New York, United States: Springer), 113–152.
- Hong, Y.-y. (2009). “A dynamic constructivist approach to culture: moving from describing culture to explaining culture,” in *Understanding Culture: Theory, Research, and Application*. eds. R. S. Wyer, C.-y. Chiu and Y.-y. Hong (Psychology Press), 3–23.
- Horberg, E. J., Oveis, C., and Keltner, D. (2011). Emotions as moral amplifiers: An appraisal tendency approach to the influences of distinct emotions upon moral judgment. *Emot. Rev.* 3, 237–244. doi: 10.1177/1754073911402384
- Huebner, B., Dwyer, S., and Hauser, M. (2009). The role of emotion in moral psychology. *Trends Cogn. Sci.* 13, 1–6. doi: 10.1016/j.tics.2008.09.006
- Hwang, K.-K. (2015). “Morality ‘east’ and ‘West’: cultural concerns,” in *International Encyclopedia of the Social and Behavioral Sciences*. 2nd Edn. ed. J. D. Wright (Oxford, England: Elsevier), 806–810.
- Jensen, L. (2011). Bridging universal and cultural perspectives: A vision for Developmental Psychology in a global world. *Child Dev. Perspect.* 6, 98–104. doi: 10.1111/j.1750-8606.2011.00213.x
- Jensen, L. (2015). *Moral Development in a Global World: Research From a Cultural-Developmental Perspective*. Cambridge: Cambridge University Press, 260.
- Kant, E. (1765). *Fondements de la métaphysique des mœurs*. Le Livre de Poche.
- Kim, H., and Markus, H. R. (1999). Deviance or uniqueness, harmony or conformity? A cultural analysis. *J. Pers. Soc. Psychol.* 77, 785–800. doi: 10.1037/0022-3514.77.4.785
- Kohlberg, L. (1976). “Moral stages and moralization: the cognitive-development approach,” in *Moral Development and Behavior: Theory Research and Social Issues*, 31–53.
- Kohlberg, L. (1981). *The Philosophy of Moral Development: Moral Stages and the Idea of Justice*. New York, United States: Harper and Row.
- Kohlberg, L., Levine, C., and Hewer, A. (1983). Moral stages: A current formulation and a response to critics. *Contrib. Hum. Dev.* 10:174.
- Koriat, A., Lichtenstein, S., and Fischhoff, B. (1980). Reasons for confidence. *J. Exp. Psychol. Hum. Learn. Mem.* 6, 107–118. doi: 10.1037/0278-7393.6.2.107
- Levi-Strauss, C. (1966). The scope of anthropology. *Curr. Anthropol.* 7, 112–123. doi: 10.1086/200687
- Lind, G. (2016). *How to Teach Morality: Promoting Deliberation and Discussion, Reducing Violence and Deceit*. Berlin: Logos Verlag.
- Lloyd, P. J. (1992). Individual and collective rationality in the household. *Aust. Econ. Pap.* 31, 127–145. doi: 10.1111/j.1467-8454.1992.tb00559.x
- Lyons, N. P. (1983). Two perspectives: On self, relationships, and morality. *Harv. Educ. Rev.* 53, 125–145. doi: 10.17763/haer.53.2.h08w5m7v217j84t1
- Matsumoto, D., and Juang, L. (2013). *Culture and Psychology, 5th Edn.* Wadsworth: Cengage learning.
- Maxwell, B. (2011). Personality, identity, and character: explorations in moral psychology. *J. Moral Educ.* 40, 136–138. doi: 10.1080/03057240.2011.541998
- Mercier, H. (2010). On the universality of argumentative reasoning. *J. Cogn. Cult.* 11, 85–113. doi: 10.1163/156853711X568707
- Mercier, H. (2016). The argumentative theory: predictions and empirical evidence. *Trends Cogn. Sci.* 20, 689–700. doi: 10.1016/j.tics.2016.07.001
- Mercier, H., Bonnier, P., and Trouche, E. (2016). “Why don’t people produce better arguments?” in *The Language of Thought*. eds. L. Macchi, M. Bagassi and R. Viale (Cambridge, Massachusetts, United States: MIT Press).
- Mercier, H., Deguchi, M., Van der Henst, J.-B., and Yama, H. (2015). The benefits of argumentation are cross-culturally robust: The case of Japan. *Think. Reason.* 22, 1–15. doi: 10.1080/13546783.2014.1002534
- Mercier, H., and Sperber, D. (2017). *The Enigma of Reason*. Cambridge, Massachusetts, United States: Harvard University Press, 396.
- Mikhail, J. (2007). Universal moral grammar: theory, evidence and the future. *Trends Cogn. Sci.* 11, 143–152. doi: 10.1016/j.tics.2006.12.007
- Mikhail, J. (2011). *Elements of Moral Cognition: Rawls’ Linguistic Analogy and the Cognitive Science of Moral and Legal Judgment*. New York, United States: Cambridge University Press, 406.
- Mill, J. S. (1863/2002). *Utilitarianism*. Cleveland: Cambridge University Press.
- Nowak, E. (2016). What is moral competence and why promote it? *Ethics Progress* 7, 322–333. doi: 10.14746/eip.2016.1.18
- Oetzel, J., Ting-Toomey, S., Masumoto, T., Yokochi, Y., Pan, X., Takai, J., et al. (2001). Face and facework in conflict: A cross-cultural comparison of China, Germany, Japan, and the United States. *Commun. Monogr.* 68, 235–258. doi: 10.1080/03637750128061
- Paharia, N., Kassam, K., Greene, J., and Bazerman, M. (2009). Dirty work, clean hands: The moral psychology of indirect agency. *Organ. Behav. Hum. Decis. Process.* 109, 134–141. doi: 10.1016/j.obhdp.2009.03.002
- Paxton, J., and Greene, J. (2010). Moral reasoning: hints and allegations. *Top. Cogn. Sci.* 2, 511–527. doi: 10.1111/j.1756-8765.2010.01096.x
- Paxton, J. M., Ungar, L., and Greene, J. D. (2012). Reflection and reasoning in moral judgment. *Cogn. Sci.* 36, 163–177. doi: 10.1111/j.1551-6709.2011.01210.x
- Peng, K., and Nisbett, R. E. (1999). Culture, dialectics, and reasoning about contradiction. *Am. Psychol.* 54, 741–754. doi: 10.1037/0003-066X.54.9.741
- Piaget, J. (1932). *Le jugement moral chez l’enfant (Bibliothèque de psychologie de l’enfant et de pédagogie édition)*. Félix Alcan.
- Piaget, J. (1977). *The Development of Thought: Equilibration of Cognitive Structures*. ed. A. Rosin (New York: Viking), 213.
- Piaget, J. (1985). *The Equilibration of Cognitive Structures: The Central Problem of Intellectual Development*. Chicago, United States: University of Chicago Press.
- Piaget, J., and Gabain, M. (1965). *The Moral Judgment of the Child*. New York, United States: Free Press.
- Rawls, W. E., Gardner, H. L., Flanders, R. W., Lowry, S. P., Kaufman, R. H., and Melnick, J. L. (1971). Genital herpes in two social groups. *Am. J. Obstet. Gynecol.* 110, 682–689. doi: 10.1016/0002-9378(71)90254-7
- Royal, C. W., and Baker, S. B. (2005). Effects of a deliberate moral education program on parents of elementary school students. *J. Moral Educ.* 34, 215–230. doi: 10.1080/03057240500136989
- Rozin, P., Lowery, L., Imada, S., and Haidt, J. (1999). The CAD triad hypothesis: A mapping between three moral emotions (contempt, anger, disgust) and three moral codes (community, autonomy, divinity). *J. Pers. Soc. Psychol.* 76, 574–586. doi: 10.1037/0022-3514.76.4.574
- Schaffer, S. P., Lei, K., and Reyes Paulino, L. (2008). A framework for cross-disciplinary team learning and performance. *Perform. Improv. Q.* 21, 7–21. doi: 10.1002/piq.20028
- Schwartz, B. (2004). *The Paradox of Choice: Why More Is Less (P. Xi, 265)*. New York, United States: HarperCollins Publishers.
- Shweder, R. A., Jensen, L. A., and Goldstein, W. M. (1995). Who sleeps by whom revisited: A method for extracting the moral goods implicit in practice. *New Dir. Child Dev.* 67, 21–39. doi: 10.1002/cd.23219956705

- Shweder, R. A., Mahapatra, M., and Miller, J. G. (1987). "Culture and moral development," in *The Emergence of Morality in Young Children*. eds. J. Kagan and S. Lamb (University of Chicago Press), 1–83.
- Shweder, R. A., Much, N. C., Mahapatra, M., and Park, L. (1997). "The 'big three' of morality (autonomy, community, divinity) and the 'big three' explanations of suffering," in *Morality and Health*. eds. A. M. Brandt and P. Rozin (Taylor and Francis/Routledge), 119–169.
- Shweder, R. A., and Sullivan, M. A. (1990). "The semiotic subject of cultural psychology," in *Handbook of Personality: Theory and Research*. ed. L. A. Pervin (The Guilford Press), 399–416.
- Skitka, L. J., Bauman, C. W., and Sargis, E. G. (2005). Moral conviction: Another contributor to attitude strength or something more? *J. Pers. Soc. Psychol.* 88, 895–917. doi: 10.1037/0022-3514.88.6.895
- Smetana, J. G. (2006). "Social-cognitive domain theory: consistencies and variations in children's moral and social judgments," in *Handbook of Moral Development*. eds. M. Killen and J. G. Smetana (Lawrence Erlbaum Associates Publishers), 119–153.
- Snarey, J. (1985). Cross-cultural universality of social-moral development. A critical review of Kohlbergian research. *Psychol. Bull.* 97, 202–232. doi: 10.1037/0033-2909.97.2.202
- Spiro, M. E. (1993). Is the Western conception of the self "peculiar" within the context of the world cultures? *Ethos* 21, 107–153. doi: 10.1525/eth.1993.21.2.02a00010
- Stanovich, K. E., and West, R. F. (2008). On the relative independence of thinking biases and cognitive ability. *J. Pers. Soc. Psychol.* 94, 672–695. doi: 10.1037/0022-3514.94.4.672
- Thomson, J. J. (1976). Killing, letting, die, and the trolley problem. *Monist* 59, 204–217. doi: 10.5840/monist197659224
- Tostain, M. (1999). "La morale est-elle universelle? Les alternatives actuelles au modèle rationaliste de Kohlberg," in *La psychologie sociale*. Vol. 1–4. eds. J. L. Beauvois, W. Doise and N. Dubois (Presses Universitaires de Grenoble), 47–57.
- Triandis, H. C. (2001). Individualism-collectivism and personality. *J. Pers.* 69, 907–924. doi: 10.1111/1467-6494.696169
- Triandis, H. (2011). Culture and self-deception: A theoretical perspective. *Soc. Behav. Pers.* 39:3. doi: 10.2224/sbp.2011.39.1.3
- Turiel, E. (1983). *The Development of Social Knowledge: Morality and Convention*. Cambridge, England: Cambridge University Press.
- Vasquez, K., Keltner, D., Ebenbach, D. H., and Banaszynski, T. L. (2001). Cultural variation and similarity in moral rhetorics: voices from the Philippines and the United States. *J. Cross-Cult. Psychol.* 32, 93–120. doi: 10.1177/0022022101032001010
- Vauclair, M., and Fischer, R. (2011). Do cultural values predict individuals' moral attitudes? A cross-cultural multilevel approach. *Eur. J. Soc. Psychol.* 41, 468–481. doi: 10.1002/ejsp.794
- Vauclair, M., Wilson, M., and Fischer, R. (2014). Cultural conceptions of morality: examining laypeople's associations of moral character. *J. Moral Educ.* 43, 54–74. doi: 10.1080/03057240.2013.873365
- Waldmann, M. R., Nagel, J., and Wiegmann, A. (2012). "Moral judgment," in *The Oxford Handbook of Thinking and Reasoning*. eds. K. J. Holyoak and R. G. Morrison (Oxford University Press), 364–389.
- Wang, X., Lei, L., Liu, D., and Hu, H. (2016). Moderating effects of moral reasoning and gender on the relation between moral disengagement and cyberbullying in adolescents. *Personal. Individ. Differ.* 98, 244–249. doi: 10.1016/j.paid.2016.04.056
- Wason, P. C., and Evans, J. (1974). Dual processes in reasoning? *Cognition* 3, 141–154. doi: 10.1016/0010-0277(74)90017-1
- 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.
- Copyright © 2021 Bentahila, Fontaine and Pennequin. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.





# How the Custom Suppresses the Endowment Effect: Exchange Paradigm in Kanak Country

Jean Baratgin<sup>1,2\*</sup>, Patrice Godin<sup>3</sup> and Frank Jamet<sup>1,2,4</sup>

<sup>1</sup> Université Paris 8, Laboratoire Cognition Humaine et Artificielle, Saint-Denis, France, <sup>2</sup> Probability, Assessment, Reasoning and Inferences Studies Association, Paris, France, <sup>3</sup> Université de la Nouvelle Calédonie, Laboratoire TROCA, Nouméa, France, <sup>4</sup> CY Cergy Paris Université, Paris, France

## OPEN ACCESS

### Edited by:

Laura Martignon,  
Ludwigsburg University, Germany

### Reviewed by:

Annelie Rothe-Wulf,  
University of Freiburg, Germany  
Alessandra Geraci,  
University of Trento, Italy

### \*Correspondence:

Jean Baratgin  
jean.baratgin@univ-paris8.fr

### Specialty section:

This article was submitted to  
Cognition,  
a section of the journal  
Frontiers in Psychology

**Received:** 29 September 2021

**Accepted:** 13 December 2021

**Published:** 25 January 2022

### Citation:

Baratgin J, Godin P and Jamet F  
(2022) How the Custom Suppresses  
the Endowment Effect: Exchange  
Paradigm in Kanak Country.  
Front. Psychol. 12:785721.  
doi: 10.3389/fpsyg.2021.785721

In this paper, Knetsch's exchange paradigm is analyzed from the perspective of pragmatics and social norms. In this paradigm the participant, at the beginning of the experiment, receives an object from the experimenter and at the end, the same experimenter offers to exchange the received object for an equivalent object. The observed refusal to exchange is called the endowment effect. We argue that this effect comes from an implicature made by the participant about the experimenter's own expectations. The participant perceives the received item as a gift, or as a present, from the experimenter that cannot be exchanged as stipulated by the social norms of western politeness common to both the experimenter and the participant. This implicature, however, should not be produced by participants from Kanak culture for whom the perceived gift of a good will be interpreted as a first act of exchange based on gift and counter-gift. This exchange is a natural, frequent, balanced, and indispensable act for all Kanak social bonds whether private or public. Kanak people also know the French social norms that they apply in their interactions with French people living in New Caledonia. In our experiment, we show that when the exchange paradigm takes place in a French context, with a French experimenter and in French, the Kanak participant is subject to the endowment effect in the same way as a French participant. On the other hand, when the paradigm is carried out in a Kanak context, with a Kanak experimenter and in the vernacular language, or in a Kanak context that approaches the ceremonial of the custom, the endowment effect is no longer observed. The same number of Kanak participants accept or refuse to exchange the endowed item. These results, in addition to providing a new explanation for the endowment effect, highlight the great flexibility of decisions according to social-cultural context.

**Keywords:** decision-making, endowment effect, exchange paradigm, Kanak culture, custom, pragmatics, human interaction, politeness social norms



# 1. INTRODUCTION

For more than 40 years, numerous studies have shown that people seem to value a good they possess more than an equivalent good they do not possess. This *endowment effect* (Thaler, 1980) is observed in particular in the economic and psychological literature through the *Exchange Paradigm* (from now on designated as *EP*). The *EP* consists of two stages: The experimenter first checks whether a group of participants are indifferent to possessing an object *A* or to possessing an object *B*. Then, the remaining participants in the study are randomly endowed with one of the two equivalent goods *A* and *B* and after a time (in which the participant does some work or exercise) are then given the opportunity to exchange the endowed good for the other good that they did not receive. The endowment effect is reflected in a refusal to exchange the received good.

This refusal to exchange is observed in young children (Harbaugh et al., 2001; Horowitz and McConnell, 2002; Lucas et al., 2008; Da Silva et al., 2014) and also in certain non-human primates (Lakshminarayanan et al., 2008; Kanngiesser et al., 2011; Brosnan et al., 2012; Flemming et al., 2012, to cite a few). It is considered a rationality bias with respect to the prescription of standard economic theory which states that individuals' preferences over goods are independent of whether or not they possess it. In *EP*, the endowment of one of the two goods should not change the initial lack of preference of individuals between the two goods. Thus, if an individual has no preference between good *A* and good *B* and they own one of them, they should have no preference between keeping it or trading it. In *EP*, we should find a similar proportion of participants agreeing or refusing to exchange the received good for the other when they initially have no preference between the two objects. The endowment effect reflects this "exchange asymmetry" (Plott and Zeiler, 2007; Marzilli Ericson and Fuster, 2014) in favor of the given good.

The traditional explanation of this behavior is given by prospect theory and in particular by the notion of *loss aversion* (Kahneman et al., 1990; Tversky and Kahneman, 1991). Psychologically, a gain triggers a feeling of satisfaction, a loss triggers a feeling of dissatisfaction. Comparing the satisfaction level for a gain of a value *X* to the level of dissatisfaction triggered by the loss of a value of  $-X$  we observe that the level of dissatisfaction is higher than that of the satisfaction (Thaler, 1980; Knetsch, 1989; Kahneman et al., 1990). According to some authors, loss aversion would be the result of an evolutionary process based on the importance of overvaluing these goods when bargaining to acquire more resources. This would allow the maintenance of more offspring than people who correctly value (or undervalue) what they possess (Heifetz and Segev, 2004; Huck et al., 2005). This would be caused by an ancestral impulse to "defend one's own territory." Authors suggest there might be a genetic predisposition to acquire and to preserve goods (food, shelters, tools and territory) which allows the individual and collective survival (Stake, 2004; Gintis, 2007)<sup>1</sup>. An alternative

explanation of a psychological nature is given with the singular status of the feeling of ownership of an object. The endowment effect would be caused by a simple possession effect which would favor a strong attachment and a privileged relationship with the object (see for a review Morewedge and Giblin, 2015).

To our knowledge, in the literature, few studies have emphasized that *EP* involves a particular interaction between two protagonists. In a study on children 4 years old, Lucas et al. (2008) found a link between the endowment effect and success in the theory of mind (TOM) task. It is thus possible that there is a link between the endowment effect and the participant's interpretation of the experimenter's intentions and beliefs. In order to understand participants' interpretations, we must first understand what are these interactions. In *EP*, an experimenter hands out an object and a recipient receives it. The experimenter is very often a teacher and the recipients are students. The relationship governing the interaction between them is hierarchical, it is unbalanced. The social status of the two people is not the same. The first phase of interaction is the experimenter's endowment to the participants. This interaction certainly has a strong contextual effect. It is rare for a professor to give something to their students in a university course and this certainly surprises the participants. Moreover, we can observe that all participants accept this gift. The second phase of interaction is the request for an exchange. This request is also unusual, at least in Western customs. Without making a pragmatic analysis of the task, Plott and Zeiler (2007), Klass and Zeiler (2013) hypothesize that the participants consider the object given to them "is a gift from the experimenter, even though the experimenter might simply intend to convey that subjects now own [the object]" (Plott and Zeiler, 2007, p. 1454). This interpretation of the endowed object as a present given by the experimenter would lead them to prefer this object to another and to feel obliged to refuse the exchange. They observe an absence of endowment effect when the endowed object is not physically given (see also Knetsch and Wong, 2009) or is given randomly in concordance with the other object. In turn, they observe a strong endowment effect when the experimenter explicitly gives the object as a gift. Many of the results in the literature can be explained using this interpretation.

In *EP*, the endowment effect also seems to disappear when the goods given and exchanged are goods of exchange, such as money (Svirsky, 2014). Moreover, individuals experienced in markets seem less subject to the endowment effect (List, 2003; Engelmann and Hollard, 2010). However, exchange goods such as money are not usually used as gifts, and market professionals who are used to receiving goods and reselling them are certainly less inclined to consider the endowment as a present. Finally, in the only study we know of using *EP* with a non-Western population, Apicella et al. (2014) show that members of hunter-gatherer tribes (Hadza Bushmen of Northern Tanzania) who are highly exposed to modern society and markets are reluctant to trade in *EP*. Hadza with little exposure to modern society and markets do not show the same reluctance to trade. It is possible

<sup>1</sup>Recent experimental results, however, have revealed that toddlers have a very helpful behavior toward agents regarding biological needs, such as food and shelter,

an effect that can also be seen with teenagers and adults (see Geraci and Franchin, 2021; Kienbaum and Mairhofer, 2021).

to analyze these observed differences as a different social response to receiving a gift from the Western experimenter<sup>2</sup>. The Hadza who have experience of Western social norms would behave like Westerners when they receive a gift the Hadza who are not familiar with the customs of the Western world would behave according to their own social norms by exchanging and sharing it with the rest of the tribe (see for example Marlowe, 2004). Thus, we support the hypothesis of Plott and Zeiler (2007) that *EP* would encourage participants to represent the question of exchange in terms of whether or not to exchange a gift received.

As noted by Horak (2018), the vast majority of cross-cultural economic experiments provide evidence that culture can moderate economic behavior, but few studies explain the reasons for this behavioral difference across societies in the field of decision-making. We argue that culture, through the social norms of individuals, shapes representations and implicatures which differ on the expectations of the experimenter, but that the underlying cognitive constructs are the same for all individuals. More generally, *EP* illustrates singular situations of interaction between the experimenter and the participant which are giving and exchanging. Such a paradigm is not only interesting for psychologists and economists but also represents an emblematic paradigm for anthropologists. Indeed *EP* illustrates experimentally the anthropological paradigm of the “gift” with its triptic “giving,” “receiving,” and “giving back” (discussed since Mauss, 1924; Malinowski, 2018) which can be easily studied in different cultures. Indeed, Mauss (1924) in his study of Maori gift giving (the “spirit of the gift”) suggests that, in many societies, the objects given are ultimately “inalienable,” that is, they cannot be entirely detached from the giver, but carry within them something of the personality of that person. They carry significant implications for the future actions of the receiver and for the relationship between them. This originality of Melanesian societies was observed by Henrich et al. (2005) in a study of the ultimatum game<sup>3</sup> among the *Au* and *Gnau* of Papua New Guinea in which the majority of participants reject the seemingly generous offers of the proposer when it represents more than 50%. The explanation provided by Henrich et al. (2005) is as follows:

<sup>2</sup>In the Apicella et al. (2014, Appendix p. 1) describing the procedure, the context of giving a present is clearly stated: “Experiments were conducted privately, in Swahili, by one of the authors (Apicella) during her last day of residence in each camp. On this final day, gifts, such as knives and pots, are normally given to participants as an expression of gratitude. Added to the gift list were lighters and cookies. Participants were called individually to receive their gift and upon approaching the experimenter the following occurred...”.

<sup>3</sup>The ultimatum game (Harsanyi, 1961) illustrates the final negotiation phase between two players: a “proposer” *A* and a “responder” *B*. *A* initially receives a certain number of units (usually 10) from the experimenter. *A* must offer to give some of his units to *B*. The latter can accept or refuse their offer. If *B* accepts the offer, the units are exchanged between the two players and kept. If *B* refuses, both players lose all the units. In a second round of play, player *B* becomes the proposer and player *A* the responder. Economic theory states that it is rational for the respondent to accept all possible offers from the proposer even if they are minimal (i.e., if it is only one unit) because the alternative is not winning anything. However, the great majority of experiments on the ultimatum game has shown that minimal offers (less than 3 units) are very often rejected. Fair share offers (4, 5 units) are widely accepted (see for a recent study Beaunay et al., 2022).

In these societies, accepting gifts, even unsolicited ones, implies a strong obligation to reciprocate at some future time. Unrepaid debts accumulate, and place the receiver in a subordinate status. Further, the giver may demand repayment at times or in forms (e.g., political alliances) not to the receiver’s liking, but the receiver is still strongly obliged to respond. As a consequence, excessively large gifts, especially unsolicited ones, will frequently be refused. (Henrich et al., 2005, p. 811).

This specificity of gift and return-gift (reciprocity norm), as a key factor in social interactions, present in all Melanesian societies (Godin, 2015; Tcherkézoff, 2016), certainly produces a different interpretation of the experimenter’s gift than that of the Western participants gift. In an *EP* effected in a Melanesian context, a Melanesian participant who receives an object from a Melanesian experimenter will also tend to perceive this endowment as a gift. However, this gift is not perceived as “a present” (as it is for Westerners) but as the source of the exchange that allows the interaction between the two individuals (here the experimenter and the participant) to come alive. It will be the same later in the question of exchange with an equivalent object, the participant can either accept it or refuse the exchange. We assume that there is no endowment effect in *EP* if the interaction involves two Melanesian individuals.

The Kanak of New Caledonia in the South Pacific is a native Melanesian population located for the most part in the Northern Province and in the province of the Loyalty Islands. Kanak society has several levels of customary authority, from the 4,000 or 5,000 family clans to the eight customary areas that make up the territory. At the head of clans are clan chiefs and clans constitute 341 tribes, with a chief at the head of each one. The tribes are then grouped into 57 customary chiefdoms, with chiefs at their head, and forming the administrative subdivisions of the customary areas. In Kanak society, giving and exchanging play a primordial role in private interactions but also in the structure of society, notably with the ceremony of the custom. The Kanak population is all the more interesting to study because it is partially bicultural. Thus, the Kanak are also perfectly familiar with all the social codes of French Western society (notably through the obligation for all French children from the age of 3 to attend the school of the French Republic). The cross-cultural studies on Kanak populations are rare, however we can note Jamet et al. (2014).

After a pragmatic analysis of the possible implicatures of Western participants confronted with *EP*, we will explain the particularity of Kanak society and why Kanak participants should not be subjected to the endowment effect in *EP*. In our experiment we will distinguish the French Western context and the Kanak context in order to look at the adaptive capacity of the Kanak between the two cultures.

## 2. THE AMBIGUITY OF THE EXCHANGE QUESTION

The literature on reasoning and decision making offers numerous examples in which behaviors or responses given by participants, initially judged to be erroneous, reveal a coherence with

respect to the inferred representation of the participants to the requested task. These representations can be explained by the different pragmatic implicatures coming from the violations of the conversational maxims of cooperation of Grice (1975) (see Dulany and Hilton, 1991; Schwarz et al., 1991; Sperber et al., 1995; Baratgin and Noveck, 2000; Macchi, 2000; Politzer and Macchi, 2000; Baratgin, 2002, 2009; Bagassi and Macchi, 2006; Baratgin and Politzer, 2006, 2007, 2010; Macchi and Bagassi, 2012; Politzer, 2016; Macchi et al., 2019, 2020; Bagassi et al., 2020; Baratgin et al., 2020, for examples). The experimental paradigms are constructed through speech acts and the gestures of the experimenter and are, as in any communication fact, pragmatic in nature (Sperber and Wilson, 1986, 2002). The participants make assumptions about the experimenter's expectations and use the simplest interpretation procedure which consists in inferring from the communicative stimulus the intention most relevant to their own point of view (Sperber (1994). However, what is relevant to the participant may be different from what the experimenter actually intends to communicate. Questions are relevant when they lead the person to whom they are directed to respond in a relevant way (i.e., questions that require the least cognitive cost for the most contextual effect). The exchange question in *EP*, can be interpreted differently depending on the social norms of the participants. In particular, we will be interested in the different interpretations of the question of exchange in a Western population (French population of Metropolitan France) and in a Kanak population in the South Pacific. The issue of social norms in the act of giving is important to understand. Before looking specifically at the issues of gift and exchange in French and Kanak society, we will briefly review the various theories of social norms of politeness.

In social interactions, norms of politeness are crucial. They help reinforce collaboration through rules that are known to all members of society. These rules lead to implicit expectations in actions and words from people interacting together (Geraci, 2020; Geraci and Franchin, 2021; Geraci et al., 2021). Since Leech (1983), it is admitted that communicative exchanges are subjected to the fundamental postulate “to be polite” in our interactions. He proposes a series of maxims and sub-maxims based on the “cost” and the “benefit” in relation to the interaction between *self* and *other*. Thus, if the benefit is higher to the receiver than the cost, then it seems to be more polite. On the contrary, if the cost is higher than the benefit to the recipient, then it seems to be less polite.

The model of politeness theory described by Brown and Levinson (1987) is the reference for most studies on politeness (for a critique see Fraser, 1990; Watts, 2003). The model is also intended to be “universal.”<sup>4</sup> The authors use the notions of *face* from (Goffman, 1967, 1971) to define their pragmatic

theory of politeness. The *face* is: “the positive social value a person effectively claims for himself by the line others assume he has taken during a particular contact” (Goffman, 1967, p. 267). Brown and Levinson (1987) maintain that each individual has two types of *face*; a negative face and a positive face. The positive face is the individual's desire to be appreciated and approved in their social interaction (valuing the image of the individual) and the negative face is their desire for freedom of action and to impose their ideas and desires (protection or defense of “[their] territory”). Brown and Levinson (1978, 1987), also use the hypothesis of Goffman (1967) that, for an individual, any interaction with others is a potential source of conflict. The rules of politeness correspond to ritual constraints, codes and strategies which aim at preserving the face (positive or negative for Brown and Levinson, 1987) of the interlocutors by avoiding conflicts. These norms thus assume the essential functions of facilitation and regulation of social interactions and are, following a learning phase at the youngest age, strongly internalized (Talwar et al., 2007). Throughout the course of the interaction, the interlocutors perform a number of verbal or non-verbal acts that potentially constitute threats to the positive or negative face of both interlocutors. The objective for the participants is to reduce as much as possible these Face Threatening Acts (FTA).

## 2.1. The Question of Exchange of Gifts in the Western Culture

In French (but also in all European languages), “donner” (to give) and “échanger” (to exchange) are the two verbs used to translate the action of transferring goods and services. The verb “donner” is polysemous, it is used when there is no financial counterpart (“Je donne à une association charitable,” I make a donation to a charity) or with a financial counterpart (“Donnez-moi un kilo de pomme,” Give me a kilo of apples, at a shop against money). It is also used for non-material goods (saying hello by shaking hands is called “donner une poignée de main,” giving a handshake). The verb *to exchange* is less ambiguous. It means to give something up in return for something else. We understand that the exchange is conditional to the counterpart. The counterpart comes to fill the imbalance, to cancel the loss. It is at the same time: the mean of the exchange, required, mandatory and a sign of the end of the exchange. To be exact, we will also use this verb by analogy with the exchange of material goods for the exchange of “words” or “politeness” (Testart, 1997; Darmangeat, 2016). In *EP*, when the experimenter gives an object to the participants, the context is not that of an experimental context. The situation takes place in a class in which the experimenter is the teacher and in which they offer an object to their students (who do not explicitly know that they are participating in an experiment). Thus, when they say, without any justification or explanation: “I give you a mug,” the student may be surprised by this gift. He does not know if this gift is free (or at least seems to be)

known by the participants. This knowledge leads to different politeness strategies (Spencer-Oatey and Jiang, 2003).

<sup>4</sup>Several comparative studies of languages other than English have shown significant differences (see Urquiza, 2009, for a review). We take the model described by Brown and Levinson (1987) as “universal” in the sense that it provides a general framework to explain (in part) the participants' implicatures in *EP*. These implicatures of the participants, on the expectations of the experimenter, are a function of the context and of the cognitive effort that they produce (Sperber and Wilson, 1986; Escandell-Vidal, 1996; Jary, 1998). These two notions of context and cognitive effort are themselves strongly dependent on the specific social norms



or if the teacher will later ask for something in return<sup>5</sup>. One can therefore really consider, as do Plott and Zeiler (2007), that in this first important stage of *EP* the given object corresponds to, even if it is not explicitly specified, an item given without counterpart: a gift. Thus, for the participant, this is a new, free, altruistic and generous action. The object given is interpreted as a present. According to Brown and Levinson (1987) such an offer should be understood as an FTA against the negative face of the participant, since the acceptance sets up for them a kind of debt which they will have to pay back. However, we think that this gift can also be seen as an act that enhances the positive face of the participant, especially since this gift is provided by the experimenter (their teacher) who is hierarchically superior. Thus, this offer should be understood by the participant as a friendly sign of sympathy and of appreciation from the experimenter; as a gift to be accepted. One can think then that for Western participants, in an automatic way, the social norms of politeness acquired in society inherent to the reception of a gift are activated. The participants accept this gift which reinforces a pragmatic collaboration with the experimenter since in our contemporary western societies, the act of giving something is perceived by the participant as a significant act of sympathy which expresses a particular link between giver and receiver. This act of giving is therefore received positively by the participant. If the given object is perceived as a present, the participants must follow the socially appropriate behavior in accepting the object and also expect the experimenter to follow the socially appropriate behavior of the giver. This is what the experimenter does at first, as they no longer talk about the given object and move on. Often they continue their lecture or the students are tasked to do some work (e.g., to fill in a short questionnaire, see Knetsch, 1989). The second stage of *EP*, that of the request for an exchange, clearly corresponds to a departure from the norm of politeness expected of someone offering a gift. This violation of the social norms is especially strong when decision-making (accepting or refusing the exchange) happens face-to-face with the experimenter. This violation of the social norms of politeness is all the stronger contextually. In French there is a well-known expression dedicated to the situation: “donner c’est donner et reprendre c’est voler” (giving is giving and taking back is stealing). This request for an exchange, still without any justification or explanation, for the object previously “offered” by the participant encourages several possible implicatures on the part of the participant.

- The experimenter regrets the first present they gave and now offers another object to replace the initial gift or to get it back (though it is not because they do not think it is important enough as the object offered in return has a similar value).
- The first endowment was in fact not really a free gift but that it served for this question of exchange.

In the first case, this request is seen as a threat to the negative face, to take back an object that is part of my “territory.” Moreover, if

the participant accepts the exchange, then they in turn produce a threat on the positive face of the experimenter by explicitly showing that they did not in fact appreciate the gift and are happy to exchange it. Thus, the participant should not exchange because that would be to say that the first gift was not satisfactory. In the second case, the context is updated by the participant. The initial offer was clearly an FTA and required something to be given in return. There is obviously a violation in the cooperation with the giver and on the receiver’s side, the cooperation is also stopped by refusing the exchange. In either case the appropriate response is to keep the object. It is this response that requires the least cognitive effort and allows one to remain in the initial adequate context of the representation of the item as a gift. Thus, in our view, *EP* implicitly favors a response that conforms to the norms of politeness in use in Western societies. This explanation was supported by the disambiguation of the paradigm using a NAO robot instead of a human experimenter. In this disambiguated context, where the norms of politeness are not activated (one is not polite with a machine), the endowment effect disappears (see Masson et al., 2015, 2016; Masson et al., 2017a,b).

## 2.2. The Question of Exchange of Gifts in the Kanak Culture

To understand how the question of exchange in *EP* should be interpreted by Kanak participants, we must first explain how exchange structures social relations in Kanak society. In order to do this, we must make what is a complete shift of reference frame for a Westerner. What allows society to exist in the Western world is the democratic (individualistic) relationship. All the aspirations, all the new rights, all the reductions of inequality of the citizens are discussed and settled in the framework of the democratic game. Once the law is voted by representatives, it applies to all and by all. Laws are followed because they have been voted in the name of the people, by the people’s representatives. All these laws constitutes the social contract. It will evolve as society changes. Western society is a law-based society. Kanak society is a strongly holistic society (Dumont, 1983; Godin, 2015; Tcherkézoff, 2016) established on another principle than the individual rights. This first principle is exchange, more precisely of exchange of gifts. The exchange is what allows the Kanak society to make society. In order to understand exchange in the Kanak world, we will begin by briefly examining the notion of exchange from a linguistic point of view in Kanak languages in relation to French, and we will then present custom, a structuring practice in Kanak society.

This importance of exchange is visible from a linguistic point of view different terms are used to specify the different types of exchange. For example, in the *némi* language, the generic term to express exchange is *pe-na-aman*, literally “to give [na] things [aman] to each other [pe].” This is the dedicated name attributed to a reciprocal giving of gifts and not to a simple isolated transfer. In this term, the action is double, it integrates the “gift,” but also “the gift in return” (*hiwec*). This double action has for main objective not to satisfy a material balance of the exchange but *to tie, to support and to maintain the social bonds* (social bonds of kinship, of neighborhood, of mutual aid...). A second term

<sup>5</sup>In psychology or experimental economics classes, students may receive goods in exchange for their participation as participants in experiments, but this is always explained and the goods are often given after the experiment.

*ge-na-aman* is used for “ceremonial” exchanges. These are the exchanges that sanction the different stages of a person’s social life, from birth to death. These exchanges of gifts must take place between the paternal and maternal relatives of the person and, beyond a desire to honor the person themselves, proceeds from a whole ritual cycle of renewal of “life” (named *maric*) (Godin, 2018). The prototypical *pe-na-aman* exchange of gifts is manifested by a double transfer of objects: a transfer from the individual (or group) X to the individual (or group) Y then a reciprocal transfer of the individual (or of the group) Y toward the individual (or toward the group) X. Contrary to the idea that the gift is a free act performed without any hope of a return, the first of the two transfers is here accomplished in expectation of a return, but here unlike what happens in the exchange this return is not conceived or perceived as a equivalent or as a compensation, but as a sign of reciprocity (Komter, 2007) and an acquiescence in the social relationship that one wants to create or continue. In Kanak society as in many other Oceania societies, the reciprocity of gifts establishes the social bond. And from this point of view, the value of objects is less important here than their social significance, even if there is indeed an accounting of given and returned “things” which shows the partners’ concern to live up to the level of the established link and of reciprocal obligations that it imposes (Godin, 2015, 2018).

This dyadic form of the exchange of gifts is found in all welcoming ceremonies. People arriving face the hosts and the latter proceed to a gift of goods and words toward the welcomed. Then it is the welcomed person who proceeds to a return-gift toward the welcoming person. The conclusion of this face-to-face meeting ends with a meal (Monnerie, 2020). This modality of exchange is called “coutume,” French for custom. In Kanak culture, all the events (birth, marriage, death, adoption of a child, dispute between neighbors, visit to a friend, etc.) that punctuate life, whether they are large or small, are all occasions for “faire un geste coutumier” (making a customary gesture). Making the custom consists of carrying out a set of acts that are indispensable for entering the Kanak world and to create or reestablish social ties in this world (Godin, 2015; Monnerie, 2017, 2020; Bretteville, 2019). It gathers a whole set of gestures in a space of speech and listening. Seen from the outside, its specificity is that it is based both on an exchange of goods and on an exchange of words. It should always be kept in mind that for the Kanak person, speech and gifts are inseparable. Relationships are considered to be unpredictable and ever changing and thus must be periodically reactivated. The relationship always precedes the things exchanged. These exchanges involve both the living and the dead. This system of social relations is based on a deep respect for natural forces, for the power of the word and for the gesture of exchange (see for more details Godin, 2015). The custom can be carried out between two people, between two clans, between two tribes, between two districts between customary areas and then mobilizes hundreds of participants. The custom allows each of the protagonists to live the double experience of being the host and the welcomed. This experience makes it possible to understand the relative character of these positions.

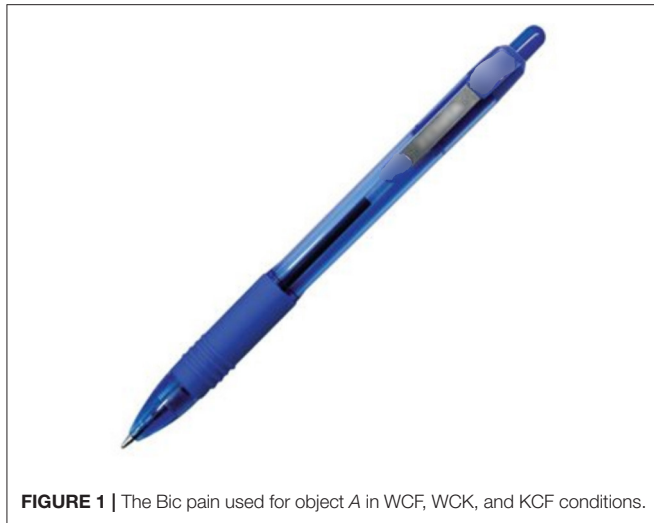
The Kanak person is thus confronted throughout their life in a daily manner with the action of giving and return-giving.

We believe that when confronted with *EP*, the Kanak participant may have a different representation of the task, all the more so if the experimenter (the donor) is also Kanak and speaks to them in their language. Thus, in this situation, the gift is taken as an initial exchange that must be followed at some point, immediately or another day, by a return gift from the participant to the experimenter. We think that the gift made by the experimenter will be interpreted differently depending on whether they do or do not belong to Kanak culture. The differences will only really appear when offering to exchange the first gift for another. If the experimenter is a foreigner, European or other, the exchange proposal will be interpreted in the register of the material exchange. If the experimenter is Kanak, on the contrary, it will be understood in the register of the gift which subordinates the material value of things to the establishment of a personal relationship. The exchange can then be carried out with all the less reluctance since it can be perceived as an extension of the gift, or even its reiteration. The existence of a family bond between the experimenter and the participant will only reinforce this tendency to accept the exchange.

The aim is always to make connections. Thus, there is no surprise in receiving something, even if it is a teacher, because it is a usual action in any human relationship in the social norm of the Kanak culture. When it comes to the question of exchange there is here, contrary to the Western context, no departure from the norm. We remain in the continuation of the previous exchange. It is not at all unusual for the Kanak participant that someone who offered something asks to exchange the good that has just been given. The desire for a link between individuals is thus pursued. Thus, the participant may accept the exchange or refuse it for a future exchange with another object. Thus, our first hypothesis is that in this situation of an interaction between a Kanak experimenter and Kanak participants (“Kanak” context), we should not have an endowment effect. Now when the experimenter is Western in a Western context, it is possible that in this “French” context the Kanak participant, who has both French and Kanak culture, adopts the social norms of French politeness and behaves like a French participant with an endowment effect. Finally, we hypothesize that the simple interaction with an experimenter from the same ethnic group, speaking in the appropriate language of that group, should lead to a change in response in *EP*. Neither the environment, i.e., the place of the experiment, nor the symbolic quality of the objects of the experiment should play a primordial role.

To test these three hypotheses, we conducted a similar experiment as was described by Knetsch (1989) on Kanak participants either in a Western context and in French with a Western experimenter, or in a Kanak context and in the vernacular with a Kanak experimenter in the same French environment (a vocational training center) and with French objects not typical of Kanak culture. In the first situation, in the French context, Kanak participants should behave similarly to Western participants under the same conditions. However, in the Kanak context, we should observe a decrease, or even an absence, of the endowment effect. This behavior should be similar to that of participants undergoing the experiment in a strongly Kanak place (the tribe) and with





**FIGURE 1** | The Bic pain used for object A in WCF, WCK, and KCF conditions.

objects that are strongly prototypical of objects used during the custom ceremony.

### 3. EXPERIMENT: THE EXCHANGE PARADIGM IN FRENCH AND KANAK CONTEXTS

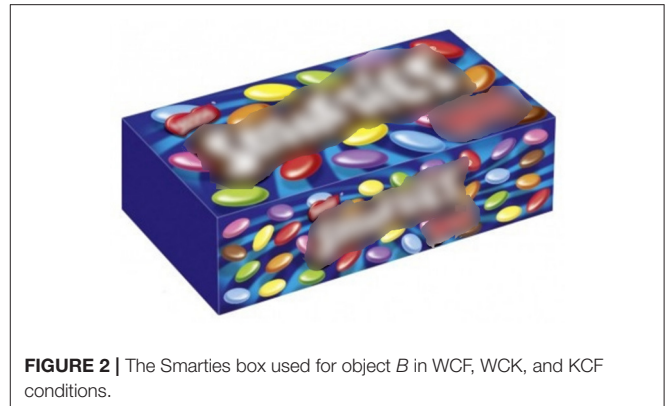
#### 3.1. Materials and Methods

##### 3.1.1. Participants

Three hundred and sixty adult participants in continuing education in metropolitan France (90 participants) and New Caledonia (270 participants) were recruited<sup>6</sup>. The 90 participants from metropolitan France (40 women and 50 men aged 28 to 48,  $M = 34.6$ ) came from urban areas in the outlying departments around Paris (Essonne, Yvelines, Haut de Seine and Val d'Oise). They were all native French speakers and natives of metropolitan France (for simplicity we will refer to them hereafter as “French participants”). All participants were normotypical and not prone to depressive disorders nor to burnout. Indeed, it was observed that there was no endowment effect in participants suffering from burnout (Jamet and Baratgin, 2018). The 270 participants (133 woman and 137 men aged 22 to 40,  $M = 32.6$ ) from New Caledonia were French of Kanak origin. They all lived on the mainland, in the Northern Province, in the towns of Koumac (west coast) and its surroundings, but also in the towns of Ouéga and Poindimié and its surroundings (east coast). They all were French speakers but their mother tongue was a Kanak vernacular language, mainly the Nemi and Nixumwak languages<sup>7</sup> (for simplicity we will refer to them hereafter as “Kanak participants”).

<sup>6</sup>Written informed consent to participate in this study was provided by the participants. All data was collected anonymously. The experiment was reviewed and approved by the Ethics Committee of the P-A-R-I-S Association. The Ethics statement can be obtained here: <https://osf.io/6hdxs/>.

<sup>7</sup>There are about 17 vernacular languages and 6 dialects in the Northern Province.



**FIGURE 2** | The Smarties box used for object B in WCF, WCK, and KCF conditions.

##### 3.1.2. Experimental Conditions and Materials

From the two contexts, “Western” and “Kanak,” we designed four conditions. In all conditions, the experimental procedure was exactly that of Knetsch (1989).

1. The “Western” context (noted WC): the experiment took place in a French vocational training center, the experimenter was French and spoke in French. The objects were French objects: the object A was a Bic pen and the object B was a mini box of smarties (see **Figures 1, 2**). The economic value of these two objects was low. It was close to 100 Pacific francs<sup>8</sup> and was 0.50 euro cents in France. This WC context was carried out with two groups:
  - (a) A group of French participants (condition noted WCF, which will be our control condition),
  - (b) A group of Kanak participants (condition noted WCK).
2. The “Kanak” context (noted KC) in which the experimenter was Kanak and spoke in a Kanak vernacular language, in two conditions:
  - (a) In a French environment (noted KCF): the experiment was carried out in the same French vocational training center and with the same French objects as in the “Western” context (A was a Bic pen and object B was a mini box of smarties (see **Figures 1, 2**).
  - (b) In a Kanak environment (noted KCK): the experiment took place within the tribe and the two objects were those found during the custom ceremony. Object A was a small braided mat measuring  $1.30 \times 1.50$  m made of pandanus and object B was a fruit tree plant (see **Figures 3, 4**). The economic value of the two objects was similar: 1,000 Pacific francs.

The 90 French participants were all distributed in the WCF condition (control group). The 270 Kanak participants were randomly distributed according to their sex and age in one of three conditions: WCK (44 women and 46 men from 22 to 35 years old,  $M = 35$  years old), KCF (45 women and 45 men from 22 to 40 years old,  $M = 32.2$  years old) and KCK (44 women and

<sup>8</sup>1 Pacific franc is about 0.0083 Euro. We chose inexpensive objects, as noted above, as this avoids the refusal of the object by the Kanak participants who could not subsequently return a good of at least the same value (Henrich et al., 2005).



**FIGURE 3 |** The small braided mat of Pandanus used for object A in the KCK condition.



**FIGURE 4 |** The fruit tree used for object B in the KCK condition.

46 men from 22 to 44 years old,  $M = 30.6$  years old). A summary of the donation design is given in **Table 1** below.

### 3.1.3. Procedure

For all conditions (WCF, WCK, KCF, and KCK), data collection was carried out in several stages with groups of participants. For WCF, WCK, and KCF, it was carried out in a vocational training center during practical work, whereas for KCK the data collection took place during different visits, according to the events (births, marriages, deaths, visits) of the inhabitants, after having proceeded to a custom of “good morning.”<sup>9</sup> The procedure was that of Knetsch (1989). For the four conditions the participants were randomly distributed in the three following groups:

1.  $P_{\text{Group}}$  evaluated the preference of the objects A and B. Participants were asked to choose which of object A or object B they wished to receive. To assess the preference between

the two objects, the experimenter (female)<sup>10</sup> presented them to the participants. She asked if they preferred object A or object B. This question was formulated in the French language by a French experimenter (female) in the WCK and WCF conditions and in the vernacular language by a Kanak experimenter in the KCF and KCK conditions.

2.  $A_{\text{Group}}$  received object A, and to which the experimenter (female) then asked if they wished to exchange it with object B. The procedure was as follows:
  - (a) The experimenter handed object A to the participant and said: “I am giving you [Object A]. Keep it, it is yours.” This information was given in French by the French experimenter in the WCF and WCK conditions and in vernacular by the Kanak experimenter in the KCF and KCK conditions. The experimenter placed object A in front of each participant.
  - (b) The experimenter then gave a one-page document (masking task) to each participant. The participant, after having indicated the date, their first name, their age, their place of birth, the languages spoken and their education proceeded with the task. For the French participants of WCF and Kanak participants of the WCK and KCF, a questionnaire on the professional project was proposed to them (see document to <https://osf.io/4cz8y/>). The activity lasted about 15–20 min. For the Kanak participants in the KCK condition, the task consisted of translating a rhyme from French into the vernacular language (see document at <https://osf.io/ey829/>).
  - (c) Once the task was completed, the experimenter asked each participant privately whether or not they agreed to exchange object A for object B. “Earlier, I gave you this [object A]...” The experimenter points to object A. “Would you be willing to exchange your [Object A] for this [Object B]. This statement was made in the French language by the French experimenter in the WCF and WCK conditions and in the vernacular language by the Kanak experimenter in the KCF and KCK conditions.

3.  $B_{\text{Group}}$  received object B. The female experimenter then asked if the participant agreed to exchange it with object A. The procedure was otherwise the same as in  $A_{\text{Group}}$ .

### 3.2. Results

The results are given in **Table 1**. Participants in  $P_{\text{Group}}$  for the WCF, WCK and KCF conditions showed an indifference between receiving object A (the Bic pen) or object B (the smarties box). Thus, these objects, although strongly Western, were preferred in the same way by French and Kanak participants. Similarly, the Kanak in condition KCK did not show any form of preference for object A (pandanus) nor for object B (fruit tree seedling). There was no difference compared to a random choice 50/50 ( $Z = 0.26$ ,  $p = 0.4$  for WCF,  $Z = 0$ ,  $p = 0.5$  for WCK,  $Z = -0.26$ ,  $p = 0.6$  for KCF and KCK). We analyzed the

<sup>9</sup>When meeting Kanak friends, the custom is to exchange a mat, a banknote, etc.

<sup>10</sup>To avoid gender affecting the quality of the exchanges, the experimenter was always a female in all our groups. The Kanak experimenters collected the data within their tribe. They were known to some of the participants (those in the clan).

**TABLE 1** | Design features and results for the four conditions ( $N = 360$ ).

	<b>WCF</b> <b><math>N = 90</math></b>	<b>WCK</b> <b><math>N = 90</math></b>	<b>KCF</b> <b><math>N = 90</math></b>	<b>KCK</b> <b><math>N = 90</math></b>
<b>Design</b>				
Participants	French	Kanak	Kanak	Kanak
Experimenter female	French	French	Kanak	Kanak
Language	French	French	Vernacular	Vernacular
Location	Vocational training center	Vocational training center	Vocational training center	Tribes
Object A	Bic pain	Bic pain	Bic pain	Pandanus
Object B	Smarties box	Smarties box	Smarties box	Fruit tree plant
<b>Results</b>				
$P_{\text{Group}}$	$N_P = 30$	$N_P = 30$	$N_P = 30$	$N_P = 30$
Prefer object A	16 (54%)	15 (50%)	14 (46%)	14 (46%)
Prefer object B	14 (46%)	15 (50%)	16 (54%)	16 (54%)
$A_{\text{Group}}$	$N_A = 30$	$N_A = 30$	$N_A = 30$	$N_A = 30$
Keep object A	26 (86%)	24 (80%)	17 (56.7%)	17 (56.7%)
Trade for object B	4 (14%)	6 (20%)	13 (43.3%)	13 (43.3%)
$B_{\text{Group}}$	$N_B = 30$	$N_B = 30$	$N_B = 30$	$N_B = 30$
Keep object B	24 (80%)	25 (83%)	13 (43.3%)	16 (54%)
Trade for object A	6 (20%)	5 (17%)	17 (56.7%)	14 (46%)
Difference $A_{\text{Group}}$ (keep object A) – $B_{\text{Group}}$ (trade for object A)	20 (66%)	19 (63%)	0 (0%)	3 (0.7%)
$Z$ , $p$ -value <sup>a</sup>	5.17, < 0.001	4.91, < 0.001	0, .50	0.77, .22

<sup>a</sup>The null hypothesis is that the percentage of participants who chose to keep object A received in  $A_{\text{Group}}$  is equal to the percentage of participants who chose to exchange object B received with object A in  $B_{\text{Group}}$ . The alternative hypothesis is that there is an endowment effect, i.e., the percentage of participants who chose to keep object A received in  $A_{\text{Group}}$  is greater than the percentage of participants who chose to exchange object B received with object A in  $B_{\text{Group}}$  (Zellen test).

endowment effect in the exact same way as Knetsch (1989), Plott and Zeiler (2007), Knetsch and Wong (2009) by looking at whether we could observe a strong exchange asymmetry between  $A_{\text{Group}}$  and  $B_{\text{Group}}$  ( $Z = 5.17$ ,  $p < 0.001$  for WCF and  $Z = 4.91$ ,  $p < 0.001$  for WCK). As expected, we found a strong endowment effect (exchange asymmetry) in the WCF condition which matched the classical results of the standard of Knetsch (1989). We also observed a strong endowment effect in the same proposition of Kanak participants in the WCK condition. We found no difference between WCF and WCK neither for  $A_{\text{Group}}$  (26 participants kept object A for WCF, 24 for WCK,  $Z = 0.69$ ,  $p = 0.24$ , and 24 kept object B in WCF, 25 in WCK,  $Z = -0.63$ ,  $p = 0.76$ ) and for  $B_{\text{Group}}$ . We observed an absence of endowment effect in the other two conditions: KCF and KCK. The participants behaved in the same way whether they were in  $A_{\text{Group}}$  or in  $B_{\text{Group}}$ . When comparing KCF and KCK, we found a similar proportion of participants who kept object A in  $A_{\text{Group}}$  and participants who had chosen object A in  $P_{\text{Group}}$  (17 vs. 14 in KCF and KCK,  $Z = 0.77$ ,  $p = 0.22$ ) who kept object B in  $A_{\text{Group}}$  and participants who chose object B in  $P_{\text{Group}}$  (13 vs. 16 in KCF,  $Z = -0.77$ ,  $p = 0.78$  and 14 vs. 16 in KCK,  $Z = -0.52$ ,  $p = 0.69$ ).

## 4. DISCUSSION

The aim of this study was to propose a new explanation for the endowment effect observed in *EP*. The endowment effect would be due to the respect of the social norms in force

in the individuals' society. Our results seem to be coherent with this hypothesis. Kanak participants are subject to the endowment effect only when the context of the experiment involves interaction with a French experimenter and in a communication made in French (WCK). The endowment effect found is comparable to the one obtained under the same conditions with French participants from metropolitan France (WCF). On the other hand, when the experiment involves an interaction between Kanak (experimenter and participants), in a communication expressed in the vernacular language of the participant, the endowment effect disappears (KCF). Acceptances and refusals of the exchange are balanced in the same proportions as the participants' preferences of the two objects. It is important to note that this change in behavior is observed while *EP* is performed with Western objects, in a Western location and without any other explicit information. The lack of an endowment effect found is comparable to the situation in which the ceremonial context of Kanak exchange is accentuated by the experimenter's words and the performance is conducted in the tribe with prototypical customary objects (KCK). These results have several important implications, not only for understanding the endowment effect found in *EP* by Knetsch (1989) but also on other aspects discussed below.

These results corroborate the criticisms of Plott and Zeiler (2007) on the traditional explanation of loss aversion (Thaler, 1980; Knetsch, 1989; Kahneman et al., 1990). But they are also in dissonance with alternative explanations, whether it be the evolutionary one of a defense of the territory (Heifetz and Segev,

2004; Huck et al., 2005) or those stemming from a particular attachment to the object (see for a review Morewedge and Giblin, 2015). Indeed, the Kanak participant does not seem to have any aversion to exchanging the object in the KCF or KCK condition and does not show any indication of a particular desire to own it. In the Western context, explanations in terms of loss aversion and territorial defense seemed relevant. In fact, our explanation was not visible because it blended with these ones, since the model of Brown and Levinson (1978, 1987) explains the refusal of the exchange with both loss aversion or defense of territory. It is the use of a different social context that distinguishes all these explanations. Our study is a new example of the importance, for cognitive psychology, to take into consideration the points of view coming from other disciplines like anthropology (Sperber and Hirschfeld, 1999). They illustrate, indeed, the ideas of Mauss (1924), Malinowski (2018) on the exchange of gifts in many traditional societies in the World, especially in Oceania.

With this experiment, we provide new experimental arguments in favor of a pragmatic explanation of the endowment effect observed in *EP*. Culture, and in particular the social norms of individuals, shapes the pragmatic interpretation of the experimenter's offer as a gift (as Plott and Zeiler, 2007, were the first to make the hypothesis). In a French context, the least onerous interpretation of this unusual action is to consider the object as a present. In the Kanak context, the interpretation of the gesture of giving is different, it is an introductory exchange in order to build or consolidate a social bond; it is a usual (even anodyne) gesture in the Kanak world. The proposal of exchange in the French context is confusing. It illustrates a violation of the social rules expected after the offering of a present. It causes an updating of the implicatures of the participant regarding their expectations of the experimenter which results in a refusal of the exchange. In the Kanak context, the experimenter's exchange proposal does not cause an update of the Kanak participant's implicatures. The latter continues to infer that the experimenter wishes to further strengthen the social bond. There is no obligation to refuse this proposal, but one can also decide that the exchange will take place later with another object (of higher value).

According to this explanation, the refusal to exchange in the French context should not be interpreted as a lack of rationality on the part of the participant. Similarly, the Kanak participant in the Kanak context, who does not produce the endowment effect, should not be interpreted as behaving more rationally. In both situations the participant's decision is consistent with their implicatures and representations of the experimenter's expectations. For participants the value of the object is not the same because the object does not have the same meaning and value. When they are asked for their preference between two equivalent material objects in  $P_{\text{Group}}$ , the objects are simply physical objects ( $\text{objet}_{\text{physical}}$ ). Then, depending on the French or Kanak context, they have either the status of a present ( $\text{objet}_{\text{present}}$ ), or the status of an exchangeable good serving as a social link ( $\text{objet}_{\text{social}}$ ). They symbolically represent the gift that must continually nourish and recreate the social bond, precisely because what circulates (when and if it circulates) is the result, not the cause, of the social bond itself (Godbout, 2009). In all these

situations, we are exactly as in the Bayesian situation of a different subjective probability judgment of the same event according to the context (Baratgin, 2002, 2009; Baratgin and Politzer, 2006, 2007, 2010).

A good has no “utility,” in the sense of intrinsic physical quantity, outside its relationship with an individual who desires it. The experiment underlying the definition therefore concerns individual behavior. Like any psychological notion, to have sense from an operational viewpoint, it must be defined on the basis of behavior. When we are dealing with physical quantities, the experiment is obviously made as observer independent as possible (observer dependence would be a source of error). (de Finetti, 2012, p. 262).

This observation of the variability of the status of the object by the participant according to the cultural and social context is to our knowledge a new experimental result. This result illustrates Searle and Willis (1995) definition of “social objects”: Social objects are created by the fact that we consider or count a physical object as something that goes beyond the physical structure of that object, thus conferring on it a social status in a certain context - for example, by virtue of collective recognition, a piece of paper counts as a fifty-euro bill in the context of the economy. In the Western French context of *EP*, the object is considered by the Kanak participant as  $\text{objet}_{\text{present}}$  which is difficult for them to exchange, whereas it becomes  $\text{objet}_{\text{social}}$  in the Kanak context [this absence of an endowment effect when the object is perceived as an exchange good is, moreover, in line with the observations of Svirskey (2014) of an absence of endowment effect for money]. The gift of the object in Kanak society (as analyzed by Mauss, 1924) can be interpreted as an *institution* (in the sense of what makes the cohesion of society as defined by Searle and Willis, 1995) resulting from the self-transcendence of the social relations that the gifts themselves are expressly designed to create and according to which individuals orient their behavior (Cedrini et al., 2020). For a renewed reading of Mauss's work on exchanges (Tcherkézoff, 2016).

Our results also offer a new example of the flexibility of bicultural individuals, observed in other contexts (Gardner, 1985; LaFromboise et al., 1993). In particular, it corroborates the results found by Chuah et al. (2007, 2009) in the ultimatum game. The study compared the decision-making behavior of participants from Malaysia and Great Britain, taking into account the location of decision-making. It was observed that the amount offered was generally higher in the Malaysian treatment group (Malaysian offerers and responders) than in the British treatment group (British offerers and responders). However, when the groups were crossed, the Malaysian proposers generally offered lower amounts to the British but not to the other Malays. The British, however, did not change their behavior.

Finally, our results argue that, contrary to the assumption of economic theory that rational agents are self-interested, individuals' decision making is strongly influenced by social interactions such as social concerns for justice, fairness, and reciprocity (Gouldner, 1960; Henrich et al., 2005; Fiddick et al., 2013; Geraci, 2020; Culpeper and Tantucci, 2021; Geraci and



Franchin, 2021; Geraci et al., 2021). In particular, our work is further evidence of the need to broaden the range of regions for cross-cultural investigation for cognitive psychology and experimental economics (Henrich et al., 2010; Masuda et al., 2020). This opening should also be done for the study of populations from holistic societies, the great majority of which are from Asian countries (see for example Masuda and Nisbett, 2001; Nisbett et al., 2001; Nisbett and Masuda, 2003; Nisbett and Miyamoto, 2005; Choi et al., 2007; Yama et al., 2007; Nakamura et al., 2018).

## 5. CONCLUSION

The essential proposition that has been developed and tested in our study is that the answer to the offer of exchange in *EP* crucially depends on the social norms at play in the contextualized interactions between experimenter and participant. In *EP*, two key elements of social interaction shared by all human societies are brought into play: *gift* and *exchange*. This paradigm, which seems disconcertingly simple, is much more than an experimental paradigm that allows us to evaluate the endowment effect. It is a paradigm offering the possibility of understanding the core of social interactions in all human societies. In this paper, *EP* makes it possible to account experimentally, for the first time in psychology, for the particularity of exchange-based interactions between Kanak. It may also allow for the study of more detailed predictions made by anthropologists on interactions linked to filiation (Godin, 2015, 2018).

The Kanak, who are partially bicultural, show a flexibility, depending on the context, to give a response either in accordance with French social norms of politeness or in accordance with Kanak social norms of exchange (gift and return-gift). This result, however, may seem to contradict certain results in the literature. First of all, the behaviors, similar to the endowment effect, observed in certain primates (Lakshminarayanan et al., 2008; Kanngiesser et al., 2011; Brosnan et al., 2012; Flemming et al., 2012) cannot be explained in terms of the social norms of politeness (of a Western society). It is the same to explain the appetite of very young children (2 years old) to keep an object that they have just received (Gelman et al., 2012; Hood et al., 2016). Indeed the concept of property and especially that of transfer of property, are completely acquired only from 4 to 5 years old (Blake and Harris, 2009, 2011; Nancekivell et al., 2013; Davoodi et al., 2020). This is the age when children, unlike apes, respect property as a cooperative arrangement, in which they inhibit their tendency to take the property of others on condition that others do the same (Kanngiesser et al., 2020). The acquisition of social norms starts from the age of 3 years old (Schmidt et al., 2016), but the norms of politeness, seem to be acquired even later (Axia and Baroni, 1985; Baroni and Axia, 1989). One can thus probably think that the endowment effect is part of a developmental trajectory and would take two forms. The first one, “primitive,” in primates and young human primates, can be explained by an evolutionary justification (Bruner et al., 2020). The second,

more sophisticated, depends on the pragmatic abilities and the capacity toward a theory of mind of the individual and manifests itself by behaving accordingly to the specific social norms of the society in which one lives. This hypothesis makes it essential to reproduce our study with Kanak children of several ages. A very recent study (Prou, 2021) indicates an endowment effect in Kanak children aged 4–5. However, this study does not allow any conclusions to be drawn because it was conducted in a French context (nursery school with a French teacher/experimenter and in French). The study carried out among older Kanak children aged 6–7, conducted in a tribe, by a Kanak experimenter and in the Kanak language, indicates a reverse endowment effect (the vast majority of children accept the exchange (Jamet et al., 2017a,b; Jamet and Baratgin, 2018)). This result can be explained by the identification of children with their cultural group, which leads them to imitate in excess the behavior observed in adults. The next studies should be conducted under a comparative life span approach with the two different contexts.

## 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 human participants were reviewed and approved by Mr. Maudinet Marc, PhD in anthropology, Former pedagogical director of the master Gestion et Politiques du Handicap Sciences Politique of Paris, freelance councilor expert in the European Council, president of the scientific council of the FISAF. Mr. Deberge Dominique, retired professor of economy and management, retired education psychosociologist, Noumea, New Caledonia. Ms. Wanguene Marie-Louise, pedagogic councilor FELP, deputy mayor of the commune of Hienghène, Haut-Coulina tribe, New Caledonia. Mr. Lionel Zannier, manager of the formation of specialized teachers in the institute of formation of teachers of New Caledonia, Noumea, New Caledonia. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

JB and FJ: conceptual elaboration and design of the study. FJ and PG: data collection. JB: data analysis and draft of the manuscript. JB, FJ, and PG: critical revision of the manuscript. All authors contributed to the article and approved the submitted version.

## FUNDING

We thank the P-A-R-I-S Association for the technical and financial help we received as well as the CHArt laboratory which participated in financing the publication of the article in open access.

## ACKNOWLEDGMENTS

We would like to express our gratitude to all the small customary chefs from the following tribes: Galagaoui, Pagu, Paop, Wanap I and II, (Koumac district, customary area: Hoot Ma Waap), Balagam, Parawa, Saint Jean-Baptiste, Saint Joseph, Saint Michel, Saint Pierre, Saint Thimothé, Sainte

Anne (Bondé district, customary area: Hoot Ma Waap), Gööpä (Muhéo district, customary area: Paici Camuki) Nêxōwaa, Nāwéélé (Pondah district) as well as Isabelle Frou and Micheline Roépingi. We would finally like to thank Baptiste Jacquet for proof-reading the paper and Jean-Louis Stilgenbauer for his careful review of the first draft of the document.

## REFERENCES

- Apicella, C. L., Azevedo, E. M., Christakis, N. A., and Fowler, J. H. (2014). Evolutionary origins of the endowment effect: evidence from hunter-gatherers. *Am. Econ. Rev.* 104, 1793–1805. doi: 10.1257/aer.104.6.1793
- Axia, G., and Baroni, M. R. (1985). Linguistic politeness at different age levels. *Child Dev.* 56, 918–927. doi: 10.2307/1130104
- Bagassi, M., and Macchi, L. (2006). Pragmatic approach to decision making under uncertainty: the case of the disjunction effect. *Think. Reason.* 12, 329–350. doi: 10.1080/13546780500375663
- Bagassi, M., Salerni, N., Castoldi, V., Sala, V., Caravona, L., Poli, F., et al. (2020). Improving children's logical and mathematical performance via a pragmatic approach. *Front. Educ.* 5:54. doi: 10.3389/educ.2020.00054
- Baratgin, J. (2002). Is the human mind definitely not Bayesian? A review of the various arguments. *Curr. Psychol. Cogn.* 21, 653–680.
- Baratgin, J. (2009). Updating our beliefs about inconsistency: the monty-hall case. *Math. Soc. Sci.* 57, 67–95. doi: 10.1016/j.mathsocsci.2008.08.006
- Baratgin, J., Dubois-Sage, M., Jacquet, B., Stilgenbauer, J.-L., and Jamet, F. (2020). Pragmatics in the false-belief task: let the robot ask the question! *Front. Psychol.* 11:3234. doi: 10.3389/fpsyg.2020.593807
- Baratgin, J., and Noveck, I. A. (2000). Not only base rates are neglected in the engineer-lawyer problem: an investigation of reasoners' underutilization of complementarity. *Memory Cogn.* 28, 79–91. doi: 10.3758/BF03211578
- Baratgin, J., and Politzer, G. (2006). Is the mind Bayesian? The case for agnosticism. *Mind Soc.* 5, 1–38. doi: 10.1007/s11299-006-0007-1
- Baratgin, J., and Politzer, G. (2007). The psychology of dynamic probability judgment: order effect, normative theories, and experimental methodology. *Mind Soc.* 6, 53–66. doi: 10.1007/s11299-006-0025-z
- Baratgin, J., and Politzer, G. (2010). Updating: a psychologically basic situation of probability revision. *Think. Reason.* 16, 253–287. doi: 10.1080/13546783.2010.519564
- Baroni, M. R., and Axia, G. (1989). Children's meta-pragmatic abilities and the identification of polite and impolite requests. *First Lang.* 9, 285–297. doi: 10.1177/014272378900902703
- Beaunay, B., Jacquet, B., and Baratgin, J. (2022). "A selfish chatbot still does not win in the ultimatum game," in *Human Interaction, Emerging Technologies and Future Systems V*, eds T. Ahram and R. Taiar (Cham: Springer International Publishing), 255–262. doi: 10.1007/978-3-030-85540-6\_33
- Blake, P. R., and Harris, P. L. (2009). Children's understanding of ownership transfers. *Cogn. Dev.* 24, 133–145. doi: 10.1016/j.cogdev.2009.01.002
- Blake, P. R., and Harris, P. L. (2011). Early representations of ownership. *N. Direct. Child Adolesc. Dev.* 2011, 39–51. doi: 10.1002/cd.295
- Bretteville, D. (2019). "L'Os et le soufflé" ou les ancêtres porteurs de vie: Le système social et cosmique des Paimboa (Nouvelle-Calédonie). Inalco Presses.
- Brosnan, S. F., Jones, O. D., Gardner, M., Lambeth, S. P., and Schapiro, S. J. (2012). Evolution and the expression of biases: situational value changes the endowment effect in chimpanzees. *Evol. Hum. Behav.* 33, 378–386. doi: 10.1016/j.evolhumbehav.2011.11.009
- Brown, P., and Levinson, S. C. (1978). "Universals in language usage: politeness phenomena," in *Questions and Politeness: Strategies in Social Interaction*, ed. E. Goody (Cambridge: Cambridge University Press), 56–311.
- Brown, P., and Levinson, S. C. (1987). *Politeness: Some universals in Language Usage*, Vol. 4. Cambridge: Cambridge University Press. doi: 10.1017/CBO9780511813085
- Bruner, J., Calegari, F., and Handfield, T. (2020). The evolution of the endowment effect. *Evol. Hum. Behav.* 41, 87–95. doi: 10.1016/j.evolhumbehav.2019.10.004
- Cedrine, M. A., Ambrosino, A., Marchionatti, R., and Caillé, A. (2020). Mauss's the gift, or the necessity of an institutional perspective in economics. *J. Instit. Econ.* 16, 687–701. doi: 10.1017/S1744137419000687
- Choi, I., Koo, M., and Choi, J. A. (2007). Individual differences in analytic versus holistic thinking. *Pers. Soc. Psychol. Bull.* 33, 691–705. doi: 10.1177/0146167206298568
- Chuah, S.-H., Hoffmann, R., Jones, M., and Williams, G. (2007). Do cultures clash? Evidence from cross-national ultimatum game experiments. *J. Econ. Behav. Organ.* 64, 35–48. doi: 10.1016/j.jebo.2006.04.006
- Chuah, S.-H., Hoffmann, R., Jones, M., and Williams, G. (2009). An economic anatomy of culture: attitudes and behaviour in inter-and intra-national ultimatum game experiments. *J. Econ. Psychol.* 30, 732–744. doi: 10.1016/j.joep.2009.06.004
- Culpeper, J., and Tantucci, V. (2021). The principle of (im) politeness reciprocity. *J. Pragmat.* 175, 146–164. doi: 10.1016/j.pragma.2021.01.008
- Da Silva, S., Moreira, B., and Da Costa, N. J. (2014). Preschoolers and the endowment effect. *PLoS ONE* 10:e109520. doi: 10.1371/journal.pone.0109520
- Darmangeat, C. (2016). Don, échange et autres transferts. Formes simples, hybrides et composées. *L'Homme* 217, 21–43. doi: 10.4000/lhomme.28828
- Davoodi, T., Nelson, L. J., and Blake, P. R. (2020). Children's conceptions of ownership for self and other: categorical ownership versus strength of claim. *Child Dev.* 91, 163–178. doi: 10.1111/cdev.13163
- de Finetti, B. (2012). "ON PREFERABILITY," in *Giornale degli Economisti e Annali di Economia*, 71 (Anno 125) (2/3), 257–279.
- Dulany, D. E., and Hilton, D. J. (1991). Conversational implicature, conscious representation, and the conjunction fallacy. *Soc. Cogn.* 9, 85–110. doi: 10.1521/soco.1991.9.1.85
- Dumont, L. (1983). *Essais sur l'Individualisme*. Une perspective anthropologique sur l'idéologie moderne. Seuil, Paris.
- Engelmann, D., and Hollard, G. (2010). Reconsidering the effect of market experience on the "endowment effect". *Econometrica* 78, 2005–2019. doi: 10.3982/ECTA8424
- Escandell-Vidal, V. (1996). Towards a cognitive approach to politeness. *Lang. Sci.* 18, 629–650. doi: 10.1016/S0388-0001(96)00039-3
- Fiddick, L., Cummins, D. D., Janicki, M., Lee, S., and Erlich, N. (2013). A cross-cultural study of noblesse oblige in economic decision-making. *Hum. Nat.* 24, 318–335. doi: 10.1007/s12110-013-9169-9
- Flemming, T. M., Jones, O. D., Mayo, L., Stoinski, T., and Brosnan, S. F. (2012). The endowment effect in orangutans. *J. Comp. Psychol.* 25, 285–298.
- Fraser, B. (1990). Perspectives on politeness. *J. Pragmat.* 14, 219–236. doi: 10.1016/0378-2166(90)90081-N
- Gardner, P. (1985). Bicultural oscillation as a long-term adaptation to cultural frontiers: cases and questions. *Hum. Ecol.* 13, 411–432. doi: 10.1007/BF01531153
- Gelman, S. A., Manczak, E. M., and Noles, N. S. (2012). The nonobvious basis of ownership: preschool children trace the history and value of owned objects. *Child Dev.* 83, 1732–1747. doi: 10.1111/j.1467-8624.2012.01806.x
- Geraci, A. (2020). How do toddlers evaluate defensive actions toward third parties? *Infancy* 25, 910–926. doi: 10.1111/inf.12367
- Geraci, A., and Franchin, L. (2021). Is defensive behavior a subtype of prosocial behaviors? *Front. Psychol.* 12:2282. doi: 10.3389/fpsyg.2021.678370
- Geraci, A., Rigo, P., Simonelli, A., Di Nuovo, S., and Simion, F. (2021). Preschoolers' evaluations of comforting actions towards third parties in different relationship contexts. *J. Appl. Dev. Psychol.* 76:101315. doi: 10.1016/j.appdev.2021.101315

- Gintis, H. (2007). The evolution of private property. *J. Econ. Behav. Organ.* 64, 1–16. doi: 10.1016/j.jebo.2006.02.002
- Godbout, J. T. (2009). *Ce Qui Circule Entre Nous. Donner, Recevoir, Rendre*. Média Diffusion.
- Godin, P. (2015). *Les changes sont le souffle de la coutume. Logiques sociales de la "vie" et de la "puissance" en pays Hyeehen* (Ph.D. thesis). Université de la Nouvelle-Calédonie, Noumea, New Caledonia.
- Godin, P. (2018). "La personne comme" "don" "en pays hyeehen". *L'Uomo Società Tradizione Sviluppo*.
- Goffman, E. (1967). *Interaction Ritual: Essays on Face-to-Face Interaction*. New York, NY: Anchor Books; GardenCity.
- Goffman, E. (1971). *Relations in Public, Microstudies of the Public Order*. New York: Basic Books.
- Gouldner, A. W. (1960). The norm of reciprocity: a preliminary statement. *Am. Sociol. Rev.* 25, 161–178. doi: 10.2307/2092623
- Grice, H. P. (1975). "Logic and conversation," in *Speech Acts (Syntax and Semantics 3)*, eds P. Cole and J. Morgan (New York, NY: Academic Press), 41–58. doi: 10.1163/9789004368811\_003
- Harbaugh, W. T., Krause, K., and Vesterlund, L. (2001). Are adults better behaved than children? Age, experience, and the endowment effect. *Econ. Lett.* 70, 175–181. doi: 10.1016/S0165-1765(00)00359-1
- Harsanyi, J. C. (1961). On the rationality postulates underlying the theory of cooperative games. *J. Conflict Resolut.* 5, 179–196. doi: 10.1177/002200276100500205
- Heifetz, A., and Segev, E. (2004). The evolutionary role of toughness in bargaining. *Games Econ. Behav.* 49, 117–134. doi: 10.1016/j.geb.2003.11.001
- Henrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., Gintis, H., et al. (2005). "Economic man" in cross-cultural perspective: behavioral experiments in 15 small-scale societies. *Behav. Brain Sci.* 28, 795–815. doi: 10.1017/S0140525X05000142
- Henrich, J., Heine, S. J., and Norenzayan, A. (2010). The weirdest people in the world? *Behav. Brain Sci.* 33, 61–83. doi: 10.1017/S0140525X0999152X
- Hood, B., Weltzien, S., Marsh, L., and Kanngiesser, P. (2016). Picture yourself: self-focus and the endowment effect in preschool children. *Cognition* 152, 70–77. doi: 10.1016/j.cognition.2016.03.019
- Horak, S. (2018). From cross-cultural economic experiments to experimental indigenous management research—a suggestion. *Manage. Organ. Rev.* 14, 651–691. doi: 10.1017/mor.2018.39
- Horowitz, J. K., and McConnell, K. E. (2002). A review of WTA/WTP studies. *J. Environ. Econ. Manage.* 44, 426–447. doi: 10.1006/jeem.2001.1215
- Huck, S., Kirchsteiger, G., and Oechssler, J. (2005). Learning to like what you have: explaining the endowment effect. *Econ. J.* 115, 689–702. doi: 10.1111/j.1468-0297.2005.01015.x
- Jamet, F., and Baratgin, J. (2018). "L'effet de dotation: un outil diagnostique du syndrome d'épuisement professionnel?" in *Burnout. Droit et Cognition*, eds F. Jamet, J. Baratgin, and C. Puigelier (Le Mans: Les éditions du Borrégo), 93–113.
- Jamet, F., Baratgin, J., and Bearune, C. K. (2017a). "Effet de dotation" approche développementale chez des enfants Kanak" in *L'école calédonienne du destin commun*, ed S. Minvielle (Nouméa: Presses Universitaires de Nouvelle-Calédonie et Centre de Documentation Pédagogique de la Nouvelle-Calédonie), 88–99.
- Jamet, F., Baratgin, J., and Filatova, D. (2014). Global warming and the rise of the sea level: A study of intellectual development in preadolescents and adolescents from 11 to 15 years old. *Studia Pedagogiczne* 24, 361–380.
- Jamet, F., Baratgin, J., and Godin, P. (2017b). "Don, droit, coutume, cultures. Études expérimentales sur l'effet de dotation," in *Droit, décision et prise de décision*, eds C. Puigelier, C. Tijus, and F. Jouen (Paris: Mare et Martin), 123–152.
- Jary, M. (1998). Relevance theory and the communication of politeness. *J. Pragmat.* 30, 1–19. doi: 10.1016/S0378-2166(98)80005-2
- Kahneman, D., Knetsch, J. L., and Thaler, R. H. (1990). Experimental tests of the endowment effect and the coase theorem. *J. Polit. Econ.* 98, 1325–1348. doi: 10.1086/261737
- Kanngiesser, P., Rossano, F., Frickel, R., Tömm, A., and Tomasello, M. (2020). Children, but not great apes, respect ownership. *Dev. Sci.* 23:e12842. doi: 10.1111/desc.12842
- Kanngiesser, P., Santos, L. R., Hood, B. M., and Call, J. (2011). The limits of endowment effects in great apes (*Pan paniscus*, *Pan troglodytes*, *Gorilla gorilla*, *Pongo pygmaeus*). *J. Comp. Psychol.* 125, 436–445. doi: 10.1037/a0024516
- Kienbaum, J., and Mairhofer, S. (2021). Need, effort, or integration? The development of intuitive distributive justice decisions in children, adolescents, and adults. *Soc. Dev.* 1–16. doi: 10.1111/sode.12563
- Klass, G., and Zeiler, K. (2013). Against endowment theory: experimental economics and legal scholarship. *UCLA Law Rev.* 61, 2–64. doi: 10.2139/ssrn.2224105
- Knetsch, J. L. (1989). The endowment effect and evidence of nonreversible indifference curves. *Am. Econ. Rev.* 79, 1277–1284.
- Knetsch, J. L., and Wong, W.-K. (2009). The endowment effect and the reference state: evidence and manipulations. *J. Econ. Behav. Organ.* 71, 407–413. doi: 10.1016/j.jebo.2009.04.015
- Komter, A. (2007). Gifts and social relations: the mechanisms of reciprocity. *Int. Sociol.* 22, 93–107. doi: 10.1177/0268580907070127
- LaFromboise, T., Coleman, H. L., and Gerton, J. (1993). Psychological impact of biculturalism: evidence and theory. *Psychol. Bull.* 114, 395–412. doi: 10.1037/0033-2909.114.3.395
- Lakshminarayanan, V., Keith Chen, M., and Santos, L. R. (2008). Endowment effect in capuchin monkeys. *Philos. Trans. R. Soc. B Biol. Sci.* 363, 3837–3844. doi: 10.1098/rstb.2008.0149
- Leech, G. (1983). *Principles of Pragmatics*. London: Longman.
- List, J. A. (2003). Does market experience eliminate market anomalies? *Q. J. Econ.* 118, 41–71. doi: 10.1162/00335530360535144
- Lucas, M. M., Wagner, L., and Chow, C. (2008). Fair game: the intuitive economics of resource exchange in four-year olds. *J. Soc. Evol. Cult. Psychol.* 2, 74–88. doi: 10.1037/h0099353
- Macchi, L. (2000). Partitive formulation of information in probabilistic problems: beyond heuristics and frequency format explanations. *Organ. Behav. Hum. Decis. Process.* 82, 217–236. doi: 10.1006/obhd.2000.2895
- Macchi, L., and Bagassi, M. (2012). Intuitive and analytical processes in insight problem solving: a psycho-rhetorical approach to the study of reasoning. *Mind Soc.* 11, 53–67. doi: 10.1007/s11299-012-0103-3
- Macchi, L., Caravona, L., Poli, F., Bagassi, M., and Franchella, M. A. (2020). Speak your mind and I will make it right: the case of "selection task". *J. Cogn. Psychol.* 32, 93–107. doi: 10.1080/20445911.2019.1707207
- Macchi, L., Poli, F., Caravona, L., Vezzoli, M., Franchella, M. A., and Bagassi, M. (2019). How to get rid of the belief bias: boosting analytical thinking via pragmatics. *Europe's J. Psychol.* 15, 595–613. doi: 10.5964/ejop.v15i3.1794
- Malinowski, B. (2018). *Crime and Custom in Savage Society*. New York, NY: Routledge. doi: 10.4324/9780203794449
- Marlowe, F. W. (2004). "Dictators and ultimatums in an egalitarian society of hunter-gatherers: the hadza of Tanzania," in *Foundations of Human Sociality: Economic Experiments and Ethnographic Evidence from Fifteen Small-Scale Societies*, eds J. P. Henrich, R. Boyd, E. Fehr, S. Bowles, C. Camerer, and H. Gintis (Oxford: Oxford University Press), 168–193. doi: 10.1093/0199262055.003.0006
- Marzilli Ericson, K. M., and Fuster, A. (2014). The endowment effect. *Annu. Rev. Econ.* 6, 555–579. doi: 10.1146/annurev-economics-080213-041320
- Masson, O., Baratgin, J., and Jamet, F. (2015). "Nao robot and the 'endowment effect'," in *2015 IEEE International Workshop on Advanced Robotics and its Social Impacts (ARSO)* (Lyon), 1–6. doi: 10.1109/ARSO.2015.7428203
- Masson, O., Baratgin, J., and Jamet, F. (2017a). "Nao robot as experimenter: social cues emitter and neutralizer to bring new results in experimental psychology," in *International Conference on Information and Digital Technologies (IDT-2017)* (Zilina), 256–264. doi: 10.1109/IDT.2017.8024306
- Masson, O., Baratgin, J., and Jamet, F. (2017b). "Nao robot, transmitter of social cues: what impacts?" in *Advances in Artificial Intelligence: From Theory to Practice*, eds S. Benferhat, K. Tabia, and M. Ali (Cham: Springer), 559–568. doi: 10.1007/978-3-319-60042-0\_62
- Masson, O., Baratgin, J., Jamet, F., Ruggieri, F., and Filatova, D. (2016). "Use a robot to serve experimental psychology: Some examples of methods with children and adults," in *International Conference on Information and Digital Technologies (IDT-2016)* (Rzeszow), 190–197. doi: 10.1109/IDT.2016.7557172
- Masuda, T., Batdorj, B., and Senzaki, S. (2020). Culture and attention: future directions to expand research beyond the geographical regions of weird cultures. *Front. Psychol.* 11:1394. doi: 10.3389/fpsyg.2020.01394

- Masuda, T., and Nisbett, R. E. (2001). Attending holistically versus analytically: comparing the context sensitivity of Japanese and Americans. *J. Pers. Soc. Psychol.* 81, 922–934. doi: 10.1037/0022-3514.81.5.922
- Mauss, M. (1924). Essai sur le don. forme et raison de l'échange dans les sociétés archaïques. *L'Année Sociologique* 1, 30–186.
- Monnerie, D. (2017). “Relations et substances: l'anthropologie et les enseignements des cérémonies kanak,” in *Puissance et impuissance de la valeur, l'anthropologie comparative de Louis Dumont*, eds C. Barraud, A. Iteanu, and I. Moya (Paris: CNRS éditions), 235–260.
- Monnerie, D. (2020). Circulation des objets et élaboration des relations dans les cérémonies du nord de la kanaky Nouvelle-Calédonie. *Archimède* 7, 96–113. doi: 10.47245/archimede.0007.dsl.08
- Morewedge, C. K., and Glibin, C. E. (2015). Explanations of the endowment effect: an integrative review. *Trends Cogn. Sci.* 19, 339–348. doi: 10.1016/j.tics.2015.04.004
- Nakamura, H., Shao, J., Baratgin, J., Over, D. E., Takahashi, T., and Yama, H. (2018). Understanding conditionals in the east: a replication study of Politzer et al. (2010) with easterners. *Front. Psychol.* 9:505. doi: 10.3389/fpsyg.2018.00505
- Nancekivell, S. E., Van de Vondervoort, J. W., and Friedman, O. (2013). Young children's understanding of ownership. *Child Dev. Perspect.* 7, 243–247. doi: 10.1111/cdep.12049
- Nisbett, R. E., and Masuda, T. (2003). Culture and point of view. *Proc. Natl Acad. Sci. U.S.A.* 100, 11163–11170. doi: 10.1073/pnas.1934527100
- Nisbett, R. E., and Miyamoto, Y. (2005). The influence of culture: holistic versus analytic perception. *Trends Cogn. Sci.* 9, 467–473. doi: 10.1016/j.tics.2005.08.004
- Nisbett, R. E., Peng, K., Choi, I., and Norenzayan, A. (2001). Culture and systems of thought: holistic versus analytic cognition. *Psychol. Rev.* 108, 291–310. doi: 10.1037/0033-295X.108.2.291
- Plott, C. R., and Zeiler, K. (2007). Exchange asymmetries incorrectly interpreted as evidence of endowment effect theory and prospect theory? *Am. Econ. Rev.* 97, 1449–1466. doi: 10.1257/aer.97.4.1449
- Politzer, G. (2016). The class inclusion question: a case study in applying pragmatics to the experimental study of cognition. *SpringerPlus* 5:1133. doi: 10.1186/s40064-016-2467-z
- Politzer, G., and Macchi, L. (2000). Reasoning and pragmatics. *Mind Soc.* 1, 73–93. doi: 10.1007/BF02512230
- Prou, J.-P. (2021). Du don au partage, étude expérimentale en société kanak. *Bull. Psychol.* 573, 245–248. doi: 10.3917/bupsy.573.0245
- Schmidt, M. F., Butler, L. P., Heinz, J., and Tomasello, M. (2016). Young children see a single action and infer a social norm: promiscuous normativity in 3-year-olds. *Psychol. Sci.* 27, 1360–1370. doi: 10.1177/0956797616661182
- Schwarz, N., Strack, F., Hilton, D., and Naderer, G. (1991). Base rates, representativeness, and the logic of conversation: the contextual relevance of “irrelevant” information. *Soc. Cogn.* 9, 67–84. doi: 10.1521/soco.1991.9.1.67
- Searle, J. R., and Willis, S. (1995). *The Construction of Social Reality*. New York, NY: Simon and Schuster.
- Spencer-Oatey, H., and Jiang, W. (2003). Explaining cross-cultural pragmatic findings: moving from politeness maxims to sociopragmatic interactional principles (SIPs). *J. Pragmat.* 35, 1633–1650. doi: 10.1016/S0378-2166(03)00025-0
- Sperber, D. (1994). “Understanding verbal understanding,” in *What is Intelligence?*, ed J. Khalfa (Cambridge: Cambridge University Press), 179–198.
- Sperber, D., Cara, F., and Girotto, V. (1995). Relevance theory explains the selection task. *Cognition* 57, 31–95. doi: 10.1016/0010-0277(95)00666-M
- Sperber, D., and Hirschfeld, L. (1999). “Culture, cognition, and evolution,” in *MIT Encyclopedia of the Cognitive Sciences*, eds R. Wilson and F. Keil (Cambridge, MA: MIT Press), 111–132.
- Sperber, D., and Wilson, D. (1986). *Relevance: Communication and Cognition*. Oxford: Harvard University Press and Blackwell.
- Sperber, D., and Wilson, D. (2002). Pragmatics, modularity and mind-reading. *Mind Lang.* 17, 3–23. doi: 10.1111/1468-0017.00186
- Stake, J. E. (2004). The property “instinct”. *Philos. Trans. R. Soc. Lond. Ser. B Biol. Sci.* 359, 1763–1774. doi: 10.1098/rstb.2004.1551
- Svirsky, D. (2014). Money is no object: Testing the endowment effect in exchange goods. *J. Econ. Behav. Organ.* 106, 227–234. doi: 10.1016/j.jebo.2014.07.003
- Talwar, V., Murphy, S. M., and Lee, K. (2007). White lie-telling in children for politeness purposes. *Int. J. Behav. Dev.* 31, 1–11. doi: 10.1177/0165025406073530
- Tcherkézoff, S. (2016). *Mauss à Samoa. Le holisme sociologique et l'esprit du don polynésien*. Marseille: Pacific-Credo Publications. doi: 10.4000/books.pacific.357
- Testart, A. (1997). Les trois modes de transfert. *Gradhiva* 21, 39–58.
- Thaler, R. (1980). Toward a positive theory of consumer choice. *J. Econ. Behav. Organ.* 1, 39–60. doi: 10.1016/0167-2681(80)90051-7
- Tversky, A., and Kahneman, D. (1991). Loss aversion in riskless choice: a reference-dependent model. *Q. J. Econ.* 106, 1039–1061. doi: 10.2307/2937956
- Urquiza, C. A. (2009). Politesse, savoir-vivre: modernité d'un concept bien classique. *Synergies Espagne* 2, 117–128.
- Watts, R. J. (2003). *Politeness*. Cambridge: Cambridge University Press. doi: 10.1017/CBO9780511615184
- Yama, H., Nishioka, M., Horishita, T., Kawasaki, Y., and Taniguchi, J. (2007). A dual process model for cultural differences in thought. *Mind Soc.* 6, 143–172. doi: 10.1007/s11299-007-0028-4

**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.

Copyright © 2022 Baratgin, Godin and Jamet. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.





# Culture as a Moderator of Epistemically Suspect Beliefs

Yoshimasa Majima<sup>1\*</sup>, Alexander C. Walker<sup>2</sup>, Martin Harry Turpin<sup>2</sup> and Jonathan A. Fugelsang<sup>2</sup>

<sup>1</sup> Department of Psychology for Well-Being, Hokusei Gakuen University, Sapporo, Japan, <sup>2</sup> Department of Psychology, University of Waterloo, Waterloo, ON, Canada

## OPEN ACCESS

### Edited by:

Jean Baratgin,  
Université Paris 8, France

### Reviewed by:

Jose Yong,  
Northumbria University,  
United Kingdom  
Keiko Ishii,  
Nagoya University, Japan

### \*Correspondence:

Yoshimasa Majima  
majima.y@hokusei.ac.jp

### Specialty section:

This article was submitted to  
Cognition,  
a section of the journal  
Frontiers in Psychology

**Received:** 22 July 2021

**Accepted:** 03 January 2022

**Published:** 09 February 2022

### Citation:

Majima Y, Walker AC, Turpin MH  
and Fugelsang JA (2022) Culture as  
a Moderator of Epistemically Suspect  
Beliefs. *Front. Psychol.* 13:745580.  
doi: 10.3389/fpsyg.2022.745580

A consistent finding reported in the literature is that epistemically suspect beliefs (e.g., paranormal beliefs) are less frequently endorsed by individuals with a greater tendency to think analytically. However, these results have been observed predominantly in Western participants. In the present work, we explore various individual differences known to predict epistemically suspect beliefs across both Western and Eastern cultures. Across four studies with Japanese ( $n = 666$ ) and Western ( $n = 650$ ) individuals, we find that the association between thinking style and beliefs varied as a function of culture. Specifically, while Westerners who scored higher on measures of Type-2 analytic thinking tended to endorse epistemically suspect beliefs less, this association was not observed in Japanese samples, suggesting that the often-observed negative association between analytic thinking and epistemically suspect beliefs may be exclusive to Western individuals. Additionally, we demonstrate that a tendency to think holistically (specifically with regards to causality) is positively associated with the endorsement of epistemically suspect beliefs within both samples. Overall, we discuss how various individual differences predict the endorsement of epistemically suspect beliefs across cultures.

**Keywords:** epistemically suspect beliefs, cultural differences, analytic thinking, analytic-holistic cognition, bullshit receptivity

## INTRODUCTION

Fundamentally, scientists are in the business of trying to improve the accuracy of both their own and humanity's beliefs via the collection of information about the universe. As such, it is no surprise that a community of researchers have become profoundly interested in epistemically suspect beliefs (ESBs), which refer to beliefs that do not cohere with established scientific evidence (e.g., paranormal beliefs; Lobato et al., 2014). Previous studies investigating ESBs have focused on the individual differences of believers as opposed to skeptics, including differences in cognitive ability, reasoning skills, and thinking style. These findings suggest that those who endorse ESBs are in general less educated (Gray and Mill, 1990; Aarnio and Lindeman, 2005), perform worse on some reasoning tasks (Blackmore and Trościanko, 1985; Roberts and Seager, 1999), and engage less in analytic thinking compared to skeptics (Lindeman and Aarnio, 2006; Pennycook et al., 2012).

Analytic thinking in this context refers to thought processes that are commonly characterized as being deliberative, reflective, and requiring working memory (i.e., Type-2 processes; Evans, 2008; Evans and Stanovich, 2013). Much research has shown that analytic thinking is a good predictor of

performance on a range of reasoning and decision making tasks (e.g., heuristics-and-biases tasks that involve successfully overriding an incorrect intuitive response; Toplak et al., 2011). With regard to the endorsement of everyday irrational beliefs, such as superstitions, research has suggested that these beliefs arise from our intuitive processes (i.e., Type-1 processes; Evans, 2008; Evans and Stanovich, 2013), tend to rely on heuristics, seek for coherent causal explanations, and favor evidence providing supports for one's current beliefs (Risen, 2016). Therefore, a line of argumentation like ESBs providing simple surface-level explanations about the universe may be intuitively appealing. These beliefs will be maintained unless they are more closely re-examined by analytic thinking. In line with this claim, other work has found that the tendency to engage in analytic thinking is negatively associated with various forms of ESBs including religious belief (Gervais and Norenzayan, 2012; Pennycook et al., 2012, 2014), belief in the paranormal (Aarnio and Lindeman, 2005; Lobato et al., 2014), and pseudoscientific beliefs (Lindeman, 2011; Lobato et al., 2014). Relatedly, analytic thinking has been shown to be negatively associated with receptivity to superficially impressive yet vacuous statements (i.e., pseudo-profound bullshit; Pennycook et al., 2015a; Walker et al., 2019). On the basis of these findings, many scholars have argued that ESBs are rooted in Type-1 intuitive processing which can be overridden by effortful and Type-2 analytic processes (Pennycook et al., 2015b).

Although the negative association between ESBs and analytic thinking appears robust, it may be reasonable to be skeptical about the underlying mechanisms proposed. First, in the domain of religious belief, studies have shown contradictory findings. For example, the role of analytic thinking in supporting religious disbelief has been challenged by research showing that promoting analytical thinking does not promote religious disbelief (Yonker et al., 2016; Sanchez et al., 2017). Furthermore, most studies examining the association between cognitive style and ESBs have been conducted exclusively with WEIRD (Western, Educated, Industrialized, Rich and Democratic; Henrich et al., 2010) participants. Therefore, it remains an open question whether the link between analytic thinking and ESBs generalizes to non-WEIRD populations. It is important to examine possible cultural differences in the underlying processes associated with ESBs in order to better understand everyday irrational beliefs. If cultural differences in thinking styles are identified between populations, they are likely to interact with interventions focused on thinking (e.g., education, and debiasing). Furthermore, cross-cultural comparisons of everyday beliefs are important as they can lead to a better understanding of cultural differences on the effects of various psycho-social factors on well-being (Yong et al., 2021).

Recent work has begun to investigate cross-cultural differences as they relate to ESBs. For example, compared to Westerners, Chinese individuals have been found to be more likely to endorse paranormal beliefs (Shiah et al., 2010) and Turkish individuals more likely to endorse conspiracy beliefs (Bruder et al., 2013). Relatedly, Bahçekapili and Yilmaz (2017) reported a series of studies featuring Muslim populations

showing that analytic thinking was negatively associated with intrinsic/extrinsic motivations for religiosity (e.g., personal duty or societal pressure), but positively associated with religiosity dealing with an open-minded seeking of answers to existential questions. Based on these findings, Bahçekapili and Yilmaz (2017) suggest that the link between analytic thinking and religiosity depends on how religiosity is expressed among individuals. Relatedly, Tosyali and Aktas (2021) show that the negative link between analytic thinking and superstitious beliefs is stronger for Turkish participants with low-to-moderate levels of religiosity than highly religious individuals. These results suggest that the relationship between analytic thinking and irrational beliefs is not as simple as analytic thinking always suppressing such beliefs, but may involve group differences related to norms surrounding belief, such as culture. In the domain of paranormal and pseudoscientific belief, Japanese individuals self-reporting a strong tendency toward analytic thinking, measured by the rationality subscale of the Rational-Experiential Inventory (Pacini and Epstein, 1999), were more likely to hold paranormal and pseudoscientific beliefs (Karasawa and Tsukimoto, 2010; Majima, 2015), providing initial evidence that the commonly observed negative association between analytic thinking and ESBs may not generalize to non-WEIRD populations. Nevertheless, participants' level of analytic thinking was self-reported within this study, leaving open the possibility that they were simply mis-calibrated in their self-assessment. Conversely, it could be that the link between analytic thinking and ESBs is absent in Japanese samples, perhaps on account of ESBs being less in violation of Japanese as opposed to Western cultural norms.

Along with differences in ESBs, findings from cultural psychology have demonstrated differences in cognitive style between Western and Eastern populations. These findings suggest that Westerners are more likely to adopt 'analytic' modes of cognition, while Easterners are more likely to take holistic approaches (Nisbett et al., 2001; Nisbett and Miyamoto, 2005; see also Buchtel and Norenzayan, 2009 for discussions regarding differences between Type-2 analytic thinking as described by contemporary dual process theorists and 'analytic' cognition as described in the domain of cultural psychology). Generally speaking, in the domain of cultural psychology, 'analytic' individuals tend to focus on the specific attributes or elements of an object or problem, rather than the larger context as a whole. In contrast, rather than focusing on individual elements, holistic individuals tend to focus on the totality of an object or problem, including the overarching context. Furthermore, holistic thinking has been shown to predict the acceptance of mutually conflicting statements (naïve dialecticism; Spencer-Rodgers et al., 2010) and complex causality (Maddux and Yuki, 2006). Relatedly, past work demonstrates that Eastern (i.e., Japanese) participants tend to report more mixed emotions than Americans, predominantly in pleasant situations (Miyamoto et al., 2010).

These findings suggest that differences in the endorsement of ESBs across Western and Eastern cultures may be explained, at least partially, by cultural differences in analytic-holistic modes of thinking. Since holistic cognition has a more dialectical

orientation, such as the acceptance of contradiction and complex causation, it is reasonable to assume that holistic thinkers may be more likely to accept mutually conflicting statements and as a result show greater endorsement of ESBs than those engaging in more rule-based, or ‘analytic’ modes of reasoning. Therefore, the tendency for Eastern individuals to think holistically may offer one explanation for why Eastern individuals seemingly endorse more ESBs compared to Western individuals. However, readers may be puzzled by the distinction between Type-2 analytic thinking, as discussed by dual process theorists, and an ‘analytic’ mode of cognition, as discussed by cross-cultural psychologists. For this difference, Buchtel and Norenzayan (2009) argue that Type-2 analytic thinking and cultural ‘analytic’ cognition share similarities with regards to context independence and weak attention to social relations. Nevertheless, holistic cognition does not necessarily correspond to Type-1 processes, nor does ‘analytic’ cognition necessarily correspond to Type-2 processes. Rather, Buchtel and Norenzayan (2009) posit that analytic-holistic modes of thinking can be viewed as different styles, or individual variations of thinking, that operate under the umbrella of Type-2 processes. From this perspective, the negative association between so-called Type-2 analytic thinking and ESBs may not necessarily be culturally universal.

The present research investigates endorsement of ESBs (e.g., paranormal and pseudoscientific beliefs) within samples of Western (North American and Western European) and Eastern (Japanese) participants. We seek to not only assess the frequency of ESBs across Western and Eastern populations, but also investigate whether such beliefs are predicted by the same individual difference variables (e.g., Type-2 analytic thinking) across cultures. Based on past work (Shiah et al., 2010; Bruder et al., 2013), we expect Western participants to endorse ESBs less than Eastern participants. We examine whether such a difference can be explained by Western participants preferring more ‘analytic’ and linear styles of thinking compared to Eastern participants, who more frequently engage in holistic and dialectic styles of thinking (Nisbett et al., 2001; Nisbett and Miyamoto, 2005).

Lastly, we investigate receptiveness to pseudo-profound bullshit across Western and Eastern cultures. Similar to holding ESBs, endorsement of pseudo-profound bullshit (i.e., statements that are superficially impressive yet consist of a largely random assortment of profound-sounding words) has been argued to result from a failure to engage Type-2 analytic thinking (Pennycook et al., 2015a; Pennycook and Rand, 2020). That is, endorsement of pseudo-profound bullshit shares a common cognitive mechanism with acceptance of ESBs. Relatedly, studies have demonstrated positive associations between bullshit receptivity and real-world beliefs, such as the endorsement of paranormal beliefs (Pennycook et al., 2015a) and “fake news” (Pennycook and Rand, 2020). Nevertheless, the claim that bullshit receptivity naturally follows from a failure to engage Type-2 analytic thinking may be incomplete as other factors such as the tendency to perceive patterns or maintain radically subjective beliefs may similarly explain receptiveness to pseudo-profound bullshit statements (Turpin et al., 2019; Walker et al., 2019). These factors likely vary

based on culture and so too may receptiveness to pseudo-profound bullshit.

## ETHICS STATEMENT

All studies were conducted in accordance with APA ethical standards and approved by the relevant ethics committees. All individuals gave their informed consent online prior to participation.

## STUDY 1

### Method

#### Participants

A sample of 298 participants were recruited from two online crowdsourcing platforms, 147 Japanese participants (59% female;  $M_{age} = 38.37$ ,  $SD_{age} = 9.45$ ) from CrowdWorks (CW) and 151 North American and European participants (47% female;  $M_{age} = 33.23$ ,  $SD_{age} = 11.50$ ; 36% United States residents, 38% United Kingdom residents, 25% other) from Prolific Academic (ProA)<sup>1</sup>. All participants received compensation (CW = 240 JPY; ProA = £2.00) upon completion of an online questionnaire. For all studies, participants were required to possess an approval rating of 95% or higher on either CW or ProA in order to be eligible to participate. We collected our full sample prior to data analyses, report all data exclusions, all manipulations, and all measures used.

### Materials

#### Paranormal Belief Scale

We assessed the degree to which participants endorsed various paranormal beliefs by asking them to judge the plausibility of 12 paranormal belief items ( $B_{PA}$ ). These items were drawn from the Psi questionnaire (6-items; Roberts and Seager, 1999; Japanese version adopted from Majima, 2015) and Revised Paranormal Belief Scale (6-items; adopted from Tobacyk, 2004<sup>2</sup>). Participants judged the plausibility of each  $B_{PA}$  item (e.g., “How likely is it that you possess some form of ‘psychic ability?’”) using a five-point scale ranging from 1 (*Extremely Unlikely*) to 5 (*Certain*). Ratings

<sup>1</sup>We did not conduct an *a priori* power analysis to determine sample size for this study. Instead, decisions regarding sample size were made with reference to related past work (e.g., Pennycook et al., 2012; Majima, 2015). We also decided to include Prolific participants having non-European origin into our Western sample since our preliminary analysis revealed that the overall results were not different when we excluded these participants. The number of corresponding participants were 6, 13, 4 and 51 in Studies 1 through 4, respectively. Similarly, CrowdWorks participants with a non-Asian origin were labeled as Japanese participants, since preliminary analysis also revealed that the results were not different when we excluded non-Asian CrowdWorks participants. The number of non-Asian CW participants were 0, 10, 1 and 24 in Studies 1 through 4, respectively. Some studies suggest that people of Asian ethnicity living in Western countries provide responses resembling an intermediate between Asian people living in Eastern countries and European people living in Western countries (Norenzayan et al., 2002). Therefore, it is noteworthy that the present results (featuring our full sample) did not differ when excluding Japanese participants with a non-Asian origin and Western participants with an Asian origin.

<sup>2</sup>The Japanese translations for R-PBS items were drawn from two previous works (Nakajima et al., 1992, 1993).

given to each item were averaged to calculate a B<sub>PA</sub> score for each participant. A complete list of items (for all studies) can be viewed in the **supplementary materials**.

### ***Pseudoscientific Belief Scale***

We assessed the degree to which participants endorsed pseudoscientific beliefs with 12 pseudoscientific belief (B<sub>PS</sub>) items (e.g., “Homeopathic remedies foster spontaneous healing”). This scale consisted of six items from Majima (2015), three items from Lobato et al. (2014), and three items from Dekker et al. (2012)<sup>3</sup>. Participants were asked to judge their agreement with each item on a five-point scale ranging from 1 (*Disagree*) to 5 (*Agree*). Once again, ratings given to each item were averaged to obtain a B<sub>PS</sub> score for each participant.

### ***Cognitive Style Measures***

We assessed participants’ tendency to engage in rational (analytic) and experiential (intuitive) thinking with 12 items drawn from Naito et al.’s (2004) Information-Processing Style Inventory (IPS). The original IPS contains 24 items adapted from Pacini and Epstein (1999) Rational-Experiential Inventory (REI), consisting of six items from each of the four REI subscales (rational engagement, rational ability, experiential engagement, and experiential ability). In order to reduce participants’ work load, we chose 12 items (three items from each subscale) showing high factor loading scores in studies with Western (Pacini and Epstein, 1999) and Japanese (Naito et al., 2004) participants. For each item, participants were presented with a statement and asked to judge the extent to which the statement was true of themselves on a five-point scale (1 = *Definitely not true*, 5 = *Definitely true*). Responses to six rationality items (e.g., “I enjoy intellectual challenges”) and six experiential items (e.g., “I like to rely on my intuitive impressions”) were averaged to obtain a rationality and experientiality score for each participant.

Participants were also presented with a three item Cognitive Reflection Test (CRT; Frederick, 2005), designed to provide a behavioral measure of participants’ ability to suppress an intuitive incorrect response in favor of an analytical correct answer. For all CRT items participants provided their answers in a free-entry text box. These two scales were introduced to measure individual differences in Type-2 analytic (rationality and CRT) and Type-1 intuitive (experientiality) thinking.

Lastly, we administered the Analysis-Holism scale (AHS; Choi et al., 2007) to assess participants’ tendencies to engage in analytic-holistic modes of thinking. The original AHS scale consisted of 24 items evenly split into four subscales (causality, attitude toward contradiction, perceived change, and locus of attention). However, to reduce participants’ work load, we only administered 12 AHS items (3 items from each subscale). Participants were presented each item individually and responded using a seven-point scale ranging from 1 (*Strongly disagree*) to 7 (*Strongly agree*). Within each subscale, ratings given to each item were averaged to obtain an AHS subscale score.

<sup>3</sup>Translations for BPS and AHS items were created as following. First, the first author translated items into Japanese. Next, another scholar working as an English teacher at the same university of the first author translated items back into English. The final translation was decided through discussion between the above two people.

### ***Cognitive Ability Measures***

We assessed participants’ cognitive ability with a syllogistic reasoning (cf. Majima, 2015) and numeracy task. We measured participants’ logical reasoning ability using a syllogistic reasoning task adopted from Markovits and Nantel (1989). The syllogistic reasoning task presented participants with eight syllogisms, all of which featured a conflict between the logical validity of the syllogism and the believability of its conclusion. Importantly, this design ensured that for each item the intuitive response (based on conclusion believability) would need to be overridden in order for the correct answer to be produced. For each syllogism, participants were asked to indicate whether the conclusion followed logically from the premises presented, irrespective of the believability of the concluding sentence. The sum of correctly solved syllogisms was used as an index of the logical reasoning ability of each participant. Additionally, we measured participants’ numeracy using the Subjective Numeracy Scale (SNS; Fagerlin et al., 2007). This scale was developed and validated as a conventional self-evaluation numeracy scale. We computed an unweighted mean of Percent of Maximum Possible (POMP; Cohen et al., 1999) scores for both our syllogistic reasoning and numeracy task in order to obtain a joint measure of cognitive ability (CAB).

### ***Procedure***

Participants were administered an online questionnaire in which they were asked to complete several tasks in the following order: pseudoscientific belief items, paranormal belief items, information-processing style inventory items (we refer to this scale as the REI hereafter referencing the origin of these items), a syllogistic reasoning task, the SNS, the AHS, and the CRT. Following completion of these tasks participants were asked a series of demographic questions (i.e., age, gender, nationality, ethnicity, native language, and highest educational level). Among these questions, only age and gender were considered predictors for the subsequent analysis<sup>4</sup>. All materials were presented in Japanese for CW participants and in English for ProA participants.

## ***Results and Discussion***

**Table 1** displays the descriptive statistics and bivariate correlations for all key variables. With the exception of AHS subscales ( $\alpha$  ranged from .60 to .75)<sup>5</sup>, all scales showed good internal consistency ( $\alpha$  ranged from .79 to .94). A series of independent samples *t*-tests found that our two samples did not differ in cognitive ability, CRT performance, or experientiality scores (all *ps* > .10). However, Westerners scored higher on our measure of rationality (i.e., the six rationality subscale items included in the REI),  $t(296) = 6.22$ ,  $p < .001$ ,  $d = 0.72$ . Consistent with past work, Japanese participants endorsed

<sup>4</sup>Responses to nationality, ethnicity and native language questions were originally included as indicators to detect participants from a different culture than the one in which they were currently living. However, as noted in text footnote 1, we decided not to exclude participants on this basis. Therefore, we did not use these variables in the subsequent analysis.

<sup>5</sup>Note that the reliability scores for AHS subscales were similar to those found in the original study ( $\alpha$  ranged from .56 to .71; Choi et al., 2007).



**TABLE 1** | Descriptive statistics and correlation of key variables (Study 1).

	West ( <i>n</i> = 151)			JP ( <i>n</i> = 147)			Sample difference			Pearson correlational coefficients <sup>a</sup>										
	$\alpha$	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>d</i>	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	
1. Age		33.23	11.50	38.37	9.45	4.22	<.001	0.49		-.003	.023	-.001	.029	.014	.030	.081	-.044	-.010	.199	
2. CAB		66.62	21.10	62.95	18.04	1.61	.108	0.19	.160		.305	-.274	.490	.018	.015	-.040	.002	-.215	-.165	
3. RAT	0.87	3.80	0.79	3.20	0.88	6.22	<.001	0.72	-.063	.453		-.259	.177	.071	.102	.011	.235	-.084	-.106	
4. EXP	0.88	3.18	0.93	3.04	0.77	1.44	.151	0.17	.033	-.285	-.125		-.299	.029	-.201	-.139	-.147	.481	.372	
5. CRT		1.63	1.18	1.44	1.09	1.47	.143	0.17	.098	.646	.342	-.335		.033	-.048	.097	.051	-.255	-.273	
6. Cause	0.75	4.89	1.37	5.33	1.06	-3.09	.002	0.36	.054	-.151	-.066	.221	-.169		.053	-.057	.195	.081	.133	
7. Contra	0.66	4.98	1.22	4.84	1.12	1.02	.307	0.12	-.031	-.104	-.068	.178	-.137	.015		-.035	.206	-.079	.121	
8. Change	0.60	4.74	1.14	5.15	1.18	-3.00	.003	0.35	-.017	-.066	.016	.019	.079	-.162	.003		.014	-.199	-.161	
9. Attention	0.64	4.51	1.30	5.28	0.91	-5.92	<.001	0.69	.001	.017	-.062	.024	-.052	.028	.097	-.075		-.045	-.069	
10. B <sub>PA</sub>	0.94	2.24	1.03	2.87	0.83	-5.81	<.001	0.66	.126	-.389	-.192	.393	-.486	.283	.112	-.121	-.042		.534	
11. B <sub>PS</sub>	0.79	2.53	0.68	2.87	0.53	-4.81	<.001	0.56	.183	-.339	-.211	.291	-.454	.353	.110	-.171	-.031	.674		

<sup>a</sup>Values above the diagonal indicate coefficients for Japanese sample, and values below the diagonal indicate coefficients for Western sample. The coefficients shown in bold face were significant at  $p < .05$ . *d*, Cohen's *d* statistics;  $\alpha$ , Cronbach's alpha coefficients; CAB, cognitive ability score described by unweighted mean POMP scores (0–100) of syllogism and subjective numeracy; RAT, rationality (five-point); EXP, experientiality (five-point); CRT, Cognitive Reflection Test; Cause, Causality scale of AHS (seven-point); Contra, Attitude toward Contradiction scale of AHS; Change, Perception of Change scale of AHS; Attention, Locus of Attention of AHS; B<sub>PA</sub>, belief in the paranormal (five-point); B<sub>PS</sub>, belief in pseudoscience (five-point). Of the above indicators, RAT and CRT are indices of Type-2 analytic thinking, whereas EXP is an index of intuitive thinking. All AHS subscales are indices of a holistic mode of thought.

more paranormal,  $t(296) = 5.81$ ,  $p < .001$ ,  $d = 0.66$ , and pseudoscientific beliefs,  $t(296) = 4.81$ ,  $p < .001$ ,  $d = 0.56$ , than Westerners. They also scored higher in three of the four AHS subscales: causality [ $t(296) = 3.09$ ,  $p = .002$ ,  $d = 0.36$ ], perception of change [ $t(296) = 3.00$ ,  $p = .003$ ,  $d = 0.35$ ], and locus of attention [ $t(290) = 5.92$ ,  $p < .001$ ,  $d = 0.69$ ]. Surprisingly, no difference between samples was observed for the attitude toward contradiction AHS subscale,  $t(296) = 1.02$ ,  $p = .307$ ,  $d = 0.12$ .

## Cultural Differences and Determinants of Epistemically Suspect Beliefs

In order to identify potential determinants of ESBs we conducted multiple regression analyses predicting ESBs (i.e., paranormal beliefs and pseudoscientific beliefs; see **Table 2**). In order to identify whether effects of our predictors differed across cultures (i.e., were moderated by cultural affiliation), we adopted a hierarchical regression approach. We excluded cognitive ability and three subscales of the AHS (attitude toward contradiction, perception of change, and locus of attention) from these analyses because preliminary analyses failed to show any contribution of these variables to differences in ESBs. In the first step, all predictors were entered simultaneously into the model. Next, the interaction terms of sample and other predictors (i.e., rationality, experientiality, CRT, and causality) were entered. For paranormal beliefs,  $\Delta R^2$ s demonstrated a significant improvement in the prediction of paranormal beliefs by introducing interaction terms of sample and other predictors ( $\Delta R^2 = .02$ ,  $p = .005$ ). We also found significant improvements in predicting pseudoscientific beliefs ( $\Delta R^2 = .01$ ,  $p = .043$ ). The final models for both paranormal and pseudoscientific beliefs can be viewed in **Table 2** (left panel).

We observed a significant gender difference for both ESBs in which women were more likely to have stronger ESBs compared to men (B<sub>PA</sub>:  $\beta = -.45$ ,  $p < .001$ , B<sub>PS</sub>:  $\beta = -.23$ ,  $p = .027$ ). As predicted, CRT performance was negatively associated with ESBs (B<sub>PA</sub>:  $\beta = -.36$ ,  $p < .001$ , B<sub>PS</sub>:  $\beta = -.38$ ,  $p < .001$ ), whereas a holistic understanding of causality was positively associated with ESBs (B<sub>PA</sub>:  $\beta = .14$ ,  $p = .023$ , B<sub>PS</sub>:  $\beta = .24$ ,  $p < .001$ ). Additionally, we observed significant experientiality  $\times$  sample (B<sub>PA</sub>:  $\beta = .24$ ,  $p = .016$ , B<sub>PS</sub>:  $\beta = .21$ ,  $p = .042$ ) and CRT  $\times$  sample interactions for both ESBs (B<sub>PA</sub>:  $\beta = .33$ ,  $p = .001$ , B<sub>PS</sub>:  $\beta = .26$ ,  $p = .013$ ). Subsequent simple slope analyses revealed cultural affiliation to be a significant moderator of the association between experientiality and ESBs. The unstandardized simple slopes for Japanese participants were, B<sub>PA</sub> = 0.08,  $p < .001$ , and B<sub>PS</sub> = 0.04,  $p < .001$ , and B<sub>PA</sub> = 0.04,  $p = .004$ , and B<sub>PS</sub> = 0.01,  $p = .250$  for Western participants. Lastly, we found cultural affiliation to be a significant moderator of the association between CRT performance and ESBs. The unstandardized simple slopes for Japanese participants were, B<sub>PA</sub> =  $-0.02$ ,  $p = .709$ , and B<sub>PS</sub> =  $-0.07$ ,  $p = .121$ , and B<sub>PA</sub> =  $-0.31$ ,  $p < .001$ , and B<sub>PS</sub> =  $-0.21$ ,  $p < .001$  for Western participants. Therefore, CRT performance predicted ESBs in our Western sample but not Japanese sample, possibly reflecting differences in cultural values with regards to avoiding ESBs. On the other hand, a propensity to value intuition was a strong predictor of ESBs

**TABLE 2 |** Regression analyses predicting beliefs by cognitive traits, cultural orientation, and interactions with sample.

Predictors	Study 1						Study 2					
	B <sub>PA</sub> (adj. R <sup>2</sup> = .39)			B <sub>PS</sub> (adj. R <sup>2</sup> = .33)			B <sub>PA</sub> (adj. R <sup>2</sup> = .22)			B <sub>PS</sub> (adj. R <sup>2</sup> = .30)		
	b	SE	β	p	b	SE	β	p	b	SE	β	p
(Intercept)	2.33	0.17		<.001	2.29	0.12		<.001	2.26	0.12		<.001
Sample <sup>a</sup>	0.57	0.10	.576	<.001	0.22	0.07	.343	.001	0.43	0.13	.474	.001
Gender <sup>b</sup>	−0.45	0.10	−.454	<.001	−0.15	0.07	−.232	.027	−0.20	0.10	−.217	.041
Age	0.01	0.00	.058	.218	0.01	0.00	.187	<.001	0.00	0.01	.048	.398
RAT	0.00	0.01	.020	.790	−0.00	0.01	−.025	.758	−0.04	0.02	−.170	.041
EXP	0.04	0.01	.183	.004	0.01	0.01	.077	.250	0.10	0.02	.431	<.001
CRT	−0.31	0.06	−.358	<.001	−0.21	0.04	−.384	<.001	−0.21	0.06	−.271	.001
Causality	0.04	0.02	.136	.023	0.04	0.01	.238	<.001				
DSS									0.29	0.12	.188	.016
Sample × RAT	0.01	0.02	.052	.609	0.00	0.01	.036	.738	0.08	0.03	.350	.003
Sample × EXP	0.05	0.02	.242	.016	0.03	0.01	.214	.042	−0.06	0.03	−.238	.036
Sample × CRT	0.29	0.09	.331	.001	0.15	0.06	.264	.013	0.16	0.09	.208	.057
Sample × Causality	−0.03	0.03	−.102	.290	−0.02	0.02	−.128	.206				
Sample × DSS									−0.14	0.19	−.089	.473
									0.24	0.13	.217	.065

All continuous variables except for age were mean-centered. <sup>a</sup>1 = Japanese, 0 = Western. <sup>b</sup>1 = men, 0 = women.

among Japanese participants, whereas it was not predictive for Western participants, particularly for pseudoscientific beliefs. Furthermore, the fact that a propensity toward multiple causality positively predicted pseudoscientific beliefs provides some support for the idea that holistic modes of thought can lead to the endorsement of ESBs. Of note however, the influence of thinking style along the analytic-holistic dimension did not vary across cultures.

## STUDY 2

Study 1 demonstrated that holistic understanding of causality partially explained participants' endorsement of ESBs. However, participants' attitude toward contradiction was not associated with endorsement of ESBs. This may be due to the fact that individuals' attitude toward contradiction in the current context doesn't reflect their propensity toward naïve dialecticism (i.e., the belief that things are changing continuously, tolerance of contradiction, and the preference for endorsing moderate options centered between two opposing options; cf. Zhang et al., 2015). Therefore, in Study 2, we further explored the association between dialectic thinking and endorsement of ESBs.

## Method

### Participants

A sample of 316 participants were recruited from two online crowdsourcing platforms, 167 Japanese participants (56% female;  $M_{\text{age}} = 39.26$ ,  $SD_{\text{age}} = 9.45$ ) from CW and 149 Western participants (42% female;  $M_{\text{age}} = 30.60$ ,  $SD_{\text{age}} = 10.04$ ) from ProA. All participants received compensation (CW = 240 JPY; ProA = £2.00) upon completion of an approximately 16-min online questionnaire. As gender was a predictor in our regression analyses, two participants from ProA, and one from CW were excluded due to not reporting gender.

### Materials

The materials used in Study 2 were nearly identical to those used in Study 1, with the following exceptions. First, we reduced the number of REI items we administered from 12 to 10 (now including five rational subscale and five experiential subscale items). These items were adopted from the REI-10 (Epstein et al., 1996), and assessed individual differences in thinking style. Second, we no longer administered the AHS, instead presenting participants with 32 Dialectical Self Scale items as our measure of holistic cognition (DSS; Spencer-Rodgers et al., 2004; the Japanese version of DSS items were adopted from Zhang et al., 2015). This scale measured participants' degree of dialectical thinking (i.e., the degree to which participants are able to synthesize competing ideas or viewpoints) within the domain of self-perception (e.g., "When I hear two sides of an argument, I often agree with both"). Participants responded to each DSS item using a seven-point scale ranging from 1 (*Strongly disagree*) to 7 (*Strongly agree*). Responses to all 32 items were averaged for each participant to obtain a DSS score.

## Procedure

Participants were administered an online questionnaire in which they were asked to respond to various items in the following order: pseudoscientific belief items, paranormal belief items, REI items, a syllogistic reasoning task, the SNS, the DSS, and the CRT. Following the completion of these tasks, participants were asked a series of demographic questions (i.e., age, gender, ethnicity, and native language). As in Study 1, all materials were presented in Japanese for CW participants and in English for ProA participants.

## Results and Discussion

**Table 3** displays the descriptive statistics and bivariate correlations of all key variables. A series of independent samples *t*-tests demonstrated that our two samples did not differ in cognitive ability or CRT performance (both *ps* > .19). In contrast, we observed differences in our measures of paranormal beliefs, pseudoscientific beliefs, dialectical thinking, rationality, and experientiality between Japanese and Western samples. As in Study 1, Japanese participants endorsed more paranormal,  $t(313) = 4.42, p < .001, d = 0.50$ , and pseudoscientific beliefs,  $t(314) = 3.97, p < .001, d = 0.45$ . Japanese participants also demonstrated a greater degree of dialectic thinking compared to Western participants,  $t(314) = 9.75, p < .001, d = 1.10$ . Lastly, Western participants scored higher on both the rationality,  $t(314) = 6.50, p < .001, d = 0.73$ , and experientiality,  $t(314) = 6.40, p < .001, d = 0.72$ , subscales of the REI-10.

## Cultural Differences and Determinants of Epistemically Suspect Beliefs

As in Study 1, we conducted multiple regression analyses predicting ESBs (i.e., paranormal beliefs and pseudoscientific beliefs) in order to identify potential determinants of ESBs (see **Table 2**). We adopted a hierarchical regression approach to identify whether the effects of predictors were moderated by cultural affiliation. Consistent with Study 1, we found that women were more likely to endorse paranormal beliefs ( $\beta = -.32, p = .015$ ) and older individuals more likely to endorse pseudoscientific beliefs ( $\beta = -.22, p = .041$ ). Additionally, experientiality was positively associated with ESBs ( $B_{PA}: \beta = .43, B_{PS}: \beta = .35, ps < .001$ ), while rationality ( $B_{PA}: \beta = -.17, p = .041, B_{PS}: \beta = -.28, p < .001$ ) and CRT performance ( $B_{PA}: \beta = -.27, p = .001, B_{PS}: \beta = -.38, p < .001$ ) was negatively associated with ESBs. Lastly, DSS scores were found to be positively associated with the endorsement of paranormal but not pseudoscientific beliefs ( $B_{PA}: \beta = .19, p = .016, B_{PS}: \beta = .02, p = .804$ ).

We observed multiple interactions between various cognitive traits and cultural affiliation. For belief in the paranormal, we found significant rationality  $\times$  sample ( $\beta = .35, p = .003$ ) and experientiality  $\times$  sample interactions ( $\beta = -.24, p = .036$ ), as well as a marginally significant CRT  $\times$  sample interaction ( $\beta = .21, p = .057$ ). Deconstructing the rationality  $\times$  sample interaction, we found a negative slope within our Western sample (unstandardized slope =  $-0.038, p = .040$ ) and a positive slope within our Japanese sample ( $0.045, p = .015$ ). Similarly, CRT performance was shown to be negatively associated with paranormal beliefs in our Western sample ( $-0.212, p < .001$ )

**TABLE 3 |** Descriptive statistics and correlations of key variables (Study 2).

	West ( <i>n</i> = 149)			JP ( <i>n</i> = 167)			Sample difference			Pearson correlation coefficients <sup>a</sup>							
	$\alpha$	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>d</i>	Age	CAB	RAT	EXP	CRT	DSS	B <sub>PA</sub>	B <sub>PS</sub>	
Age		30.60	10.03	39.47	9.34	-7.92	<.001	0.92		.063	.118	-.098	.163	-.134	-.098	-.059	
CAB		62.49	12.97	60.65	12.39	1.29	.199	0.15	.067		.395	-.208	.441	-.025	-.037	-.304	
RAT	0.79	3.66	0.77	3.10	0.75	6.50	<.001	0.73	.105	.368		-.091	.381	-.209	.117	-.171	
EXP	0.80	3.59	0.70	3.08	0.73	6.40	<.001	0.72	.127	.017	.092		-.201	-.211	.217	.336	
CRT		1.41	1.15	1.39	1.19	0.10	.917	0.01	.054	.588	.236	-.015		-.057	-.064	-.329	
DSS	0.83	3.62	0.59	4.20	0.45	-9.75	<.001	1.10	-.171	-.075	-.252	-.166	-.156		.019	.124	
B <sub>PA</sub>	0.93	2.24	0.94	2.69	0.85	-4.42	<.001	0.50	.159	-.275	-.221	.365	-.334	.197		.468	
B <sub>PS</sub>	0.79	2.48	0.69	2.76	0.57	-3.97	<.001	0.45	.202	-.317	-.281	.312	-.390	.070	.624		

<sup>a</sup>Values above the diagonal indicate coefficients for Japanese sample, and values below the diagonal indicate coefficients for Western sample. The coefficients shown in bold face were significant at  $p < .05$ . All scales except DSS (seven-point) are five-point scales. As in Study 1, RAT and EXP are indices of Type-2 analytic styles of thinking and EXP is an index of intuitive thinking. DSS is an index of holistic thinking. DSS, Dialectical Self Scale; *B<sub>PA</sub>*, belief in the paranormal; *B<sub>PS</sub>*, belief in pseudoscience.

and not associated with such beliefs in our Japanese sample ( $-0.058, p = .321$ ). Deconstructing the experientiality  $\times$  sample interaction, we found a positive simple slope in our Western sample ( $0.104, p < .001$ ) and a more moderate, but significant, positive slope in our Japanese sample ( $0.050, p = .007$ ). For belief in pseudoscience, we observed significant rationality  $\times$  sample ( $\beta = .26, p = .019$ ) and marginally significant DSS  $\times$  sample interactions ( $\beta = .22, p = .065$ ). Simple slope analyses revealed that rationality was negatively associated with belief for Western participants ( $-0.044, p < .001$ ), but not associated with belief for Japanese participants ( $-0.001, p = .917$ ). Thus, highly rational Westerners were less likely to endorse ESBs whereas rationality scores were not associated with ESBs in our Japanese sample. Conversely, DSS scores were positively associated with pseudoscientific belief in our Japanese sample ( $0.236, p = .015$ ), but not in our Western sample ( $0.019, p = .814$ ), demonstrating that Japanese participants high in dialectical thinking endorsed more pseudoscientific beliefs while the same was not true in our Western sample. Overall, the results of Study 2 provide further evidence suggesting that the mechanisms underlying ESBs differ across cultures. Specifically, rationality and Type-2 analytic thinking, were negatively correlated with ESBs in Westerners, but not Japanese participants. Furthermore, in some cases, these relations were reversed (i.e., positive) within our Japanese sample.

## STUDY 3

In Studies 1 and 2, we observed that a tendency toward holistic cognition was positively associated with ESBs. However, we failed to find an association between propensity toward contradiction and ESBs. As discussed earlier, the self-rated measure of attitude toward contradiction, namely, the attitude toward contradiction subscale of the AHS, may not reflect an individual's dialectical thinking behavior. Therefore, Study 3 was conducted to see whether individuals who think dialectically have stronger paranormal and pseudoscientific beliefs than those who do not. To this end, participants in Study 3 were asked to indicate to what extent they endorse statements expressing epistemically suspect beliefs (pro-belief), as well as statements which explicitly deny epistemically suspect beliefs (anti-belief).

## Method

### Participants

A sample of 301 participants were recruited from two online sources, 151 Japanese participants (69% female;  $M_{\text{age}} = 36.62$ ,  $SD_{\text{age}} = 8.99$ ) from CW and 150 Western participants (43% female;  $M_{\text{age}} = 32.91$ ,  $SD_{\text{age}} = 11.42$ ; 17% United States residents, 41% United Kingdom residents, 39% other) from ProA. All participants received compensation (CW = 240 JPY; ProA = £2.00) upon completion of an approximately 18-min online questionnaire. One participant from the CW sample was excluded from all analyses due to providing incomplete responses to belief tasks.

## Materials

The materials used in Study 3 were similar to those used in Study 1, with the following exceptions. First, we administered only 12 AHS items (those from the causality and attitude toward contradiction subscales), removing the 12 AHS items associated with the perception of change and locus of attention subscales on account of responses to these items failing to explain endorsement of ESBs. However, we decided not to exclude six items from attitude toward contradiction subscale to see if it correlates with actual dialectical thinking behavior. Second, we chose five paranormal belief and five pseudoscientific belief items from Studies 1 and 2 (e.g., "Some people can have a dream that has predicted some future events") and created anti-belief statements for each item (e.g., "No one can have a dream that has predicted future events"). The resulting 10 pairs of statements were divided into two sets, such that each set contained five pro- and five anti-belief items. We ensured that pro- and anti-belief statements for the same item were not included in the same set. As in Studies 1 and 2, participants rated their agreement with each presented statement on a seven-point scale ranging from "1 (*Strongly disagree*)" to "7 (*Strongly agree*). A paranormal ( $B_{PA}$ ) and pseudoscience ( $B_{PS}$ ) score was calculated for each participant by taking the average of their responses to paranormal and pseudoscientific pro-belief statements, respectively.

Lastly, we assessed Dialectic Thinking (DT) using a methodology featured in past work (Zhang et al., 2015). In order to calculate a DT score for each participant, believability ratings for paired pro- and anti-belief statements were standardized (Z-scores) for each issue such that the midpoint "4" was set to equal zero. Next, both Z-scores were summed to create a DT score for a particular item. Finally, all five DT scores were averaged for paranormal ( $DT_{PA}$ ) and pseudoscientific items ( $DT_{PS}$ ), separately, creating a DT score pertaining to paranormal beliefs and another score pertaining to pseudoscientific beliefs.

Z-score  $P_k$  ( $Z_{Pk}$ ) = (raw rating of Pro-belief statement of item  $k - 4) / SD_{Pk+Ak}$

Z-score  $A_k$  ( $Z_{Ak}$ ) = (raw rating of Anti-belief statement of item  $k - 4) / SD_{Pk+Ak}$

$$DT \text{ score} = \frac{1}{5} \sum_{k=1}^5 |Z_{Pk} + Z_{Ak}|$$

## Procedure

Participants were administered an online questionnaire in which they were asked to respond to various items in the following order: a belief task, REI-10 items, the AHS, a second belief task, a syllogistic reasoning task, the SNS and the CRT. Following the completion of these tasks, participants were asked a series of demographic questions (i.e., age, gender, nationality, ethnicity, and native language). As in Studies 1 and 2, all materials were presented in Japanese for CW participants and in English for ProA participants.

## Results and Discussion

Table 4 shows the descriptive statistics and bivariate correlations for all key variables. Once again, we conducted a series of



**TABLE 4 |** Descriptive statistics and correlations of key variables (Study 3).

	West ( <i>n</i> = 135)			JP ( <i>n</i> = 126)			Sample difference			Pearson correlation coefficients <sup>a</sup>										
	<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>		<i>t</i>	<i>p</i>	<i>d</i>	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Age	32.91	11.42		36.62	8.99		-3.13	.002	0.36		.100	.124	-.032	.127	.077	.089	.026	<b>.264</b>	-.158	<b>-.234</b>
2. CAB	61.33	19.07		57.79	17.15		1.69	.092	0.20	-.079		.117	-.046	<b>.454</b>	.068	-.073	-.104	.022	-.053	-.089
3. RAT	3.69	0.71		3.15	0.79		6.18	<.001	0.72	-.118	<b>.210</b>		.026	.129	<b>.208</b>	-.120	.078	-.063	-.037	
4. EXP	3.65	0.72		3.32	0.67		5.29	<.001	0.61	.029	<b>-.251</b>	-.057		-.055	.114	.143	<b>.226</b>	.146	.038	.007
5. CRT	1.31	1.16		1.43	1.00		-0.99	.322	0.11	<b>-.189</b>	<b>.376</b>	<b>.182</b>	-.145		-.057	.062	<b>-.305</b>	-.096	-.143	-.059
6. Cause	5.07	0.88		5.43	0.90		-3.50	<.001	0.40	-.087	-.128	.079	<b>.167</b>	.075		<b>.178</b>	<b>.262</b>	<b>.196</b>	.046	.008
7. Contra	4.77	0.98		4.77	0.82		0.03	.978	0.00	-.053	-.111	<b>-.222</b>	-.024	<b>-.179</b>	.158		-.010	.053	-.040	.082
8. B <sub>PA</sub>	3.03	1.33		3.83	1.38		-5.15	<.001	0.60	.058	<b>-.223</b>	-.107	<b>.385</b>	<b>-.225</b>	<b>.417</b>	.070	<b>.430</b>	-.067	-.159	
9. B <sub>PS</sub>	3.54	0.87		3.63	0.76		1.20	.229	0.14	<b>.255</b>	<b>-.291</b>	<b>-.174</b>	<b>.283</b>	<b>-.338</b>	<b>.272</b>	<b>.161</b>	<b>.513</b>	-.059	<b>-.366</b>	
10. DT <sub>PA</sub>	0.36	0.33		0.38	0.27		-0.48	.630	0.06	.042	-.137	-.139	<b>.224</b>	-.048	.034	-.004	.085	<b>.196</b>	<b>-.164</b>	
11. DT <sub>PS</sub>	0.54	0.38		0.63	0.42		-2.00	.046	0.23	<b>-.162</b>	-.156	.007	.107	-.109	-.072	.087	-.087	-.046	<b>.226</b>	

<sup>a</sup>Values above the diagonal indicate coefficients for Japanese sample, and values below the diagonal indicate coefficients for Western sample. The coefficients shown in bold face were significant at  $p < .05$ . All scales except subscales of AHS (Cause and Contra; seven-point) are five-point scales. DT<sub>PA</sub>, Dialectic Thinking score for paranormal items; DT<sub>PS</sub>, Dialectic Thinking score for pseudoscience items.

independent samples *t*-tests to investigate differences across our Japanese and Western samples. We observed no differences between Western and Japanese participants with regards to their attitude toward contradiction, CRT performance, cognitive ability, or endorsement of pseudoscientific beliefs (all  $ps > .09$ ). Replicating the findings of Studies 1 and 2, Western participants scored higher on our measure of rationality,  $t(299) = 6.14$ ,  $p < .001$ ,  $d = 0.72$ , and endorsed less paranormal beliefs,  $t(299) = 5.15$ ,  $p < .001$ ,  $d = 0.60$ . Western participants also scored higher on our measure of experientiality,  $t(299) = 5.29$ ,  $p < .001$ ,  $d = 0.61$ , whereas Japanese participants scored higher in causal perception (as measured by the causality subscale of the AHS),  $t(299) = 3.50$ ,  $p < .001$ ,  $d = 0.40$ . Interestingly, DT scores were not correlated with either causality or contradiction scores.

### Cultural Differences and Determinants of Epistemically Suspect Beliefs

As in Studies 1 and 2, we investigated potential determinants of ESBs by conducting hierarchical regression analyses. We excluded measures of cognitive ability and attitude toward contradiction as preliminary analyses failed to show any contribution of these variables in predicting the endorsement of ESBs. With the exception of these exclusions, all predictors were entered simultaneously into our model in Step 1. In Step 2, we entered the interaction terms with sample. The introduction of these interaction terms marginally improved our model for pseudoscientific beliefs ( $\Delta R^2 = .02$ ,  $p = .056$ ), but not paranormal beliefs ( $\Delta R^2 = .01$ ,  $p = .143$ ). In Step 3, we entered DT scores for both ESB domains (pseudoscientific and paranormal beliefs) as well as the DT  $\times$  sample interaction into our model. These additions improved our model for pseudoscientific beliefs ( $\Delta R^2 = .04$ ,  $p < .001$ ), but not paranormal beliefs ( $\Delta R^2 = .002$ ,  $p = .243$ ). Both Step 2 (without DT scores) and Step 3 (with DT scores) models for both paranormal and pseudoscientific beliefs can be viewed in Table 5.

As in Study 1, our measure of experientiality was positively associated with ESBs ( $\beta_{PA} = .25$ ,  $\beta_{PS} = .19$ ,  $ps < .05$ ) and CRT performance was negatively associated with ESBs ( $\beta_{PA} = -.14$ ,  $\beta_{PS} = -.26$ ,  $ps < .05$ ). Additionally, holistic understanding of causality was positively associated with ESBs ( $\beta_{PA} = .38$ ,  $\beta_{PS} = .32$ ,  $ps < .001$ ). Therefore, consistent with past theorizing, the tendency to think holistically may leave one susceptible to ESBs while analytic thinking may protect against such beliefs. Unlike in Studies 1 and 2, significant interactions with sample were found only for dialectic thinking pertaining to pseudoscientific beliefs ( $\beta = -.24$ ,  $p = .019$ ). Simple slope analysis revealed that dialectic thinking was positively associated with pseudoscientific beliefs in our Western sample ( $0.047$ ,  $p < .001$ ), but not our Japanese sample ( $0.018$ ,  $p = .116$ ). Thus, Western participants high in dialectical thinking endorsed more pseudoscientific beliefs while the same was not true in our Japanese sample. Interestingly, the actual behavior of dialectic thinking exhibited a slightly different pattern of results from self-report measures of dialecticism. Overall, Study 3 provided further

**TABLE 5 |** Regression analyses predicting beliefs by cognitive traits, cultural orientation, dialectical thinking, and interactions with sample (Study3).

Predictors	B <sub>PA</sub>								B <sub>PS</sub>							
	Without DT				With DT				Without DT				With DT			
	<i>b</i>	<i>SE</i>	$\beta$	<i>p</i>	<i>b</i>	<i>SE</i>	$\beta$	<i>p</i>	<i>b</i>	<i>SE</i>	$\beta$	<i>p</i>	<i>b</i>	<i>SE</i>	$\beta$	<i>p</i>
(Intercept)	3.09	0.27		<.001	3.12	0.28		<.001	3.29	0.16		<.001	3.39	0.19		<.001
Sample <sup>a</sup>	0.77	0.16	.548	<.001	1.00	0.24	.552	<.001	−0.22	0.10	−.266	.031	0.12	0.15	−.206	.438
Gender <sup>b</sup>	−0.35	0.15	−.247	.022	−0.35	0.15	−.248	.022	−0.19	0.09	−.236	.041	−0.15	0.09	−.184	.106
Age	0.01	0.01	.036	.476	0.00	0.01	.028	.574	0.02	0.00	.232	<.001	0.02	0.00	.199	<.001
RAT	−0.03	0.03	−.077	.328	−0.03	0.03	−.077	.330	−0.03	0.02	−.123	.142	−0.03	0.02	−.127	.120
EXP	0.10	0.03	.248	.001	0.10	0.03	.248	.001	0.04	0.02	.175	.023	0.04	0.02	.185	.015
CRT	−0.19	0.09	−.144	.031	−0.19	0.09	−.146	.030	−0.19	0.05	−.249	.001	−0.20	0.05	−.263	<.001
Causality	0.10	0.02	.379	<.001	0.10	0.02	.379	<.001	0.05	0.01	.320	<.001	0.05	0.01	.316	<.001
DT <sup>c</sup>					0.01	0.30	.002	.970					−0.07	0.16	−.035	.649
RAT × sample	0.05	0.04	.137	.197	0.05	0.04	.131	.218	0.03	0.02	.169	.136	0.03	0.02	.167	.132
EXP × sample	−0.02	0.04	−.044	.671	−0.02	0.04	−.040	.701	−0.01	0.03	−.039	.722	−0.01	0.02	−.051	.639
CRT × sample	−0.17	0.13	−.131	.193	−0.19	0.13	−.146	.149	0.13	0.08	.169	.117	0.12	0.08	.161	.126
Causality × sample	−0.05	0.03	−.206	.044	−0.05	0.03	−.199	.051	−0.03	0.02	−.213	.050	−0.03	0.02	−.198	.064
DT × sample <sup>c</sup>					−0.61	0.47	−.130	.194					−0.49	0.21	−.241	.019
Adjusted <i>R</i> <sup>2</sup>	.31				.31				.21				.25			

All continuous variables except for age were mean-centered.

<sup>a</sup>1 = Japanese, 0 = Western. <sup>b</sup>1 = men, 0 = women. <sup>c</sup>DT, Dialectical Thinking score of each domain (DT<sub>PA</sub> for B<sub>PA</sub> and DT<sub>PS</sub> for B<sub>PS</sub>).

evidence suggesting that the mechanisms underlying ESBs differ across cultures.

## STUDY 4

Study 4 explored cultural differences in receptivity to pseudo-profound bullshit. The fact that individuals' receptivity to pseudo-profound bullshit is positively associated with their acceptance of ESBs suggests common cognitive mechanisms underlying bullshit receptivity and acceptance of ESBs. While past work has examined the mechanisms underlying bullshit receptivity (Pennycook et al., 2015a; Walker et al., 2019), no work (to our knowledge) has examined these mechanisms cross-culturally. As evidenced by Studies 1–3, the association between various individual difference measures (e.g., analytical thinking) and ESBs (e.g., pseudoscientific belief) may vary between cultures. Similar to ESBs, bullshit receptivity has been found to be negatively associated with analytical thinking (Pennycook et al., 2015a; Pennycook and Rand, 2020), however, such studies have relied heavily on WEIRD samples. Thus, in Study 4 we aim to investigate whether the same mechanisms (e.g., analytical thinking) underlie bullshit receptivity across Western (American) and Eastern (Japanese) participants. Furthermore, recent studies have demonstrated how individual differences in illusory pattern perception relate to bullshit receptivity (Walker et al., 2019) and various ESBs (van Prooijen et al., 2018). Therefore, in Study 4, we also assessed participants' performance on a pattern perception task. We predict that individuals demonstrating greater illusory pattern perception will also show a greater receptivity to pseudo-profound statements. Additionally, we assess whether the association between illusory pattern perception and bullshit receptivity differs between American and Japanese individuals.

## Method

### Participants

A sample of 401 participants were recruited from two online crowdsourcing platforms, 201 Japanese participants (46% female;  $M_{\text{age}} = 39.45$ ,  $SD_{\text{age}} = 10.02$ ) from CW and 200 U. S. residents (37% female;  $M_{\text{age}} = 34.30$ ,  $SD_{\text{age}} = 10.67$ ) from Amazon's Mechanical Turk (MTurk). All participants received compensation (CW = 270 JPY; Mturk = \$2.50 USD) upon completion of an approximately 15-min online questionnaire.

### Materials

In Study 4, we administered the CRT and AHS (24-item version; Choi et al., 2007) along with two new measures: a modified snowy pictures task (Whitson and Galinsky, 2008) and a profundity judgment task (Pennycook et al., 2015a).

### Modified Snowy Pictures Task

The modified snowy pictures task (MSPT; Whitson and Galinsky, 2008) was used to measure participants' ability to detect real patterns and avoid endorsing illusory patterns. Participants were presented with 24 pictures, 12 of which contained a difficult to perceive object and 12 of which contained only visual noise.

For each picture, they were asked whether the presented image contained an object and responded with either a "yes" or "no" response. A non-illusory pattern perception score was calculated for each participant by determining how many object-present items they correctly endorsed as containing an object. Similarly, an illusory pattern perception score was calculated for each participant by determining how many object-absent items participants correctly endorsed as not containing an object. Thus, higher scores for object-present and object-absent items were indicative of a greater tendency to identify real patterns and a reduced tendency to endorse illusory patterns, respectively.

### Profundity Judgments

Participants were presented with 30 statements (10 pseudo-profound bullshit statements, 10 motivational quotations, and 10 mundane statements) and were asked to assess the profundity of each statement on a five-point scale ranging from "1 = *Not at all profound*" to 5 "*Very profound*." All statements originated from Pennycook et al. (2015a)<sup>6</sup>. Pseudo-profound bullshit statements were originally obtained from two websites<sup>7</sup> able to create superficially impressive yet meaningless statements by randomly arranging a list of profound sounding words in a way that maintains syntactic structure. A bullshit receptivity score (BSR) was created for each participant by calculating their mean profundity rating given to pseudo-profound bullshit items (e.g., "Hidden meaning transforms unparalleled abstract beauty"), with higher scores indicating greater bullshit receptivity. Ten motivational quotations and mundane statements were also presented to participants, contrasting the meaningless nature of pseudo-profound bullshit statements. All motivational quotations were originally obtained via an internet search and were designed to communicate something meaningful and reasonably profound (e.g., "A wet man does not fear the rain"). Mundane statements also communicated something meaningful, however, they were designed so that the message being communicated was banal (e.g., "New born babies require constant attention"). Identical to that of the BSR, a motivational quotation (MQ) and mundane statement (MS) score was calculated for each participant by determining their mean profundity rating given to motivational and mundane items, respectively.

### Procedure

Participants were once again administered an online questionnaire for which they completed 30 profundity judgments, 24 MSPT items, 24 AHS items, the CRT, and a host of demographic questions in that order. As in previous studies, all materials were presented in Japanese for CW participants and in English for Mturk participants.

<sup>6</sup>The Japanese version of the profundity judgment task was created through the following procedure. First, the first author translated items into Japanese. Next, a professional English-proofing company translated the Japanese version of all items back into English and the accuracy of the translation was checked against the original text. Based on their suggestions, the first author made minor revisions to the translation, and finally, the first and second authors decided on the final translation by consensus.

<sup>7</sup><http://wisdomofchopra.com> and <http://sebearce.com/bullshit/>

**TABLE 6 |** Descriptive statistics of cognitive traits and beliefs (Study 4).

	West ( <i>n</i> = 181)		JP ( <i>n</i> = 177)		Sample difference			Pearson correlation coefficients <sup>a</sup>										
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>d</i>	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Age	34.30	10.67	39.45	10.02	-4.97	<.001	0.50		<b>.165</b>	.046	.130	.079	-.040	.075	<b>.157</b>	-.101	-.021	-.056
2. CRT	1.54	0.70	1.43	1.11	1.21	.227	0.12	.057		-.087	.084	.050	-.127	<b>.151</b>	-.087	-.049	<b>-.160</b>	<b>-.400</b>
3. Pattern (P)	9.03	2.60	8.55	2.37	1.92	.055	0.19	.084	.059		<b>-.523</b>	<b>.160</b>	-.013	-.012	.139	<b>.155</b>	<b>.234</b>	.036
4. Pattern (A)	9.89	2.33	9.61	2.44	1.21	.227	0.12	.014	<b>.165</b>	<b>-.376</b>		-.054	.008	<b>.146</b>	-.071	<b>-.250</b>	<b>-.213</b>	<b>-.242</b>
5. Cause	5.18	0.92	5.36	0.73	-2.17	.030	0.22	-.035	.020	.064	.069		.139	<b>.142</b>	<b>.341</b>	.103	<b>.207</b>	-.026
6. Contra	4.91	1.05	4.73	0.73	2.00	.046	0.20	-.116	.066	.108	-.050	<b>.237</b>		-.133	<b>.292</b>	.024	<b>.177</b>	.079
7. Change	4.53	0.97	4.86	0.75	-3.83	<.001	0.38	.084	<b>.142</b>	.097	<b>.225</b>	.014	-.003		-.111	-.023	-.002	<b>-.152</b>
8. Attention	4.95	0.94	5.16	0.61	-2.66	.008	0.27	-.009	<b>-.159</b>	.010	-.004	<b>.230</b>	<b>.244</b>	<b>-.146</b>		.087	<b>.167</b>	-.006
9. BSR	2.60	1.00	2.58	0.75	0.28	.778	0.03	<b>-.157</b>	<b>-.382</b>	.116	<b>-.334</b>	<b>.147</b>	.104	<b>-.169</b>	.089		<b>.527</b>	<b>.332</b>
10. MQ	3.20	0.76	2.99	0.65	2.94	.003	0.29	-.033	<b>-.178</b>	.089	<b>-.270</b>	.130	<b>.267</b>	-.123	<b>.193</b>	<b>.575</b>	<b>.442</b>	
11. MS	1.50	0.86	1.96	0.83	-5.52	<.001	0.55	-.112	<b>-.358</b>	-.096	<b>-.453</b>	-.062	-.027	<b>-.516</b>	.100	<b>.452</b>	<b>.292</b>	

Pattern (P), number of correct responses to 12 object-present items where an object was embedded; Pattern (A), number of correct responses to 12 object-absent items where an object was not embedded (lower scores illustrate greater illusory pattern perception); BSR, mean profundity rating given to pseudo-profound bullshit statements; MQ, mean profundity rating given to motivational quotes; MS, mean profundity rating given to mundane statements. All profundity judgments are five-point scales and subscales of AHS are seven-point scales.

<sup>a</sup>Values above the diagonal indicate coefficients for Japanese sample, and values below the diagonal indicate coefficients for Western sample. The coefficients shown in bold face were significant at  $p < .05$ .

## Results and Discussion

Descriptive statistics and bivariate correlations for all variables can be viewed in **Table 6**. Independent samples *t*-tests revealed that Japanese participants scored higher on 3 of the 4 sub-scales of the AHS [Causality:  $t(399) = 2.17$ ,  $p = .030$ ,  $d = 0.22$ ; Change:  $t(399) = 3.83$ ,  $p = .001$ ,  $d = 0.38$ ; Attention:  $t(399) = 2.66$ ,  $p = .008$ ,  $d = 0.27$ ] demonstrating an overall greater tendency to engage in holistic thinking compared to United States participants. No differences were observed between Japanese and United States participants with regards to CRT performance, illusory pattern perception or bullshit receptivity (all  $ps > .220$ ). Furthermore, consistent with past work (Walker et al., 2019), bullshit receptivity was found to positively correlate with illusory pattern perception [United States:  $r(198) = .33$ ,  $p < .001$ ; Japan:  $r(198) = .25$ ,  $p < .001$ ]. Also consistent with past work (Pennycook et al., 2015a; Pennycook and Rand, 2020), CRT performance was found to negatively relate to bullshit receptivity within our United States sample,  $r(198) = -.38$ ,  $p < .001$ . Interestingly, no association was found between CRT performance and bullshit receptivity for Japanese participants,  $r(198) = -.05$ ,  $p = .487$ .

Next, we conducted multiple regression analyses predicting bullshit receptivity with individual differences in CRT performance, holistic cognition (as measured by the AHS), illusory pattern perception, and interactions of these variables with culture. Since preliminary analyses revealed that the AHS subscales of attitude toward contradiction, perception of change, and locus of attention failed to predict individuals' receptivity to bullshit, the causality subscale was the only measure of holistic thinking included in our model. Analyses of  $\Delta R^2$  showed that our model was significantly improved at all steps (Step 1:  $\Delta R^2s = .144$ ,  $p < .001$ ; Step 2:  $\Delta R^2s = .057$ ,  $p < .001$ ). The final model can be viewed in **Table 7**. These results show that individual differences in CRT performance ( $\beta = -.50$ ,  $p < .001$ ), illusory pattern perception ( $\beta = -.34$ ,  $p < .001$ ), and holistic cognition (as measured by the causality subscale of the AHS;  $\beta = .18$ ,  $p = .002$ )

**TABLE 7 |** Regression analysis predicting bullshit receptivity by reflective thinking, holistic cognition, illusory pattern perception, and interactions with sample (Study 4).

Predictors	<i>b</i>	<i>SE</i>	$\beta$	<i>p</i>
(Intercept)	2.91	0.16		<.001
Sample <sup>a</sup>	-0.05	0.08	-.048	.595
Gender <sup>b</sup>	0.10	0.08	.114	.230
Age	-0.01	0.00	-.109	.022
Pattern absent	-0.13	0.03	-.342	<.001
CRT	-0.48	0.08	-.503	<.001
Causality	0.03	0.01	.179	.002
Sample $\times$ Pattern	0.06	0.03	.152	.100
Sample $\times$ CRT	0.46	0.10	.479	<.001
Sample $\times$ Causality	-0.01	0.02	-.075	.425

Pattern absent, number of correct responses to object-absent items where an object was not embedded (lower scores illustrate greater illusory pattern perception). Adjusted  $R^2 = .182$ ,  $F(9,390) = 10.90$ ,  $p < .001$ .

<sup>a</sup>1 = Japanese, 0 = Western. <sup>b</sup>1 = men, 0 = women.



predicted bullshit receptivity. Furthermore, we observed a significant CRT  $\times$  sample interaction ( $\beta = .48, p < .001$ ). A simple slope analysis revealed that CRT was negatively associated with bullshit receptivity within our United States sample ( $-0.48, p < .001$ ), and shared no association with bullshit receptivity in our Japanese sample ( $-0.023, p = .666$ ), suggesting that the mechanisms underlying bullshit receptivity, like ESBs, may differ across cultures.

## GENERAL DISCUSSION

The present study investigated cultural differences related to the endorsement of ESBs and pseudo-profound bullshit. Specifically, we examined the cognitive mechanisms supporting these beliefs across Eastern (Japanese) and Western (United States and Western Europe) cultures, revealing the generality versus specificity of cognitive mechanisms proposed in the literature surrounding ESBs. A number of key findings emerged from the current set of studies. First, consistent with past work (Shiah et al., 2010), Easterners, such as Japanese participants, showed stronger paranormal beliefs (Studies 1–3) and some evidence of stronger pseudoscientific beliefs (Studies 1 and 2) compared to Western participants<sup>8</sup>. Conversely, receptivity to pseudo-profound bullshit did not differ across cultures.

Individual differences in holistic cognition partly explained differences in ESBs and bullshit receptivity. Specifically, individual differences in the holistic understanding of causality (i.e., multiple and complex causality) played a key role in explaining differences in ESBs and bullshit receptivity. However, contrary to expectations, participants' attitudes toward contradictions failed to explain ESBs and bullshit receptivity, suggesting that the stronger endorsement of ESBs in our Japanese sample was not due to a cultural difference in receptiveness to contradiction. Furthermore, individual differences in thinking style also explained differences in ESBs and bullshit receptivity, with a propensity to engage in analytic thinking negatively associated with the endorsement of ESBs and pseudo-profound bullshit statements as profound. Interestingly, the association between Type-2 analytic thinking (as measured by the CRT and rationality subscale of the REI) and ESBs differed across cultures. That is, for Westerners, individuals high in analytic thinking were less likely to endorse ESBs and pseudo-profound bullshit whereas no association was found between analytic thinking and either ESBs or bullshit receptivity in our Japanese sample. Thus, the present findings suggest that a propensity to engage in analytic thinking may protect against ESBs in Western individuals, but may not do so across cultures (specifically Eastern cultures).

Cultural psychologists have proposed a framework to understand cultural differences in cognitive styles between

Western and Eastern individuals, distinguishing between analytic and holistic cognition (Nisbett et al., 2001; Nisbett and Miyamoto, 2005; Ishii, 2013). Related to this distinction, we hypothesized that individuals demonstrating a high tolerance for contradictions would be more likely to endorse ESBs, as we suspected that those accepting contradictions would tend to perceive pro-ESB statements as plausible even when they did not specifically endorse the ESB themselves. However, our results suggest that it is not a tendency to accept contradictions that positively relates to the endorsement of ESBs, but rather the consideration that causality is complex and multifaceted and that events may have multiple causes which need not necessarily contradict. Holistic thinkers, therefore, may be less impacted by conflicts caused by scientifically unsound claims and be more open to alternative explanations of events.

The culture (i.e., holistic cognition) hypothesis may be challenged by the fact that, with the exception of Study 3, our results failed to show significant sample by holistic cognition interactions. Nevertheless, it is possible that the present findings arose, at least in part, due to the mixture of falsifiable and unfalsifiable statements within ESB items. That is, the endorsement of an empirically falsifiable belief (e.g., a pseudoscientific belief) may be more strongly associated with an analytical mode of thought compared to unfalsifiable beliefs, on account of falsifiability being connected to the type of scientific, deductive, linear thinking that is characteristic of analytic thinking. Consistent with this claim, the observed negative association between CRT and ESBs was generally stronger when evaluating participants' endorsement of falsifiable pseudoscientific beliefs compared to less readily falsifiable paranormal ones.

Additionally, within three of our four studies, we observed a sample by CRT interaction on ESBs and bullshit receptivity. Therefore, individuals' CRT performance (an assessment of their tendency to engage in Type-2 analytic thinking) related differently to endorsement of ESBs and receptiveness to pseudo-profound bullshit across cultures. Consistent with past work (Pennycook et al., 2012, 2015a), CRT performance was negatively associated with ESBs and bullshit receptivity within our Western sample, suggesting that more deliberative modes of thinking may protect against these seemingly irrational beliefs. However, a different pattern of results was observed in our Japanese samples, for which CRT was unrelated to the endorsement of ESBs and pseudo-profound bullshit. Therefore, the present study suggests that the often observed negative association between Type-2 analytic thinking and various ESBs may be exclusive to Western individuals.

Of course, it remains an open question as to *why* Type-2 analytic thinking relates differently to the endorsement of ESBs across cultures. One possibility is that measures of analytic thinking (such as the CRT) in part measure a tendency to oppose cultural norms. In support of this claim is the finding that cognitive reflection is positively associated with religious disbelief within highly religious countries but shares no association with religious disbelief in less religious countries (Gervais et al., 2018). If true, we may expect the association between cognitive reflection and ESBs to differ between cultures with different cultural norms

<sup>8</sup>However, it is worth noting that participants' endorsement of ESBs in the present research may have been affected by factors other than the believability of statements. For example, past work has found evidence of a midpoint preference among Japanese participants (Heine and Lehman, 1999). Thus, factors not related to participants' endorsement of ESBs may have nevertheless contributed to these differences.

surrounding ESBs. Notably, in the present study, the effects of CRT on pseudoscientific beliefs were observed to be roughly the same across cultures, as opposed to paranormal beliefs which differed across cultures. One possible explanation for the different results observed for pseudoscientific and paranormal beliefs is that both Western and Eastern individuals may hold a similar norm against endorsing readily falsifiable pseudoscientific claims, while a norm against endorsing less readily falsifiable paranormal beliefs may be stronger among Western individuals. Therefore, in the present context, the weak association between cognitive reflection and ESBs (particularly paranormal beliefs) in our Japanese sample may arise due to the fact that these beliefs may not necessarily violate prevailing cultural norms, while the same may not be true of a Western sample.

## SUMMARY

The present research investigates cultural differences in ESBs and bullshit receptivity. Critically, we demonstrate how the importance of Type-2 analytic thinking for suppressing ESBs (often observed in Western samples) fails to generalize across cultures (i.e., Japanese samples). Of course, the current work is not intended to be definitive; therefore, future studies should explore how factors such as analytic thinking predict other important real-world beliefs (e.g., endorsement of conspiracy theories and “fake news”) across cultures. Furthermore, the underlying mechanisms explaining what cultural factors elicit cultural differences regarding the endorsement of ESBs remains an open question. Nevertheless, we provide initial evidence demonstrating that not only does the endorsement of ESBs differ across cultures, but so too might the cognitive mechanisms supporting these beliefs, calling into question the generality of various cognitive mechanisms often thought to support ESBs.

## DATA AVAILABILITY STATEMENT

Data and analysis scripts of all studies are available at <https://osf.io/cbfwj/>.

## REFERENCES

- Aarnio, K., and Lindeman, M. (2005). Paranormal beliefs, education, and thinking styles. *Pers. Individ. Diff.* 39, 1227–1236. doi: 10.1016/j.paid.2005.04.009
- Bahçekapili, H. G., and Yilmaz, O. (2017). The relation between different types of religiosity and analytic cognitive style. *Pers. Individ. Diff.* 117, 267–272. doi: 10.1016/j.paid.2017.06.013
- Blackmore, S., and Trościński, T. (1985). Belief in the paranormal: probability judgements, illusory control, and the ‘chance baseline shift’. *Br. J. Psychol.* 76, 459–468. doi: 10.1111/j.2044-8295.1985.tb01969.x
- Bruder, M., Haffke, P., Neave, N., Nouripanah, N., and Imhoff, R. (2013). Measuring individual differences in generic beliefs in conspiracy theories across cultures: conspiracy mentality questionnaire. *Front. Psychol.* 4:225. doi: 10.3389/fpsyg.2013.00225
- Buchtel, E. E., and Norenzayan, A. (2009). “Thinking across cultures: implications for dual processes,” in *In Two Minds: Dual Processes and Beyond*, eds

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Research Ethics Committee at Hokusei Gakuen University and the Office of Research Ethics, at the University of Waterloo. All participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

YM designed the project, conducted empirical studies and statistical analyses, and drafted the manuscript. AW and MT co-designed and conducted Study 4 and revised the manuscript. JF supervised the project and critically reviewed the manuscript. All authors discussed the results and commented on the manuscript.

## FUNDING

This research was supported by grants from JSPS KAKENHI Grant (15K04033 and 19K03194) and The Natural Sciences and Engineering Research Council of Canada.

## ACKNOWLEDGMENTS

The authors thank Aki Nishihara for her help in translating materials of Study 1. The authors also thank Crimson Interactive Pvt. Ltd. (Ulatu) – [www.ulus.jp](http://www.ulus.jp) for their assistance in translating materials of Study 4.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2022.745580/full#supplementary-material>

- J. S. B. T. Evans and K. Frankish (Oxford: Oxford University Press), 217–238.
- Choi, I., Koo, M., and Choi, J. A. (2007). Individual differences in analytic versus holistic thinking. *Pers. Soc. Psychol. Bull.* 33, 691–705. doi: 10.1177/0146167206298568
- Cohen, P., Cohen, J., Aiken, L. S., and West, S. G. (1999). The problem of units and the circumstance for POMP. *Multivar. Behav. Res.* 34, 315–346. doi: 10.1207/S15327906MBR3403\_2
- Dekker, S., Lee, N. C., Howard-Jones, P., Jolles, J., Kuan-Chung, C., and Jordan, A. (2012). Neuromyths in education: prevalence and predictors of misconceptions among teachers. *Front. Psychol.* 3:429. doi: 10.3389/fpsyg.2012.00429
- Epstein, S., Pacini, R., Denes-Raj, V., and Heier, H. (1996). Individual differences in intuitive-experiential and analytical-rational thinking styles. *J. Pers. Soc. Psychol.* 71, 390–405. doi: 10.1037/0022-3514.71.2.390
- Evans, J. S. B. T. (2008). Dual-processing accounts of reasoning, judgment, and social cognition. *Annu. Rev.*

- Psychol.* 59, 255–278. doi: 10.1146/annurev.psych.59.103006.093629
- Evans, J. S. B. T., and Stanovich, K. E. (2013). Dual-process theories of higher cognition: advancing the debate. *Perspect. Psychol. Sci.* 8, 223–241. doi: 10.1177/1745691612460685
- Fagerlin, A., Zikmund-Fisher, B. J., Ubel, P. A., Jankovic, A., Derry, H. A., and Smith, D. M. (2007). Measuring numeracy without a math test: development of the subjective numeracy scale. *Med. Dec. Mak.* 27, 672–680. doi: 10.1177/0272989x07034449
- Frederick, S. (2005). Cognitive reflection and decision making. *J. Econ. Perspect.* 19, 25–42. doi: 10.1257/089533005775196732
- Gervais, W. M., and Norenzayan, A. (2012). Analytic thinking promotes religious disbelief. *Science* 336, 493–496. doi: 10.1126/science.1215647
- Gervais, W. M., van Elk, M., Xygalatas, D., McKay, R. T., Aveyard, M., Buchtel, E. E., et al. (2018). Analytic atheism: a cross-culturally weak and fickle phenomenon? *Judg. Dec. Mak.* 13, 268–274.
- Gray, T., and Mill, D. (1990). Critical abilities, graduate education (Biology vs. English), and belief in unsubstantiated phenomena. *Can. J. Behav. Sci.* 22, 162–172. doi: 10.1037/h0078899
- Heine, S. J., and Lehman, D. R. (1999). Culture, self-discrepancies, and self-satisfaction. *Pers. Soc. Psychol. Bull.* 25, 915–925. doi: 10.1177/01461672992511001
- Henrich, J., Heine, S. J., and Norenzayan, A. (2010). The weirdest people in the world? *Behav. Brain Sci.* 33, 61–83. doi: 10.1017/S0140525X0999152X
- Ishii, K. (2013). Culture and the mode of thought: a review. *Asian J. Soc. Psychol.* 16, 123–132. doi: 10.1111/ajsp.12011
- Karasawa, K., and Tsukimoto, T. (2010). The effect of information processing style on beliefs toward paranormal phenomena. *J. Hum. Environ. Stud.* 8, 1–5. doi: 10.4189/shes.8.1
- Lindeman, M. (2011). Biases in intuitive reasoning and belief in complementary and alternative medicine. *Psychol. Health* 26, 371–382. doi: 10.1080/08870440903440707
- Lindeman, M., and Aarnio, K. (2006). Paranormal beliefs: their dimensionality and correlates. *Eur. J. Pers.* 20, 585–602. doi: 10.1002/per.608
- Lobato, E., Mendoza, J., Sims, V., and Chin, M. (2014). Examining the relationship between conspiracy theories, paranormal beliefs, and pseudoscience acceptance among a university population. *Appl. Cogn. Psychol.* 28, 617–625. doi: 10.1002/acp.3042
- Maddux, W. W., and Yuki, M. (2006). The “Ripple Effect”: cultural differences in perceptions of the consequences of events. *Pers. Soc. Psychol. Bull.* 32, 669–683. doi: 10.1177/0146167205283840
- Majima, Y. (2015). Belief in pseudoscience, cognitive style and science literacy. *Appl. Cogn. Psychol.* 29, 552–559. doi: 10.1002/acp.3136
- Markovits, H., and Nantel, G. (1989). The belief-bias effect in the production and evaluation of logical conclusions. *Mem. Cogn.* 17, 11–17. doi: 10.3758/BF03199552
- Miyamoto, Y., Uchida, Y., and Ellsworth, P. C. (2010). Culture and mixed emotions: co-occurrence of positive and negative emotions in Japan and the United States. *Emotion* 10, 404–415. doi: 10.1037/a0018430
- Naito, M., Suzuki, K., and Sakamoto, A. (2004). Development of rational and intuitive information-processing style inventory. *Jpn. J. Pers.* 13, 67–78. doi: 10.2132/personality.13.67
- Nakajima, S., Sato, T., and Watanabe, Y. (1992). Tobacyk no Chou shizen genshou shinpou shakudo ni tuite. [On the Tobacyk's Paranormal Belief Scale]. *J. Japan Skept.* 1, 73–79.
- Nakajima, S., Sato, T., and Watanabe, Y. (1993). Chou shizen genshou shinpou shakudo no sakusei [the development of belief in paranormal phenomena scale]. *J. Japan Skept.* 2, 69–80.
- Nisbett, R. E., Choi, I., Peng, K., and Norenzayan, A. (2001). Culture and systems of thought: holistic versus analytic cognition. *Psychol. Rev.* 108, 291–310. doi: 10.1037/0033-295X.108.2.291
- Nisbett, R. E., and Miyamoto, Y. (2005). The influence of culture: holistic versus analytic perception. *Trends Cogn. Sci.* 9, 467–473. doi: 10.1016/j.tics.2005.08.004
- Norenzayan, A., Smith, E. E., Kim, B. J., and Nisbett, R. E. (2002). Cultural preferences for formal versus intuitive reasoning. *Cogn. Sci.* 26, 653–684. doi: 10.1207/s15516709cog2605\_4
- Pacini, R., and Epstein, S. (1999). The relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon. *J. Pers. Soc. Psychol.* 76, 972–987. doi: 10.1037/0022-3514.76.6.972
- Pennycook, G., Cheyne, J. A., Barr, N., Koehler, D. J., and Fugelsang, J. A. (2014). Cognitive style and religiosity: the role of conflict detection. *Mem. Cogn.* 42, 1–10. doi: 10.3758/s13421-013-0340-7
- Pennycook, G., Cheyne, J. A., Barr, N., Koehler, D. J., and Fugelsang, J. A. (2015a). On the reception and detection of pseudo-profound bullshit. *Judg. Dec. Mak.* 10, 549–563.
- Pennycook, G., Cheyne, J. A., Seli, P., Koehler, D. J., and Fugelsang, J. A. (2012). Analytic cognitive style predicts religious and paranormal belief. *Cognition* 123, 335–346. doi: 10.1016/j.cognition.2012.03.003
- Pennycook, G., Fugelsang, J. A., and Koehler, D. J. (2015b). Everyday consequences of analytic thinking. *Curr. Dir. Psychol. Sci.* 24, 425–432. doi: 10.1177/0963721415604610
- Pennycook, G., and Rand, D. G. (2020). Who falls for fake news? The roles of bullshit receptivity, overclaiming, familiarity, and analytic thinking. *J. Pers.* 88, 185–200.
- Risen, J. L. (2016). Believing what we do not believe: acquiescence to superstitious beliefs and other powerful intuitions. *Psychol. Rev.* 123, 182–207. doi: 10.1037/rev0000017
- Roberts, M. J., and Seager, P. B. (1999). Predicting belief in paranormal phenomena: a comparison of conditional and probabilistic reasoning. *Appl. Cogn. Psychol.* 13, 443–450. doi: 10.1002/(SICI)1099-0720(199910)13:5<443::AID-ACP592<3.0.CO;2-K
- Sanchez, C., Sundermeier, B., Gray, K., and Calin-Jageman, R. J. (2017). Direct replication of Gervais & Norenzayan (2012): No evidence that analytic thinking decreases religious belief. *PLoS One* 12:e0172636. doi: 10.1371/journal.pone.0172636
- Shiah, Y.-J., Wu, M.-H., Tam, W.-C. C., and Chang, F. (2010). Paranormal beliefs and religiosity: chinese version of the revised paranormal belief scale. *Psychol. Rep.* 107, 367–382. doi: 10.2466/08.09.17.Pr0.107.5.367-382
- Spencer-Rodgers, J., Peng, K., Wang, L., and Hou, Y. (2004). Dialectical self-esteem and East-West differences in psychological well-being. *Pers. Soc. Psychol. Bull.* 30, 1416–1432. doi: 10.1177/0146167204264243
- Spencer-Rodgers, J., Williams, M. J., and Peng, K. (2010). Cultural differences in expectations of change and tolerance for contradiction: a decade of empirical research. *Pers. Soc. Psychol. Rev.* 14, 296–312. doi: 10.1177/1088868310362982
- Tobacyk, J. J. (2004). A revised paranormal belief scale. *Int. J. Transpers. Stud.* 23, 94–98.
- Toplak, M. E., West, R. F., and Stanovich, K. E. (2011). The cognitive reflection test as a predictor of performance on heuristics-and-biases tasks. *Mem. Cogn.* 39, 1275–1289. doi: 10.3758/s13421-011-0104-1
- Tosyalı, F., and Aktas, B. (2021). Does training analytical thinking decrease superstitious beliefs? Relationship between analytical thinking, intrinsic religiosity, and superstitious beliefs. *Pers. Individ. Differ.* 183:111122. doi: 10.1016/j.paid.2021.111122
- Turpin, M. H., Walker, A. C., Kara-Yakoubian, M., Gabert, N. N., Fugelsang, J. A., and Stolz, J. A. (2019). Bullshit makes the art grow profounder. *Judg. Dec. Mak.* 14, 658–670.
- van Prooijen, J.-W., Douglas, K. M., and De Inocencio, C. (2018). Connecting the dots: Illusory pattern perception predicts belief in conspiracies and the supernatural. *Eur. J. Soc. Psychol.* 48, 320–335. doi: 10.1002/ejsp.2331
- Walker, A. C., Turpin, M. H., Stolz, J. A., Fugelsang, J. A., and Koehler, D. J. (2019). Finding meaning in the clouds: illusory pattern perception predicts receptivity to pseudo-profound bullshit. *Judg. Dec. Mak.* 14, 109–119.
- Whitson, J. A., and Galinsky, A. D. (2008). Lacking control increases illusory pattern perception. *Science* 322, 115–117. doi: 10.1126/science.1159845
- Yong, J. C., Hartanto, A., and Tan, J. J. X. (2021). Subjective social status and inflammation: the role of culture and anger control. *Health Psychol.* 40, 62–70. doi: 10.1037/hea0001029

- Yonker, J. E., Edman, L. R. O., Cresswell, J., and Barrett, J. L. (2016). Primed analytic thought and religiosity: the importance of individual characteristics. *Psychol. Relig. Spirit.* 8, 298–308. doi: 10.1037/rel0000095
- Zhang, B., Galbraith, N., Yama, H., Wang, L., and Manktelow, K. I. (2015). Dialectical thinking: a cross-cultural study of Japanese, Chinese, and British students. *J. Cogn. Psychol.* 27, 771–779. doi: 10.1080/20445911.2015.1025792

**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.

Copyright © 2022 Majima, Walker, Turpin and Fugelsang. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.





# A Study on the Sufficient Conditional and the Necessary Conditional With Chinese and French Participants

Jing Shao<sup>1,2\*</sup>, Dilane Tikiri Banda<sup>3</sup> and Jean Baratgin<sup>1,3</sup>

<sup>1</sup> Laboratory Cognition Humaine et Artificielle, Université Paris 8, Paris, France, <sup>2</sup> Université de Haute-Alsace, Mulhouse, France, <sup>3</sup> Probability, Assessment, Reasoning and Inferences Studies (P-A-R-I-S) Association, Paris, France

## OPEN ACCESS

### Edited by:

Ulrich Hoffrage,  
University of Lausanne, Switzerland

### Reviewed by:

Niels Skovgaard-Olsen,  
University of Göttingen, Germany  
Nicole Cruz,  
University of New South Wales,  
Australia

### \*Correspondence:

Jing Shao  
jing.wang@uha.fr

### Specialty section:

This article was submitted to  
Cognition,  
a section of the journal  
Frontiers in Psychology

**Received:** 30 September 2021

**Accepted:** 10 January 2022

**Published:** 24 February 2022

### Citation:

Shao J, Tikiri Banda D and  
Baratgin J (2022) A Study on  
the Sufficient Conditional  
and the Necessary Conditional With  
Chinese and French Participants.  
Front. Psychol. 13:787588.  
doi: 10.3389/fpsyg.2022.787588

According to the weak version of linguistic relativity, also called the Sapir-Whorf hypothesis, the features of an individual's native language influence his worldview and perception. We decided to test this hypothesis on the sufficient conditional and the necessary conditional, expressed differently in Chinese and French. In Chinese, connectors for both conditionals exist and are used in everyday life, while there is only a connector for the sufficient conditional in French. A first hypothesis follows from linguistic relativity: for the necessary conditional, better logic performance is expected in Chinese participants rather than French participants. As a second hypothesis, for all participants, we expect performance on the sufficient conditional to be better than on the necessary conditional. Indeed, despite the isomorphism of the two conditionals, they differ in how information is processed for reasoning. We decided to study reasoning under uncertainty as it reflects reality more accurately. To do so, we analyzed the coherence of participants using de Finetti's theory for deduction under uncertainty. The results of our study show no significant difference in performance between Chinese and French participants, neither on the sufficient conditional nor on the necessary conditional. Thus, our first hypothesis derived from the weak version of linguistic relativity is not confirmed. In contrast, our results confirm the second hypothesis in two out of three inference schemas.

**Keywords:** Sapir-Whorf hypothesis, universalist hypothesis, cross-cultural comparison, sufficient conditional, necessary conditional, deduction under uncertainty, de Finetti's coherence

## INTRODUCTION

### The Sapir-Whorf Hypothesis

For decades, linguistic relativity theory, also known as the Sapir-Whorf hypothesis, has been omnipresent in studying the relationship between thought and language. Linguistic relativity theory, defended by Sapir (1921) and more radically by Whorf (1956), proposes that language influences the way people perceive and think about the world. This hypothesis focuses on the differences in both vocabulary and grammar between languages. It suggests that people's language vocabulary and grammatical structure strongly influence how they conceptualize the world. Whorf considers that human language has an additional role in shaping thought besides its function as a communication tool. Two versions of the principle of linguistic relativity can be distinguished: the weak version and the strong version (Carnes, 1970; Brown, 1976). According to the strong version,

the characteristics of our native language *determine* our worldview and way of perceiving; as for the weak version, the former *influences* the latter. The strong version refers to linguistic determinism. Whorf himself does not make such a distinction. As Yao (2002) has pointed out, Whorf sometimes favored the weak version, sometimes the strong one. Compared to the strong version, which is very radical and that most researchers do not adhere to, the weak version seems much more realistic.

Whorf (1956) claims that grammatically based systems that differ across languages exercise an unconscious control over reasoning; that is, the grammar of one's native language might affect one's reasoning. Precisely, one's reasoning competence would be constrained by the presence or absence of grammatical structures in one's mother tongue. Counterfactual reasoning is an important topic in this area of research. Bloom (1981, 1984) proposed that Chinese speakers lacked a specific counterfactual construction without a distinct counterfactual marker (the subjunctive). For Bloom, this leads to a reduced ability to engage in counterfactual reasoning for Chinese speakers, compared to English speakers, who have a subjunctive structure. His results confirm the weak version of the Sapir-Whorf hypothesis. In contrast, Au (1983, 1984) and Liu (1985) did not find any particular difficulty of Chinese speakers with counterfactual reasoning compared to English speakers. Takano (1989) did not find any difference between Japanese speakers, who similarly lack a counterfactual marker, and English speakers. Their results invalidate the Sapir-Whorf hypothesis. However, more recently, the result of Yeh and Gentner (2005) has partly validated the weak version of the Sapir-Whorf hypothesis. In their experiment, when the participants had sufficient knowledge to interpret a counterfactually presented portion of a story, there was no difference between Chinese and English speakers. When they did not, the results showed an advantage for English speakers over Chinese speakers. As for the interference between thought and language, Hunt and Agnoli (1991) have argued that the locus of the interference between thought and language would not lie at the conceptual level but instead at the information processing level.

## Sufficient Conditional and Necessary Conditional

In the same manner, as with counterfactual reasoning, we would like to test the validity of the weak version of the Sapir-Whorf hypothesis. We compared Chinese and French speakers regarding the sufficient conditional and the necessary conditional in our experiment. The sufficient conditional refers to the reasoning "if A, then C," which means that, given the antecedent A, the consequent C occurs. As for the necessary conditional, it refers to "only if A, then C," which implies that the antecedent A is necessary for the consequent C to happen. A's presence is required to make C happen but might not be enough, unlike the sufficient conditional. The two conditionals are not expressed identically in Chinese and French. On the one hand, in Chinese, both connectors for the sufficient conditional and the necessary conditional are present in daily life; on the other hand, only a connector for the sufficient conditional exists in French.

According to the Sapir-Whorf hypothesis, Chinese participants should perform better than French participants on the necessary conditional, given the presence of the corresponding connector in their mother tongue. Also, there should be no significant difference between Chinese and French participants concerning the sufficient conditional, given that the connector for the sufficient conditional is present and widely used in both languages. In addition, we state a second hypothesis that there should be better performance in the sufficient conditional than in the necessary conditional. In the necessary conditional "only if A, then C," the antecedent A is necessary for the consequent C. This means that, without the presence of A, there is no C. So, "Only if A, C" is equivalent to "If not-A, then not-C" (Johnson-Laird and Byrne, 1991; Gomes, 2009; Wang and Gao, 2010), which has the same structure as the sufficient conditional "If P, then Q" (P being not-A, Q being not-C). Thus, the two conditionals can be interpreted as isomorphic. Nevertheless, the information processing most likely differs between the two conditionals, as reasoning in the necessary conditional *a priori* implies the process of transformation to the sufficient conditional in our experiment, in addition to reasoning in the sufficient conditional. We make such a claim due to the nature of the necessary conditional, which does not guarantee any event; it does not lead to another result in general, which makes the reasoning more difficult.

In Chinese communication, the sufficient conditional with the connector "*rúguǒ* A, *nàme* C" translates into "If A, then C" and the necessary conditional with the connector "*zhīyǒu* A, *cáihuì* C" translates into "Only if A, C." Most studies on conditional reasoning have focused on the sufficient conditional "if A, then C." There are few studies on the necessary conditional "A, only if C," logically equivalent to the sufficient conditional "if A, then C" (Evans, 1977; Evans and Beck, 1981; Grosset and Barrouillet, 2003). Those studies examined whether both conditionals were interpreted similarly by the participants. Despite logical equivalence, the results showed that those two forms seemed to be interpreted differently by the participants (Evans, 1977; McCawley, 1981). "If A, then C" is not always interpreted as "A, only if C": it is sometimes interpreted as "A, only if C," and sometimes as "C, only if A." Evans (1977); Evans and Newstead (1977), and Evans and Beck (1981) considered that the "only if" syntax involves both a temporal and a necessity relation. Thompson and Mann (1995) consider that pragmatic contexts, such as in the interpretation of necessity and temporal relations, might play a more indirect role. From another perspective, the study of Wang and Gao (2010) consisted in comparing the performance of Chinese participants with the traditional inference schemas: Modus Ponens (MP), Modus Tollens (MT), Denying the Antecedent (DA), and Affirmation of the Consequent (AC), with the sufficient conditional "If A, then C" and the necessary conditional "Only if C, A" logically equivalent. By way of a reminder, MP denotes the reasoning from a premise "if A, then C," knowing the event A occurs. MT implies reasoning from the same premise, considering the event C does not occur. Likewise, DA refers to a situation where A does not occur, and AC to a condition in which C occurs. Their study showed a significant effect of the representation of semantic relations on conditional inferences. For example, for

MP, the rate of correct response (73.8%) with “If A, then C” was much higher than the rate (47.7%) with “Only if C, A,” despite the logical equivalence of both inferences. To interpret this result, the authors explained that, in the “If A, then C” form, the sufficiency of A for C is explicit, whereas in the necessary conditional “Only if C, A,” it is implicit. The participants performed better on conditional inferences corresponding to explicit semantic relations than those corresponding to implicit semantic relations. It should be noted that all the studies so far on the necessary conditional, including the studies cited above, investigated reasoning under certainty, which means reasoning from certain assumption. As for us, we decided to study the reasoning on the necessary conditional under uncertainty, implying the possibility that the assumptions might not certainly happen, as it reflects reality more accurately.

As one should note, the necessary conditional statement “Only if A, C” in Chinese is different from the statement “A, only if C.” Firstly, there is a difference of directionality: “Only if A, C” in Chinese starts from the antecedent, and consists in deducing the consequent, from the antecedent, whereas “A, only if C” starts from the consequent, and consists in inferring the antecedent. Numerous studies in the context of certainty have underlined a directionality effect, which means people perform better while making inferences that correspond to the direction of the conditional (Evans, 1977, 1993; Evans and Beck, 1981; Johnson-Laird and Byrne, 1991; Ormerod et al., 1993; Rips, 1994; Grosset and Barrouillet, 2003; Byrne and Johnson-Laird, 2009). Secondly, the necessary conditional “Only if A, C” in Chinese is used as such in daily life. Thus, we deem it natural and relevant to study the Chinese necessary conditional as it appears in Chinese: “Only if A, C,” instead of “Only if C, A.” The necessary conditional “Only if A, C” implies the sufficient conditional “If not-A, then not-C.” Our study on the sufficient conditional and the necessary conditional offers us twice as many situations to study the reasoning as the classical study of the sole sufficient conditional.

## Reasoning Under Uncertainty: A New Paradigm

In the study of inferences, we classically set the premise as certain, but this rarely occurs in everyday life. Hence, we decided to use a framework to consider uncertainty in human reasoning. We have opted for the new paradigm approach of reasoning (Oaksford and Chater, 2007, 2009; Over, 2009; Evans, 2012; Elqayam and Evans, 2013; Elqayam and Over, 2013; Evans and Over, 2013; Mandel, 2014), which highlights the importance of uncertainty in human deductive reasoning. In this approach, the reference model is no longer binary logic but the Bayesian model. More specifically, in our study, we adopt the subjective Bayesian theory of De Finetti (1964), which has many theoretical, methodological, and prescriptive advantages (Baratgin and Politzer, 2016; Over and Baratgin, 2016; Politzer and Baratgin, 2016; Baratgin et al., 2017; Oaksford and Chater, 2020; Politzer et al., 2020a,b; Baratgin, 2021; Lassiter and Baratgin, 2021).

Theoretically, the Finettian approach is based on the Bayesian subjective concept of coherence, which states that the degrees of belief must respect the axioms of probability (Baratgin, 2002;

Baratgin and Politzer, 2006). The theory of De Finetti (1980) distinguishes two levels of experimental analysis, corresponding to two levels of knowledge of an event. The elementary level concerns the belief in the realization of some event C conditioned on the state of knowledge of some individual A (noted  $C|A$ ).  $C|A$  is a tri-event having three values of truth: true when A and C are true, false when A is true and C is false, and uncertain when A is uncertain or false. Recent studies (Politzer et al., 2010; Baratgin et al., 2013, 2014, 2018; Nakamura et al., 2018) have shown that most participants interpret the conditional of natural language in the same way as indicated in the theory of De Finetti (1995). The epistemic meta-level relates to the degrees of belief in the event. Many studies have shown the strong acceptance of participants to the principal property of this level, that the probability of the indicative conditional “if A, then C” is equal to the conditional probability  $P(C|A)$  (Evans and Over, 2004; Oaksford and Chater, 2007, 2009; Pfeifer and Kleiter, 2010; Politzer et al., 2010; Manktelow, 2012). More recently, there have been advances in the study of human coherence in deduction under uncertainty (Pfeifer and Kleiter, 2011; Pfeifer, 2014; Singmann et al., 2014; Cruz et al., 2015; Evans et al., 2015; Politzer and Baratgin, 2016). De Finetti (1964, 1974) provides an effective method to appraise the coherence of a probability evaluation, using coherence intervals determined by the probability of the premises (Suppes, 1966; Hailperin, 1996, 2010; Coletti and Scozzafava, 2002; Gilio and Over, 2012; Baratgin and Politzer, 2016; Politzer, 2016). If the coherence interval of the conclusion is  $[0, 1]$ , the inference schema is called “probabilistically uninformative”; if the coherence interval of the conclusion is a restrained interval  $[l, u]$ , it is called “probabilistically informative” (Pfeifer and Kleiter, 2006). Pfeifer and Kleiter (2007) used this methodology to study inference schemas MP and DA. In their experiment on MP, the inference schema was probabilistic because they used statements such as “exactly 80% of the red cars on this parking lot are two-door cars, exactly 90% of the cars on this parking lot are two-door cars,” and the question “Imagine all the cars that are on this parking lot. How many of these cars are two-door cars?” 63% of the participants gave coherent intervals for MP, only 41% for DA. The results for MP are in line with the pioneering study by George (1997) (see also Singmann et al., 2014; Evans et al., 2015, for similar results).

In the context of uncertainty, we decided to study three inference schemas, among which the two main classical ones: the probabilistic inference schema for MP, called PMP, covering from DA to MP; the probabilistic inference schema for AC, called PAC, covering from MT to AC. Besides PMP and PAC inference schemas, we also studied a third inference schema, IF-introduction: “A, C, therefore, if A then C” in probabilistic form, called PIF. **Table 1** shows probabilistic inference schemas in the sufficient conditional “If A, then C” and the necessary conditional “Only if A, C.”

We thus have a kind of “trilogy,” in which the premises are taken in pairs out of a set of three sentences (A, C, and “if A, C”).<sup>1</sup>

<sup>1</sup>Thus, the variant schema of PIF called “centering” or the “conjunctive sufficiency” schema: “A and C, therefore if A then C” will be not studied (for studies of this schema, see, for example, Cruz et al., 2015, 2016; Politzer and Baratgin, 2016; Vidal and Baratgin, 2017; Skovgaard-Olsen et al., 2019).

**TABLE 1 |** Probabilistic inference schemas in the sufficient conditional “If A, then C” and the necessary conditional “Only if A, C”.

Probabilistic inference schemas	Sufficient conditional “If A, then C”	Necessary conditional “Only if A, C”
PMP	$P(\text{If } A, \text{ then } C), P(A) \Rightarrow P(C)$	$P(\text{Only if } A, C), P(A) \Rightarrow P(C)$
PAC	$P(\text{If } A, \text{ then } C), P(C) \Rightarrow P(A)$	$P(\text{Only if } A, C), P(C) \Rightarrow P(A)$
PIF	$P(A), P(C) \Rightarrow P(\text{If } A, \text{ then } C)$	$P(A), P(C) \Rightarrow P(\text{Only if } A, C)$

In this study, we analyze the performances in terms of coherence, for Chinese and French participants, in these three inference schemas with two conditional forms: the sufficient conditional “If A, then C” and the necessary conditional “Only if A, C.” The coherence interval for the conclusions of MP and AC can be obtained by calculation (Suppes, 1966; Hailperin, 1996, 2010; Coletti and Scozzafava, 2002; Gilio, 2002; Wagner, 2004; Sobel, 2009) or by an analogical representation method (Politzer, 2016). We present the coherence intervals for the three inference schemas in each, the sufficient conditional and the necessary conditional.

In the sufficient conditional, the probabilistic inference schema for MP (PMP), which can be obtained from the probability of the conditional and the probability of the antecedent, is written:

$$\frac{P(\text{if } A, \text{ then } C) = i}{\frac{P(A) = a}{a \times i \leq P(C) \leq a \times i + 1 - a}}$$

When  $i = 1$ ,  $a = 0$ , we are in the particular situation that corresponds to classical DA, and when  $i = 1$ ,  $a = 1$ , we are in the particular situation of classical MP.

The probabilistic inference schema AC (PAC), obtained from the probability of the conditional and the probability of the consequent, is written:

$$\frac{P(\text{if } A, \text{ then } C) = i}{\frac{P(C) = c}{0 \leq P(A) \leq \min\left\{\frac{c}{i}, \frac{1-c}{1-i}\right\}}}$$

when  $i = 1$ ,  $c = 0$ , we are in the particular situation that corresponds to classical MT, and when  $i = 1$ ,  $c = 1$ , we are in the particular situation of classical AC.

The probabilistic inference schema IF-introduction (PIF), which can be obtained from the probability of the antecedent and the probability of the consequent, is written:

$$\frac{P(A) = a}{\frac{P(C) = c}{\max\left\{0, \frac{c-1+a}{a}\right\} \leq P(\text{if } A, \text{ then } C) \leq \min\left\{\frac{c}{a}, 1\right\}}}$$

We examined the case of the necessary conditional “Only if A, C.” “Only if A, C” corresponds to “If not-A, then not-C” in the

sufficient conditional. The probability of the conditional “Only if A, C” is that of the sufficient conditional “If not-A, then not-C,” the probability of the antecedent is  $P(A)$ , and the probability of consequence is  $P(C)$ .

Thus, the inference schema MP in the necessary conditional « “Only if A, C,” A » corresponds to DA « “If not-A, then not-C,” A » in the sufficient conditional. The probabilistic inference schema for MP (PMP) in necessary conditional is the probabilistic inference schema for DA (PDA) in the sufficient conditional, which is written as follows:

$$\frac{P(\text{if not-}A, \text{ then not-}C) = i}{\frac{P(A) = a}{(1-a)(1-i) \leq P(C) \leq 1 - (1-a) \times i}}$$

when  $i = 1$ ,  $a = 0$ , we are in the particular situation of DA in the necessary conditional that corresponds to classical MP in the sufficient conditional. When  $i = 1$ ,  $a = 1$ , we are in the particular situation of MP in the necessary conditional that corresponds to classical DA in the sufficient conditional.

In the same way, the inference schema PAC in the necessary conditional corresponds to PMT in the sufficient conditional. Thus, the inference schema AC in the necessary conditional « “Only if A, C,” C » corresponds to MT « “If not-A, then not-C,” C » in the sufficient conditional. The probabilistic inference schema for AC (PAC) in necessary conditional is the probabilistic inference schema for MT (PMT) in the sufficient conditional, which is written as follows:

$$\frac{P(\text{if not-}A, \text{ then not-}C) = i}{\frac{P(C) = c}{\max\left\{\frac{c-i}{1-i}, \frac{i-c}{i}\right\} \leq P(A) \leq 1}}$$

when  $i = 1$ ,  $c = 0$ , we are in the particular situation of MT in the necessary conditional that corresponds to classical AC in the sufficient conditional. When  $i = 1$ ,  $c = 1$ , we are in the particular situation of AC in the necessary conditional that corresponds to classical MT in the sufficient conditional.

Because the probability of the necessary conditional “only if A, C” corresponds to the probability of the sufficient conditional “If not-A, then not-C,” which is  $P[(1-c)/(1-a)]$ , the probabilistic inference schema IF-introduction (PIF) in necessary conditional is written as follows:

$$\frac{P(A) = a}{\frac{P(C) = c}{\max\left\{0, \frac{1-a-c}{1-a}\right\} \leq P(\text{if not-}A, \text{ then not-}C) \leq \min\left\{\frac{1-c}{1-a}, 1\right\}}}$$

## EXPERIMENT

On the one hand, our goal was to test the Sapir-Whorf hypothesis by comparing the percentage of coherence of Chinese and



French participants in both the sufficient conditional and the necessary conditional. On the other hand, we expected a better performance in the sufficient conditional than in the necessary conditional. Despite isomorphism of the sufficient conditional and the necessary conditional, the two conditionals might involve different information processing, resulting in better performances for the sufficient conditional. Indeed, it is likely that reasoning in the necessary conditional would imply *a priori* the transformation process to the sufficient conditional and reasoning in the sufficient conditional.

In this study, we took the methodology used in Politzer and Baratgin (2016). The uncertainty of the premises as the choices of answers provided for the participants is formulated in a qualitative form, in contrast with a numerical form (a value between 0 and 1, or in the form of a percentage) as used in most previous studies on PMP and PAC (Pfeifer and Kleiter, 2009, 2010, 2011; Pfeifer, 2014; Singmann et al., 2014; Cruz et al., 2015; Evans et al., 2015; Nickerson et al., 2019). This methodology is consistent with the subjective conception of de Finetti's theory. Moreover, we believe that in everyday life, people do not reason by assigning a quantitative probability to an event or a conditional, but a qualitative probability such as high, medium, and low as de Finetti suggested himself (De Finetti, 1964; Baratgin and Politzer, 2006, 2007).

## Methods

### Material

In our pilot experiment carried out on the sufficient conditional in France, the participants had to deal with two probabilistic inference schemas: PMP and PAC. The probability of the major premise as that of the minor premise varied from 0% to 100%, passing through low, medium, and high. We found out that when the two premises are uncertain, with verbal probability (probability of the first premise: high/medium/low, and probability of the minor premise: high/medium/low), most participants were confused, they had difficulty choosing their responses, the answers were primarily given randomly. Therefore, we decided not to combine two uncertain probabilities in our experiment. Indeed, we had the apprehension that the participants in the whole experiment would randomly select their answers instead of reasoning.

In our questionnaire, each item had two premises, a first premise and a second premise, for which we varied the levels of uncertainty: 100%, high, medium, low, 0%. When the first premise's value was 100% or 0%, the second premise's value was 100%, high, medium, low, or 0%. When the first premise's value was high, medium, or low, the second premise's value was 100% or 0%.

As in the experiments of Politzer and Baratgin (2016), it was followed by a multiple-choice response format.

When the first premise and the second premise are both certain (0% or 100%), the response options are:

- exactly 0% and above 0%, when the second premise is 0%;
- exactly 100% and below 100%, when the second premise is 100%.

When one of the premises is *high*, *medium*, or *low*, there are three response options, depending on the degree of uncertainty of the uncertain premise:

- above [the level of the uncertain premise];
- just [the level of the uncertain premise];
- below [the level of the uncertain premise].

For example, if the first premise is 100% and the second premise is high, the response options are *above high*, *just high*, and *below high*. In this situation, there were seven possible responses from participants: *above*; *just*; *below* (only one primitive option at a time); *above and just*; *below and just*; *above and below* (two primitive options); and *above, just, and below* (all three primitive options). **Table 2** summarizes the design of the items.

The point of this multiple-choice format is that it makes the ideas of De Finetti (1980) explicit by differentiating between certainty, where one is certain that an event is true or false, whether or not it is verified, and subjective uncertain judgments. Thus, 0% and 100% are used to indicate certainty with extreme objectivity to avoid confusion and qualitative probability to express uncertainty. Therefore, this response format we used is not an ordinary mixture of numerical and verbal responses.

Each participant had to deal with one of eight different questionnaires: 4 with the sufficient conditional and 4 with the necessary conditional. For each questionnaire, questions were presented in 2 counterbalanced orders. Every questionnaire included 12 questions. In each questionnaire, the participants had to treat the 3 probabilistic inference schemas: PMP, PAC, and PIF. The participants were asked to select all the options that seemed correct. Here is an example of a question for PMP in the sufficient conditional:

*Knowing that the chances that "If Sophie is in the living room, then Mary is in the kitchen" are 100%,*

*knowing that the chances are low that "Sophie is in the living room."*

*In your opinion, the chances that "Mary is in the kitchen" are:*

- ☐ above low
- ☐ just low
- ☐ below low

The ordinal judgment "low" is considered as equivalent to the numerical probability 1/4 for us, "medium" is considered as similar as 1/2, and "high" is considered as 3/4. In this example, the first premise  $P(C/A)$  is 1 and the second premise  $P(A)$  is considered equivalent to 1/4. When we use the PMP formula mentioned in the previous part,  $a \times i \leq P(C) \leq a \times i + 1 - a$ , we find the interval [1/4, 1]. Therefore, the coherent responses are "just low" and "above low." We may also translate "low" into 0.20, "medium" into 0.50, and "high" into 0.80. We consider "low" as a probability of less than 50%, "medium" as a probability of 50%, and "high" as a probability of more than 50%.

It should be noted that in the questions, there was no causality between the antecedent and the consequent. Furthermore, to study only the logical aspect of reasoning, we paid attention to the

**TABLE 2 |** Response format according to the level of uncertainty of the premises.

		First premise				
		100%	High	Medium	Low	0%
Second premise	100%	- Exactly 100% - Below 100%	- Above high - Just high - Below high	- Above medium - Just medium - Below medium	- Above low - Just low - Below low	- Exactly 100% - Below 100%
	High	- Above high - Just high - Below high				- Above high - Just high - Below high
	Medium	- Above medium - Just medium - Below medium				- Above medium - Just medium - Below medium
	Low	- Above low - Just low - Below low				- Above low - Just low - Below low
	0%	- Exactly 0% - Above 0%	- Above high - Just high - Below high	- Above medium - Just medium - Below medium	- Above low - Just low - Below low	- Exactly 0% - Above 0%

choice of the first names, the gender, and the actions to prevent stereotypes from intervening.<sup>2</sup>

## Participants

The Chinese participants were 295 students in the first and second grades of “media management” at Zhejiang University of Media and Communications in China. They were all native speakers of Chinese. The age of the participants extended from 18 to 23, with a mean age of 19.3. The French participants were 242 students, mainly from Universities Paris 1, Paris 5, Paris 8, and the others being students or former students of other universities in Paris. They were all native speakers of French. The age of the participants extended from 18 to 27, with a mean age of 20.3. Education levels ranged from high school diplomas to master’s diplomas. The participants voluntarily took part in the experiment and gave their consent to participate in it. None of them were trained in logic. The participants were not screened for knowledge of other languages than the one classified as their mother tongue, and it was assumed each participant would only have one mother tongue. We used the criterion of the mother tongue because we wanted to test the Sapir-Whorf hypothesis, which focuses on an individual’s native language. The duration of the test was 15 min.

## Results

### Comparison of Coherence Between the Chinese and the French Participants

If a participant’s response is within the coherence interval, it is considered coherent.

<sup>2</sup>There are stereotypes about gender and first names (Coulmont and Simon, 2019). For example, a stereotype might be that housework is more women’s business. Thus, participants might make the shortcut during their reasoning: men are in the living room, while women are in the kitchen. To avoid this, we indicate that “Sophie is in the living room; Mary is in the kitchen.” We took the same precautions for the first names. Some studies show that the choice of the first name can be an indicator of social origin (Charonnat, 2017).

### Sufficient Conditional

**Figures 1–3** show the comparison of the percentage of coherence for the Chinese and the French participants in inference schemas PMP, PAC, and PIF in the sufficient conditional. The Z-test for comparing two proportions was used to compare the coherence for the Chinese and the French participants.

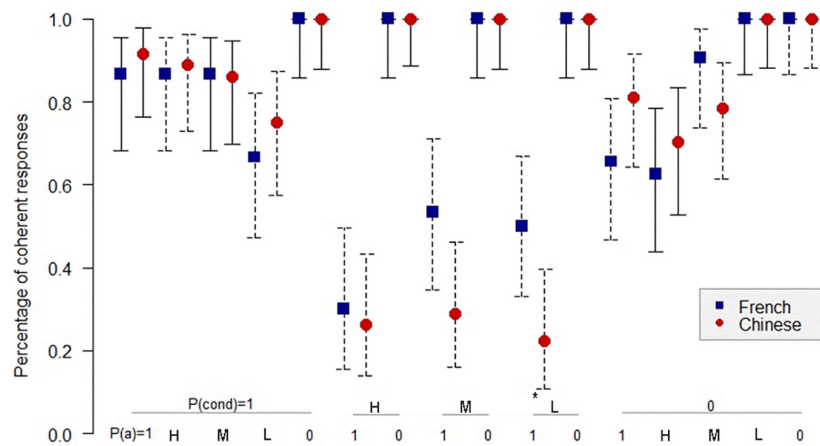
We see on the abscissa all the combinations of the probabilities of the conditional and the probabilities of the antecedent, and on the ordinate, the percentage of coherent response for the Chinese and the French participants. For example, when the probability of the conditional is 1, and the probability of the antecedent is high, the percentage of coherent response is 87% for the French and 89% for the Chinese. There is no significant difference between the percentage of coherent responses for the Chinese and the French participants.

In PMP, it is to be noted that, in 6 out of 16 cases, the inference schema is called probabilistically uninformative as all responses are considered coherent, the coherence interval being [0, 1]. **Figure 1** shows that in 10 informative cases, overall, there is no significant difference in coherence between the Chinese and the French participants. The only significant difference ( $p < 0.05$ ) concerns the case where the probability of conditional is low, and the probability of antecedent is 100%. In this case, the percentage of coherence is higher for the French participants than for the Chinese participants.

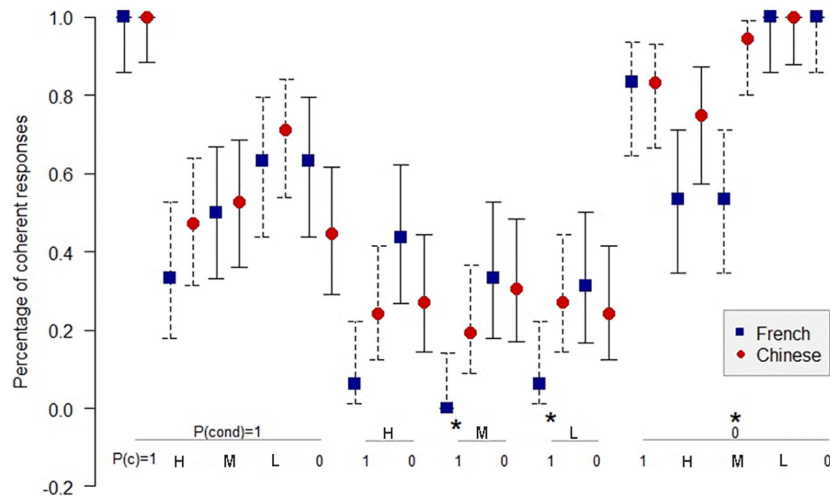
**Figure 2** shows that in 13 informative cases in PAC, there are three significant differences ( $p < 0.05$ ) in the percentage of coherent responses between the Chinese and the French participants. For PIF, **Figure 3** indicates only two significant differences ( $p < 0.05$ ) in the percentage of coherence between the Chinese and the French participants in 12 informative cases.

In total, among the 35 informative cases in the three inference schemas, we observed only six significant differences in the

<sup>3</sup>There is no difference between straight and dashed confidence intervals in the figures. The two types of lines have been used alternately to facilitate reading.



**FIGURE 1 |** Percentage of coherent responses for the Chinese and the French participants in PMP in the sufficient conditional. \*:  $p < 0.05$ . On the abscissa, the probabilities of the conditional and the probabilities of the antecedent below; on the ordinate: the percentage of coherent response for the Chinese and the French participants. Uninformative cases are those where the percentage of coherent responses is 1.0 for the French and the Chinese participants. MP:  $P(\text{cond}) = 1$ ,  $P(a) = 1$ ; DA:  $P(\text{cond}) = 1$ ,  $P(a) = 0$ . The bars indicate the 95% confidence intervals for proportions.



**FIGURE 2 |** Percentage of coherent responses for the Chinese and the French participants in PAC in the sufficient conditional. \*:  $p < 0.05$ . On the abscissa, the probabilities of the conditional and the probabilities of the consequent below; on the ordinate, the percentage of coherent response for the Chinese and the French participants. Uninformative cases are those where the percentage of coherent responses is 1.0 for the French and the Chinese participants. MT:  $P(\text{cond}) = 1$ ,  $P(c) = 0$ ; AC:  $P(\text{cond}) = 1$ ,  $P(c) = 1$ . The bars indicate the 95% confidence intervals for proportions.

percentage of coherence between the Chinese participants and the French participants, three in favor of the Chinese and three in favor of the French. Given that the connector of the sufficient conditional is present and the sufficient conditional is widely used in both languages, the result is in line with the expectation: there is, overall, no significant difference between the percentage of coherence for the Chinese participants and the French participants.

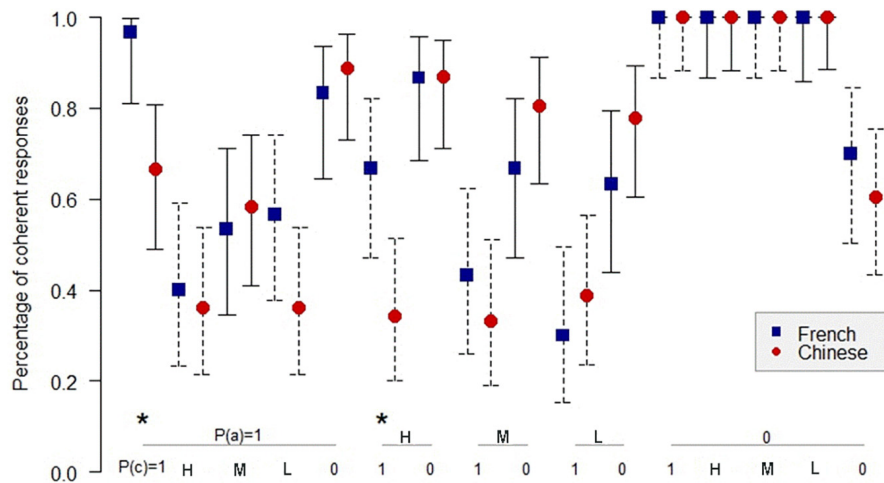
### Necessary Conditional

Figures 4–6 show the comparison of the coherence percentage between the Chinese and the French participants in inference schemas PMP, PAC, and PIF in the necessary conditional. The

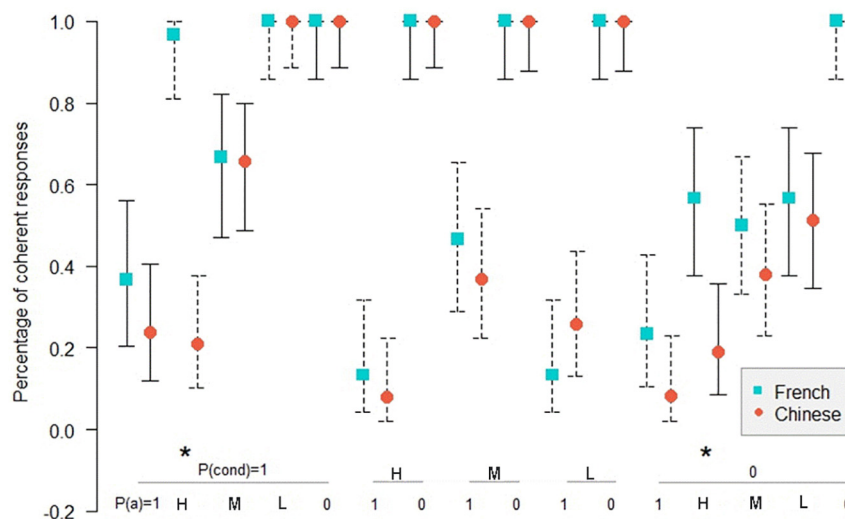
Z-test was used to compare the percentage of coherence between the Chinese and the French participants.

Figure 4 shows that in 10 informative cases in PMP, there are 2 significant differences ( $p < 0.05$ ) in coherence between the Chinese and the French participants. As indicated in Figure 5, in 14 informative cases in PAC, there are 3 significant differences ( $p < 0.05$ ) in the percentage of coherent response between the Chinese and the French participants. Figure 6 illustrates no significant difference of coherent response for PIF between the Chinese and the French participants in 12 informative cases.

In total, among 36 informative cases in the three inference schemas, we observed only five significant differences between Chinese and the French participants, all in favor of the French.



**FIGURE 3 |** Percentage of coherent responses for the Chinese and the French participants in PIF in the sufficient conditional. \*:  $p < 0.05$ . On the abscissa: the probabilities of the antecedent and the probabilities of the consequent below; on the ordinate: the percentage of coherent response for the Chinese and the French participants. Uninformative cases are those where the percentage of coherent responses is 1.0 for the French and the Chinese participants. The bars indicate the 95% confidence intervals for proportions.



**FIGURE 4 |** Percentage of coherent responses for the Chinese and the French participants in PMP in the necessary conditional. \*:  $p < 0.05$ . On the abscissa, the probabilities of the conditional and the probabilities of the antecedent below; on the ordinate, the percentage of coherent response for the Chinese and the French participants. Uninformative cases are those where the percentage of coherent responses is 1.0 for the French and the Chinese participants. MP:  $P(\text{cond}) = 1$ ,  $P(a) = 1$ ; DA:  $P(\text{cond}) = 1$ ,  $P(a) = 0$ . The bars indicate the 95% confidence intervals for proportions.

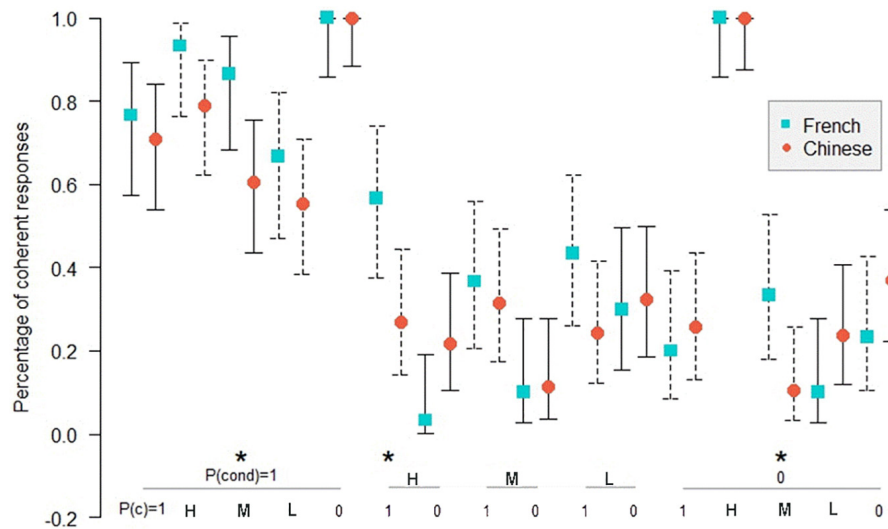
This result disproves our hypothesis that there should be better performance for the Chinese compared to the French, so the presence of the connector of the necessary conditional in the Chinese language, as opposed to the French language, did not give the Chinese participants an advantage over the French participants.

### Comparison of Coherence Between the Sufficient Conditional and the Necessary Conditional

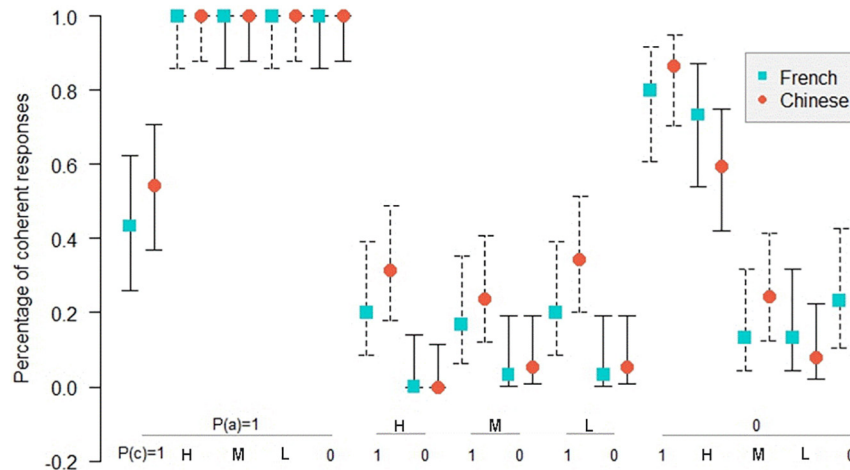
To know if the participants are really coherent in a given situation, we need to examine whether the coherence percentage

for the Chinese and the French participants is above the success rate by chance. Before that, we should determine the success rate by chance. For example, in the presence of uncertainty, the participants are asked to evaluate three propositions  $A$ ,  $B$ , and  $C$ . They have seven possible responses:  $A$ ;  $B$ ;  $C$ ;  $A$  and  $B$ ;  $B$  and  $C$ ;  $A$  and  $C$ ;  $A$ ,  $B$ , and  $C$ . Supposing that  $A$ ,  $B$  are in the coherence interval,  $C$  is not in the coherence interval, then, we have three possible coherent responses:  $A$ ;  $B$ ;  $A$  and  $B$ . The success rate by chance to give a coherent response is  $3/7$ . Supposing now that only  $A$  is in the coherence interval among the seven possible responses, the success rate by chance is then  $1/7$ . When there is





**FIGURE 5 |** Percentage of coherent responses for the Chinese and the French participants in PAC in the necessary conditional. \*:  $p < 0.05$ . On the abscissa, the probabilities of the conditional and the probabilities of the consequent below; on the ordinate, the percentage of coherent response for the Chinese and the French participants. Uninformative cases are those where the percentage of coherent responses is 1.0 for the French and the Chinese participants. MT:  $P(\text{cond}) = 1$ ,  $P(c) = 0$ ; AC:  $P(\text{cond}) = 1$ ,  $P(c) = 1$ . The bars indicate the 95% confidence intervals for proportions.



**FIGURE 6 |** Percentage of coherent responses for the Chinese and the French participants in PIF in the necessary conditional. On the abscissa, the probabilities of the antecedent and the probabilities of the consequent below; on the ordinate, the percentage of coherent response for the Chinese and the French participants. Uninformative cases are those where the percentage of coherent responses is 1.0 for the French and the Chinese participants. The bars indicate the 95% confidence intervals for proportions.

a combination of certainty in the statements: 0% and/or 100%, the participants are invited to evaluate two proposals: *A* and *B*. They have three possible responses: *A*; *B*; *A* and *B*. If only *A* is in the coherence interval, the success rate by chance is 1/3. Thus, for each question, we compare the coherence percentage of the participants with the success rate by chance.

In the informative cases, the  $\chi^2$  test is used to compare the rate of coherence with the success rate by chance in each inference schema of the two conditionals. **Table 3** shows the number of cases where the rate of coherence is above the chance of the total number of informative cases.

It indicates that, in PMP, the coherence rate of the Chinese participants is higher than the success rate by chance in 9 of 10 informative cases in the sufficient conditional and in only 2 of 10 informative cases in the necessary conditional. Likewise, the coherence rate for the French participants is higher than the success rate by chance in all 10 informative cases in the sufficient conditional and in only 3 of 10 informative cases in the necessary conditional. According to Fischer's exact test, the difference in performance between the sufficient conditional and the necessary conditional is significant for both the Chinese and the French. There is better performance in the sufficient conditional than in

**TABLE 3** | Number of cases where the rate of coherence is above chance of the total number of informative cases.

Conditional	Inference schema	French	Chinese
Sufficient conditional	PMP	10/10	9/10
	PAC	6/13	5/13
	PIF	12/12	12/12
	Total	28/35	26/35
Necessary conditional	PMP	3/10	2/10
	PAC	8/14	4/14
	PIF	2/12	5/12
	Total	13/36	11/36

the necessary conditional. Our results in the sufficient conditional in PMP, which includes classical DA and MP, are consistent with Evans et al. (2015), who found that the scores of coherence were significantly above chance for MP and DA.

**Table 3** shows that in PAC, the coherence rate for the Chinese participants is higher than the success rate by chance in 5 of 13 informative cases in the sufficient conditional and 4 of 14 informative cases in the necessary conditional. For the French participants, it happens in 6 of 13 informative cases in the sufficient conditional and 8 of 14 informative cases in the necessary conditional. According to Fischer's exact test, there is no significant difference in performance between the sufficient conditional and the necessary conditional, neither for the Chinese nor the French. Our results in the sufficient conditional in PAC, which includes classical MT and AC, are relatively consistent with Evans et al. (2015), who found that the scores of coherence were below chance for MT and above chance for AC in one of two experimental situations. The poor performance of the Chinese and the French participants in PAC on the sufficient conditional could be explained by directionality, which plays an important role in conditional reasoning (Oberauer and Wilhelm, 2000; Evans et al., 2005; Oberauer et al., 2005). The direction of PAC (knowing the probability of conditional "if A, then C," and the probability of C, one should deduce the probability of A) does not correspond to the direction of the conditional. PAC is, therefore, more difficult than PMP (knowing the probability of conditional "if A, then C," and the probability of A, one should infer the probability of C), which corresponds to the direction of the conditional.

In PIF, the coherence rate for the Chinese participants is higher than the success rate by chance in all 12 informative cases in the sufficient conditional and in only 5 of 12 informative cases in the necessary conditional. That happens for the French participants in all 12 cases in the sufficient conditional and only 2 of 12 informative cases in the necessary conditional. According to Fischer's exact test, there is a significant difference in performance between the sufficient conditional and the necessary conditional, both for the Chinese and the French. The high coherence rate in the sufficient conditional is consistent with the results of previous studies (i.e., Cruz et al., 2015).

We noted the number of coherent and not coherent responses in each situation in the sufficient conditional and the necessary conditional. We indicated the cases where the rate of coherence

is above chance (see Data Availability Statement). We found that the coherence rate is very low in some situations, even though it could be higher than the success rate by chance. In **Table 4**, we have identified the number of cases where the coherence rate is below 50% of the total number of cases.

**Table 4** shows that the coherence rate below 50% is found chiefly with uncertain conditional, even though it is above chance in some cases. One explanation is that our task required making relative probability judgments, which are known to be more difficult than absolute probability judgments (Stewart et al., 2005; Guest et al., 2016). This could have impaired the coherence rate of our participants in the conditions involving uncertainty.

## GENERAL DISCUSSION

According to the weak version of the Sapir-Whorf hypothesis, namely that language influences the way of thinking, we expected a similar performance for the Chinese and the French participants in the sufficient conditional, and better performance for the Chinese participants in the necessary conditional, since a connector for the necessary conditional exists only in Chinese. However, comparing the percentage of coherence between the Chinese and the French participants in inference schemas PMP, PAC, and PIF shows no significant difference in the sufficient conditional and the necessary conditional. This result does not confirm our hypothesis.

Thus, the presence of the necessary conditional connector in the Chinese language does not give the Chinese participants an advantage in this type of reasoning compared to the French participants. The different languages implying a difference about the presence of the necessary conditional connector, more widely different grammatically based categorization, do not affect the reasoning since a difference does not follow them in reasoning performance. To explain this result, we consider that in the French language, although the connector of the necessary conditional does not exist as such, the reasoning of the necessary conditional exists by expressions less concise and formal than a connector, which seem to be as efficient as connectors yet. Our result supports the universalist hypothesis. According to the universals of grammar, there is an isomorphism in the lexical and grammatical core of the world's languages, even if they all differ infinitely from one another, both in their structure and in their lexicon. Cross-cultural communication would be impossible if there were not, besides considerable variations, a kind of common core based on shared or equivalent words but also on shared or equivalent grammatical structures (Wierzbicka, 1993). For Wierzbicka (1993, p. 119), "It is clear that what is necessary both for a comparative study of languages and for a study of the functioning of language as a human faculty is an authentic universal perspective, and not a perspective specific to a particular language. Although every language has its own unique structure and equally unique lexicon (a lexicon that also incorporates a unique semantic structure), some areas can be considered mutually isomorphic. It is this (partial) isomorphism in grammar and lexicon that makes the notion of "linguistic universals" a legitimate notion." Chomsky (1994)

**TABLE 4 |** Number of cases where the coherence rate is below 50% of the total number of informative cases.

Conditional	Inference schema	French		Chinese	
		Certain conditional	Uncertain conditional	Certain conditional	Uncertain conditional
Sufficient conditional	PMP	0/7	1/3 (1)	0/7	3/3 (2)
	PAC	1/7	6/6 (3)	2/7	6/6 (1)
	Total	1/14	7/9 (4)	2/14	9/9 (3)
Necessary conditional	PMP	2/7	3/3 (1)	5/7	3/3 (1)
	PAC	4/8	5/6 (3)	4/8	6/6 (2)
	Total	6/15	8/9 (4)	9/15	9/9 (3)
2 conditionals	Total	7/29	15/18 (8)	11/29	18/18 (6)

In the brackets ( ): the number of cases where the coherent rate is below 50% but above chance.

For example, 5/6 (3): among the French participants, in PAC with the necessary conditional, when the conditional is uncertain, among 6 informative cases, the coherence rate is below 50% in 5 cases, 3 of which are above chance.

proposes a description based on phrase structure syntax and x-bar (headword) grammar. According to the theory of principles and parameters, the deep structure thus identified is part of universal grammar. The universalist hypothesis considers that logical reasoning is performed on abstract representations, which are common, universal, and products of semantic, grammatical, and pragmatic analysis, regardless of the realization of a function in the surface structure of a particular language. In fact, we agree with Politzer (1991) that connectors in one language will operate in all languages because they stem from general principles of human communication. However, the Sapir-Whorf hypothesis could not be categorically refuted in the field of conditional reasoning. Indeed, although it has not been confirmed in most research (Brown et al., 1980; Au, 1983; Zepp, 1983; Zepp et al., 1987; Politzer, 1991; Cara and Politzer, 1993), Yeh and Gentner (2005) partly validated its weak version. More generally, some experimental studies on color perception, spatial cognition, and spatial representation of events in time support the weak version of linguistic relativity theory (for recent reviews, see Pederson, 2007; Everett, 2013). Furthermore, concerning the weak version of the Sapir-Whorf hypothesis, one of the difficulties is to isolate the effects of language from the impact of culture. Indeed, the role of culture in thinking is undeniable (Nisbett et al., 2001; Hiroshi et al., 2007; Hiroshi, 2016; Nakamura et al., 2018).

As claimed by our second hypothesis, there should be a better performance in the sufficient conditional than in the necessary conditional for both the Chinese and the French. We consider that despite isomorphism of the sufficient conditional and the necessary conditional, the two conditionals might involve different processes, resulting in differences in reasoning performance in favor of the sufficient conditional. In fact, on the logical aspect, the necessary conditional “Only if A, C” is equivalent to the sufficient conditional “If not-A, then not-C”, thus, the sufficient conditional and the necessary conditional could be considered as isomorphic. Nevertheless, our results show an important difference in favor of the sufficient conditional compared to the necessary conditional. Precisely, in the PMP and the PIF inference schemas, the Chinese and the French participants are coherent in the sufficient conditional, which is not the case of the necessary conditional. In the PAC inference schema, the number of situations where participants are coherent

is quite close in the sufficient conditional and the necessary conditional. This result confirms our hypothesis in the PMP and the PIF inference schemas that predicted better performance in favor of the sufficient condition.

We first examined PMP and PAC inference schemas in the sufficient conditional and the necessary conditional. The probability of the sufficient conditional  $P(\text{If } A, \text{ then } C) = P(C|A)$ , but the probability of the necessary conditional  $P(\text{Only if } A, C)$  is not  $P(C|A)$ . When the probability of the necessary conditional  $P(\text{Only if } A, C)$  is 100%, the inference is clear; participants can infer directly without going through the sufficient conditional. But when the probability of the necessary conditional  $P(\text{Only if } A, C)$  is not 100%, the participants very likely need to transform the necessary conditional into the sufficient conditional. Indeed, a necessary condition does not guarantee any event, and it does not lead to another result in general. If, in addition, we apply a probability to this conditional, it is very difficult to make PMP, PAC, or PIF inferences. For example, the probability of the necessary conditional “Only if A, C” is low, the probability of A is 0%, the participants must choose the probability of C: below low, just low, or above low. According to these elements, we think it is very likely that the participants would transform *a priori* the necessary conditional into a sufficient conditional before the reasoning process. The exceptional case is where the probability of the necessary conditional “Only if A, C” is 100%. In this condition, if the probability of A is 0%, one can infer that the probability of C is 0%; if the probability of C is 100%, one can deduce that the probability of A is 100%; one can also make other PMP and PAC inferences from the verbal probabilities of the second premise.

Normally, the interpretation of the necessary conditional “Only if A, C” is the sufficient conditional “If not-A, then not-C,” but it is not known if this is the actual interpretation of the participants. Indeed, the mental load to transform the necessary conditional “Only if A, C” to the sufficient conditional “If not-A, then not-C” is rather high because of the presence of negation in the sufficient conditional. The polarity effect (affirmative or negative), as the directionality effect, has been demonstrated in studies of conditional reasoning. For example, research by Grosset and Barrouillet (2003) showed that affirmative inferences took less time to endorse than denial

inferences. Evans et al. (2015) found that coherent rates are better for affirmative inferences than negative inferences. The mental load is heavier with one negation; it might be even more with double negation. It is unlikely that the participants will do such a costly transformation. Instead, the most likely transformation of the necessary conditional “Only if A, C” would be the sufficient conditional “If C, then A.” In addition, some participants spontaneously told us that they made this interpretation. We analyzed the coherence of the participants with the transformation of “Only if A, C” to “If C, then A.” We noted the number of coherent and not coherent responses in each situation in the necessary conditional and indicated the cases where the rate of coherence is above chance (see Data Availability Statement). The result shows a better performance for the French participants and slightly better for the Chinese participants than the transformation of “Only if A, C” to “If not-A, then not-C.” The number of cases where the rate of coherence is above the chance of the total number of informative cases goes from 13/36 to 21/33 for the French participants and from 11/36 to 15/33 for the Chinese participants. With the transformation of “Only if A, C” to “If C, then A,” PMP in the necessary conditional  $P(\text{Only if A, C}), P(A) = > P(C)$  presents two additional difficulties compared to PMP in the sufficient conditional: the transformation of the necessary conditional into the sufficient conditional, and the directionality in the transformed PMP:  $P(\text{If C, then A}), P(A) = > P(C)$ . This is what makes this inference schema particularly difficult. In PAC, in the sufficient conditional  $P(\text{If A, then C}), P(C) = > P(A)$ , there is the difficulty of directionality in comparison with PMP in the sufficient conditional. On the other side, in PAC, in the necessary conditional  $P(\text{Only if A, C}), P(C) = > P(A)$  transformed into  $P(\text{If C, then A}), P(C) = > P(A)$ , there is the difficulty of the transformation compared to PMP in the sufficient conditional. So, according to this analysis, among the 4 cases of PMP and PAC in both conditionals, the PMP in the sufficient conditional is the easiest; the PMP in the necessary conditional is the most difficult. The result provided in **Table 3** confirms this. Indeed, the number of cases with coherence above chance in PMP in the sufficient conditional is very high: 10/10 for the French, and 9/10 for the Chinese; whereas the number of cases of coherence above chance in PMP in the necessary conditional is meager: 3/10 for the French, and 2/10 for the Chinese. The number of cases with coherence above chance in PAC is moderately low, in the sufficient conditional: 6/13 for the French, 5/13 for the Chinese; in the necessary conditional: 8/14 for the French, and 4/14 for the Chinese.

We then studied the PIF inference schema in the two conditionals. The number of cases with coherence above chance in PIF in the sufficient conditional is very high: 12/12 for the French and Chinese, whereas it is much lower in the necessary conditional: 2/12 for the French and 5/12 for the Chinese. On one side, the fact that PIF works in the sufficient conditional but not in the necessary conditional indicates that the different conditional connectors play an important role in this inference, therefore the predominant role of semantics, which supports the position of the inferential conditional. On the other side, the good performance of the participants

in PIF in the sufficient conditional confirms the position of the probability conditional, showing the important effect of the general pragmatic. Nevertheless, one might ask why the participants can perform PIF in the sufficient conditional but not in the necessary conditional. In fact, PIF having no semantic connection, it can work in the sufficient conditional, which is simple, direct, and much closer to conjunction than the necessary conditional. Moreover, in the sufficient conditional, it is easy to obtain  $P(C|A) = P(C)$ , which explains excellent performance from the participants. In contrast, the necessary conditional is more complex and very likely needs to be transformed beforehand into the sufficient conditional. As argued previously, the most likely transformation of the necessary conditional “Only if A, C” would be “If C, then A.” Thus,  $P(\text{Only if A, C})$  would be transformed to  $P(\text{if C, then A})$ , so into  $P(A|C)$ . In addition, there is also the question of order. With the probabilities being given in the order  $P(A)$  and  $P(C)$ , it is more natural to consider the first statement as an antecedent, the second as a consequent. Then, it is easier to go to  $P(C|A)$  than to  $P(A|C)$ , making PIF in the necessary conditional more difficult than in the sufficient conditional. In short, from  $P(A), P(C)$ , without semantic connection between them, the participants with their experiences, intuitions, and general pragmatic can go to the probability of the sufficient conditional, but hardly go to the probability of the necessary conditional. Indeed, the path of the PIF in the sufficient conditional is  $P(A), P(C) = > P(C|A)$ . Compared to this path, in the necessary conditional, to make the inference  $P(A), P(C) = > P(\text{Only if A, C})$ , two additional steps would be required: change of order between  $P(A)$  and  $P(C)$ , and transformation of  $P(\text{Only if A, C})$  to  $P(\text{If C, then A})$ , which allows reaching  $P(C), P(A) = > P(A|C)$ . This comparison of PIF between the two conditionals helps us understand the difficulty of PIF in the necessary conditional.

Therefore, from the analysis of three inference schemas in the sufficient conditional and the necessary conditional, we can say that the two conditionals can be considered isomorphic. Still, their information processing is different: very likely, further transformation steps, the problem of directionality, and the problem of order have made inferences schemas PMP and PIF more difficult in the necessary conditional.

Finally, we addressed the limits of our work.<sup>4</sup> To avoid random responses, we decided not to combine two uncertain premises, while keeping a large spectrum of the level of uncertainty in the remaining premise. It is essential to combine two uncertain premises in the design of the experiment. Indeed, it might be interesting to include this situation to study the coherent rates in all situations. In this study, we chose to represent “objective” certainty (De Finetti, 1980) by numerical values 0% and 100%. To represent uncertainty, we used verbal labels. This choice allowed us to take into consideration the first epistemic level described by De Finetti with the idea that, in the first instance, the intuition of the probability of occurrence of an event is qualitative and can be positioned on an ordinal scale but also likely to be

<sup>4</sup>We thank the reviewer NC for pointing out these important points and also on the idea of using probability intervals for the premises.



compared with another event (Baratgin and Politzer, 2016). The second level corresponds to quantitative evaluation (De Finetti, 1964). This choice, however, can be discussed. We assumed that degrees of qualitative belief are naturally verbalizable in language by many expressions and that these expressions are a natural and appropriate format for communicating probability. We take the fact that they are imprecise as a reflection of how they can be mentally represented. However, using a mix of numerical (for certainty) and verbal (for uncertainty) scales can pose some challenges (Jenkins et al., 2018). Several studies have shown differences in the interpretation of verbal probabilities when reported in quantitative values. For example, people tend to interpret certain verbal statements in an extreme way (Teigen et al., 2013) or to interpret expressions referring to a serious event as indicating a higher probability than those referring to a more neutral event (Harris and Corner, 2011). These variations even appear to be greater with Chinese than Western participants (Harris et al., 2013). However, in this study, the participants were asked to respond without converting their probability judgment numerically. This suggests that the participants remained at the verbal level, without moving to the meta (quantitative) level. The correspondence of the quantitative values 0% and 100% with “certainly false” and “certainly true” should be quite immediate and should not lead to any problems. Nevertheless, there is another way to represent the imprecision of qualitative degrees of belief using probability intervals (as opposed to point premise probabilities). Indeed, there are extensions of coherence formulas to interval premise probabilities (for a review, see Kleiter, 2018). It would, therefore, be interesting to replicate our experiment using this probability interval format to represent the uncertainty of the premises. In addition, we decided to study the coherent rate globally in this paper. Individual differences were not investigated as the participants did not have to deal with the same questions. It would be relevant to study such differences in our future project.

In summary, the framework of the new paradigm, more precisely the Finettian approach, allowed us to take into account uncertainty in human reasoning. Also, the use of qualitative probability allowed us to be closer to reality than numerical probability in the research of conditional reasoning. We found that, in some situations, the coherence rate is very low, it is possible that relative probability judgments are more difficult to process than absolute judgment. Although we are convinced of the validity of our method, it would be interesting to propose a numerical probability in a future study for comparison. The new paradigm model is interesting but could not explain the incoherent responses of the participants that are numerous and not negligible. So, we suggest that the different pragmatic aspects in information processing should be better taken into consideration to describe and evaluate human rationality. In addition, through this study on the comparison between the

sufficient conditional and the necessary conditional, we think that apart from the models of the new paradigm, other forms of logic should also be studied not to neglect the semantic aspect.

## DATA AVAILABILITY STATEMENT

The datasets analyzed for this study can be found in the Open Science Framework repository at the following address: <https://osf.io/zawyj/>.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by M. Maudinet Marc, Docteur en anthropologie, Ancien Directeur pédagogique du Master Gestion et Politiques du Handicap Sciences Po de Paris, Consultant indépendant expert auprès du Conseil de L'Europe, Président du Conseil Scientifique de la FISAF. M. Gutnik Fabrice, Enseignant-chercheur associé, Chercheur associé CURAPP, Université Jules Verne Amiens. Consultant en ressources humaines. Mme Aitao Tang, Ingénieur en informatique, diplômée de l'université de Paris VI, SOPRA STERIA. M. Daniel Morfouace, Professeur de philosophie, université Lille. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

JS and JB contributed to conceptual elaboration, design of the study, and draft of the manuscript. JS and DT contributed to data collection. JS contributed to data analysis. All authors contributed to the article and approved the submitted version.

## FUNDING

Financial support for this work was provided by a grant from the ANR Chorus 2011 (BTAFD0C project). We thank the P-A-R-I-S Association and CHART laboratory, which participated in financing the article's publication in open access.

## ACKNOWLEDGMENTS

We are very grateful to Guy Politzer for his valuable advice on the design of the experiment and helpful comments on the previous draft of the manuscript. We would like to thank Jean-Louis Stilgenbauer for his help in statistical analysis.

## REFERENCES

- Au, T. K. F. (1983). Chinese and English counterfactuals: the Sapir-Whorf hypothesis revisited. *Cognition* 15, 155–187. doi: 10.1016/0010-0277(83)90038-0
- Au, T. K. F. (1984). Counterfactuals: in reply to Alfred Bloom. *Cognition* 17, 289–302. doi: 10.1016/0010-0277(84)90012-X
- Baratgin, J. (2002). Is the human mind definitely not Bayesian? A review of the various arguments. *Curr. Psychol. Cogn.* 21, 653–680.

- Baratgin, J. (2021). Discovering early de finetti's writings on trivalent theory of conditionals. *Argumenta* 2, 267–291. doi: 10.14275/2465-2334/202112.bar
- Baratgin, J., and Politzer, G. (2006). Is the mind Bayesian? The case for agnosticism. *Mind Soc.* 5, 1–38. doi: 10.1007/s11299-006-0007-1
- Baratgin, J., and Politzer, G. (2007). The psychology of dynamic probability judgement: order effect, normative theory and experimental methodology. *Mind Soc.* 5, 53–66. doi: 10.1007/s11299-006-0025-z
- Baratgin, J., and Politzer, G. (2016). "Logic, probability, and inference: A methodology for a new paradigm," in *Cognitive unconscious and human rationality*, eds L. Macchi, M. Bagassi, and R. Viale (Cambridge, Ma: MIT Press), 119–142.
- Baratgin, J., Coletti, G., Jamet, F., and Petturiti, D. (2017). "Experimental evaluation of the understanding of qualitative probability and probabilistic reasoning in young children," in *Advances in Artificial Intelligence: From Theory to Practice*, Lecture Notes in Computer Science, eds S. Benferhat, K. Tabia, and M. Ali (Berlin: Springer), 107–112.
- Baratgin, J., Over, D. P., and Politzer, G. (2013). Uncertainty and the de Finetti tables. *Think. Reason.* 19, 308–328. doi: 10.1080/13546783.2013.809018
- Baratgin, J., Over, D. P., and Politzer, G. (2014). New psychological paradigm for conditionals and general de Finetti tables. *Mind Lang.* 29, 73–84. doi: 10.1111/mila.12042
- Baratgin, J., Politzer, G., Over, D. E., and Takahaschi, T. (2018). The psychology of uncertainty and three-valued truth tables. *Front. Psychol.* 9:1479. doi: 10.3389/fpsyg.2018.01479
- Bloom, A. H. (1981). *The Linguistic Shaping of Thought: A Study in the Impact of Language on Thinking in China and in the West*. Hillsdale, NJ: Erlbaum Associates.
- Bloom, A. H. (1984). Caution-the words you use may affect what you say: a response to au. *Cognition* 17, 257–287.
- Brown, C. A., Keats, J. A., Keats, D. M., and Seggie, I. (1980). Reasoning about implication: a comparison of malaysian and australian subjects. *J. Cross-Cult. Psychol.* 11, 395–410.
- Brown, R. (1976). Reference: in memorial tribute to Eric Lenneberg. *Cognition* 4, 125–153.
- Byrne, R. M. J., and Johnson-Laird, P. N. (2009). "If" and the problems of conditional reasoning. *Trends Cogn. Sci.* 13, 282–287. doi: 10.1016/j.tics.2009.04.003
- Cara, F., and Politzer, G. (1993). A comparison of conditional reasoning in english and chinese. *Adv. Psychol.* 103, 283–297.
- Carnes, R. L. (1970). A perceptual model of the Whorfian thesis. *ETC: A Rev. Gener. Semant.* 27, 55–65.
- Charonnat, E. (2017). *Le prénom, un indicateur de l'origine sociale ? CBExpert*. Available online at: <https://www.cb-expert.fr/2017/07/13/le-prenom-un-indicateur-de-lorigine-sociale/> (accessed November 28, 2021)
- Chomsky, N. (1994). *Bare phrase structure*. Cambridge: MIT Working Papers in Linguistics.
- Coletti, G., and Scozzafava, G. (2002). *Probabilistic logic in a coherent setting*. Dordrecht: Kluwer.
- Coulmont, B., and Simon, P. (2019). Quel prénom les immigrés donnent-ils en France ? *Population et Sociétés* 4, 1–4.
- Cruz, N., Baratgin, J., Oaksford, M., and Over, D. P. (2015). Bayesian reasoning with ifs and ands and ors. *Front. Psychol.* 6:192. doi: 10.3389/fpsyg.2015.00192
- Cruz, N., Over, D., Oaksford, M., and Baratgin, J. (2016). "Centering and the meaning of the conditional," in *The annual meeting of the Cognitive Science Society Proceedings*. (Philadelphia), 104–109.
- De Finetti, B. (1964). "Foresight: Its logical laws, its subjective sources," in *Studies in subjective probability*, eds H. E. Kyburg Jr. and H. E. Smokler (New York: John Wiley), 139–158.
- De Finetti, B. (1974). *Theory of probability*. Chichester: John Wiley.
- De Finetti, B. (1980). *Voice Probabilità in Enciclopedia*. Torino: Einaudi, 1146–1187.
- De Finetti, B. (1995). The logic of probability. *Philosoph. Stud.* 77, 181–190.
- Elqayam, S., and Evans, J. T. (2013). Rationality in the new paradigm: Strict versus soft Bayesian approaches. *Think. Reason.* 19, 453–470. doi: 10.1080/13546783.2013.834268
- Elqayam, S., and Over, D. E. (2013). New paradigm psychology of reasoning: An introduction to the special issue edited by Elqayam, Bonnefon, and Over. *Think. Reason.* 19, 249–265. doi: 10.1080/13546783.2013.841591
- Evans, J. B. T. (1977). Linguistic factors in reasoning. *Quart. J. Exp. Psychol.* 29, 297–306. doi: 10.1080/14640747708400605
- Evans, J. B. T. (1993). The mental model theory of conditional reasoning: critical appraisal and revision. *Cognition* 48, 1–20. doi: 10.1016/0010-0277(93)90056-2
- Evans, J. S. B. T. (2012). Questions and challenges for the new psychology of reasoning. *Think. Reason.* 18, 5–31. doi: 10.1080/13546783.2011.637674
- Evans, J. S. B. T., and Beck, M. A. (1981). Directionality and temporal factors in conditional reasoning. *Curr. Psychol. Res.* 1, 111–120.
- Evans, J. S. B. T., and Newstead, S. E. (1977). Language and reasoning: A study of temporal factors. *Cognition* 5, 265–283.
- Evans, J. S. B. T., and Over, D. E. (2004). *If*. Oxford: Oxford University Press. doi: 10.1093/acprof:oso/9780198525134.001.0001
- Evans, J. S. B. T., and Over, D. E. (2013). Reasoning to and from belief: Deduction and induction are still distinct. *Think. Reason.* 19, 267–283. doi: 10.1080/13546783.2012.745450
- Evans, J. S. B. T., Over, D. E., and Handley, S. J. (2005). Suppositions, extensionality, and conditionals: A critique of the mental model theory of Johnson-Laird and Byrne (2002). *Psychol. Rev.* 112, 1040–1052. doi: 10.1037/0033-295X.112.4.1040
- Evans, J. S. B. T., Thompson, V., and Over, D. E. (2015). Uncertain deduction and conditional reasoning. *Front. Psychol.* 6:398. doi: 10.3389/fpsyg.2015.00398
- Everett, G. (2013). *Linguistic Relativity: Evidence Across Languages and Cognitive Domains*. Berlin: Mouton de Gruyter.
- George, C. (1997). Reasoning from uncertain premises. *Think. Reason.* 3, 161–189. doi: 10.1080/135467897394338
- Gilio, A. (2002). Probabilistic reasoning under coherence in system P. *Ann. Math. Artif. Intel.* 34, 131–159. doi: 10.1023/A:1014422615720
- Gilio, A., and Over, D. P. (2012). The psychology of inferring conditionals from disjunctions: A probabilistic study. *J. Math. Psychol.* 56, 118–131. doi: 10.1016/j.jmp.2012.02.006
- Gomes, G. (2009). Are necessary and sufficient conditions converse relations? *Aust. J. Philos.* 87, 375–387. doi: 10.1080/00048400802587325
- Grosset, N., and Barrouillet, P. (2003). On the nature of mental models of conditional: the case of if, if then, and only if. *Think. Reason.* 9, 289–306. doi: 10.1080/1354678034000240
- Guest, D., Adelman, J. S., and Kent, C. (2016). Relative judgement is relatively difficult: Evidence against the role of relative judgement in absolute identification. *Psych. Bull. Rev.* 23, 922–931. doi: 10.3758/s13423-015-0940-2
- Hailperin, T. (1996). *Sentential probability logic*. Bethlehem: Lehigh University Press, doi: 10.2307/2275588
- Hailperin, T. (2010). *Logic with a probability semantics*. Bethlehem: Lehigh University Press.
- Harris, A. J., and Corner, A. (2011). Communicating environmental risks: Clarifying the severity effect in interpretations of verbal probability expressions. *J. Exp. Psychol.* 37, 1571–1578. doi: 10.1037/a0024195
- Harris, A. J., Corner, A., Xu, J., and Du, X. (2013). Lost in translation? Interpretations of the probability phrases used by the intergovernmental panel on climate change in China and the UK. *Clim. Chan.* 121, 415–425. doi: 10.1007/s10584-013-0975-1
- Hiroshi, Y. (2016). "A Perspective of Cross-Cultural Psychological Studies for Global Business," in *Handbook of Research on Impacts of International Business and Political Affairs on the Global Economy*, eds Z. Norhayati, A.-T. Asmat-Nizam, and O. Nazariah (Hershey: IGI Global), 185–206.
- Hiroshi, Y., Miwa, N., Tomoko, H., Yayoi, K., and Junichi, T. (2007). A dual process model for cultural differences in thought. *Mind Soc.* 6, 143–172. doi: 10.1007/s11299-007-0028-4
- Hunt, E., and Agnoli, F. (1991). The whorfian hypothesis: a cognitive psychology perspective. *Psychol. Rev.* 98, 377–389. doi: 10.1037/0033-295X.98.3.377

- Jenkins, S. C., Harris, A. J. L., and Lark, R. M. (2018). Understanding ‘unlikely (20% likelihood)’ or ‘20% likelihood (unlikely)’ outcomes: The robustness of the extremity effect. *J. Behav. Decis. Mak.* 31, 572–586. doi: 10.1002/bdm.2072
- Johnson-Laird, P. N., and Byrne, R. M. J. (1991). *Deduction*. Hove: Lawrence Erlbaum.
- Kleiter, G. D. (2018). Adams’p-validity in the research on human reasoning. *FLAP* 5, 775–826.
- Lassiter, D., and Baratgin, J. (2021). Nested Conditionals and Genericity in the de Finetti Semantics. *Thought* 10, 42–52. doi: 10.1002/tht3.478
- Liu, L. G. (1985). Reasoning counterfactually in Chinese: are there any obstacles? *Cognition* 21, 239–270. doi: 10.1016/0010-0277(85)90026-5
- Mandel, D. R. (2014). The psychology of Bayesian reasoning. *Front. Psychol.* 5:1144. doi: 10.3389/fpsyg.2014.01144
- Manktelow, K. I. (2012). *Thinking and reasoning: An introduction to the psychology of reason, judgment and decision making*. Hove: Psychology Press.
- McCawley, J. D. (1981). *Everything that Linguists have Always Wanted to know about Logic*. Chicago: University of Chicago Press.
- Nakamura, H., Shao, J., Baratgin, J., Over, D. E., Takahashi, T., and Hiroshi, Y. (2018). Understanding conditionals in the East: A Replication study of Politzer et al. (2010) with Easterners. *Front. Psychol.* 9:505. doi: 10.3389/fpsyg.2018.00505
- Nickerson, R. S., Barch, D. H., and Butler, S. F. (2019). Evaluating conditional arguments with uncertain premises. *Think. Reason.* 25, 48–71. doi: 10.1080/13546783.2018.1465474
- Nisbett, R. E., Peng, K., Choi, I., and Norenzayan, A. (2001). Culture and systems of thought: holistic versus analytic cognition. *Psychol. Rev.* 108, 291–310.
- Oaksford, M., and Chater, N. (2007). *Bayesian rationality: the probabilistic approach to human reasoning*. Oxford: Oxford University Press, doi: 10.1093/acprof:oso/9780198524496.001
- Oaksford, M., and Chater, N. (2009). Précis of *Bayesian rationality: The probabilistic approach to human reasoning*. *Behav. Brain Sci.* 32, 69–84. doi: 10.1017/S0140525X09000284
- Oaksford, M., and Chater, N. (2020). New paradigms in the psychology of reasoning. *Ann. Rev. Psychol.* 71, 305–330. doi: 10.1146/annurev-psy-010419-051132
- Oberauer, K., and Wilhelm, O. (2000). Effects of directionality in deductive reasoning: I. The comprehension of single relational premises. *J. Exp. Psychol.* 26, 1702–1712. doi: 10.1037/0278-7393.26.6.1702
- Oberauer, K., Hornig, R., Weidenfeld, A., and Wilhelm, O. (2005). Effects of directionality in deductive reasoning: II. Premise integration and conclusion evaluation. *Quart. J. Exp. Psychol.* 58, 1225–1247. doi: 10.1080/02724980443000566
- Ormerod, T. C., Manktelow, K. I., and Jones, G. V. (1993). Reasoning with three conditionals: biases and mental models. *Quart. J. Exp. Psychol.* 46, 653–678. doi: 10.1080/14640749308401032
- Over, D. E. (2009). New paradigm psychology of reasoning. *Think. Reason.* 15, 431–438. doi: 10.1080/13546780903266188
- Over, D. E., and Baratgin, J. (2016). “The « defective » truth table: Its past, present, and future,” in *The Thinking Mind: A Festschrift for Ken Manktelow*, eds N. Galbraith, E. Lucas, and D. E. Over (London: Psychology Press), 15–28.
- Pederson, E. (2007). “Cognitive Linguistics and Linguistic Relativity,” in *The Oxford Handbook of Cognitive Linguistics*, eds D. Geeraerts and H. Cuyckens (Oxford: Oxford University Press), 1012–1044. doi: 10.1093/oxfordhb/9780199738632.001.0001
- Pfeifer, N. (2014). Reasoning about uncertain conditionals. *Stud. Log.* 8, 1–18. doi: 10.1007/s11225-013-9505-4
- Pfeifer, N., and Kleiter, G. D. (2006). “Is human reasoning about nonmonotonic reasoning conditionals probabilistically coherent?” in *Proceedings of the 7th Workshop on Uncertainty Reasoning*. (Mikulov), 138–150.
- Pfeifer, N., and Kleiter, G. D. (2007). “Human reasoning with imprecise probabilities: Modus ponens and denying the antecedent,” in *Fifth International Symposium on Imprecise Probability: Theories and applications* Prague. 347–356.
- Pfeifer, N., and Kleiter, G. D. (2009). Framing human inference by coherence based probability logic. *J. Appl. Log.* 7, 206–217. doi: 10.1016/j.jal.2007.11.005
- Pfeifer, N., and Kleiter, G. D. (2010). “The conditional in mental probability logic,” in *Cognition and conditionals*, eds M. Oaksford and N. Chater (Oxford: Oxford University Press), 153–173. doi: 10.1093/acprof:oso/9780199233298.003.0009
- Pfeifer, N., and Kleiter, G. D. (2011). “Uncertain deductive reasoning,” in *The science of reason*, eds K. Manktelow, D. Over, and S. Elqayam (Hove: Psychology Press), 145–166.
- Politzer, G. (1991). Comparison of deductive abilities across language. *J. Cross Cult. Psychol.* 22, 389–402. doi: 10.1177/0022022191223005
- Politzer, G. (2016). Deductive reasoning under uncertainty: A Water tank analogy. *Erkenntnis* 81, 479–506. doi: 10.1007/s10670-015-9751-0
- Politzer, G., and Baratgin, J. (2016). Deductive schemas with uncertain premises using qualitative probability expressions. *Think. Reason.* 22, 78–98. doi: 10.1080/13546783.2015.1052561
- Politzer, G., Baratgin, J., Hattori, M., and Hattori, I. (2020a). “Objecting to Uncertain Conditional Sentences: A Cross-linguistic Study,” in *Logic and Uncertainty in the Human Mind: A Tribute to David E. Over*, eds S. Elqayam, I. Douven, J. Evans, and N. Cruz (London: Routledge), 133–160.
- Politzer, G., Jamet, F., and Baratgin, J. (2020b). “Children’s Comprehension of Conditional Requests,” in *Logic and Uncertainty in the Human Mind: A Tribute to David E. Over*, eds S. Elqayam, I. Douven, J. Evans, and N. Cruz (London: Routledge), 161–177.
- Politzer, G., Over, D. P., and Baratgin, J. (2010). Betting on conditionals. *Think. Reason.* 16, 172–197. doi: 10.1080/13546783.2010.504581
- Rips, L. J. (1994). *The Psychology of proof*. New York: MIT Press.
- Sapir, E. (1921). *Language: an introduction to the study of speech*. New York: Harcourt.
- Singmann, H., Klauer, K. C., and Over, D. (2014). New normative standards of conditional reasoning and the dual-source model. *Front. Psychol.* 5:316. doi: 10.3389/fpsyg.2014.00316
- Skovgaard-Olsen, N., Kellen, D., Hahn, U., and Klauer, K. C. (2019). Norm conflicts and conditionals. *Psychol. Rev.* 126, 611–633. doi: 10.1037/rev0000150
- Sobel, J. H. (2009). Modus ponens and modus tollens for conditional probabilities, and updating on uncertain evidence. *Theory Decis.* 66, 103–148. doi: 10.1007/s11238-007-9072-0
- Stewart, N., Brown, G. D. A., and Chater, N. (2005). Absolute identification by relative judgment. *Psychol. Rev.* 112, 881–911. doi: 10.1037/0033-295X.112.4.881
- Suppes, P. (1966). “Probabilistic Inference and the Concept of Total Evidence,” in *Aspects of Inductive Inference*, eds J. Hintikka and P. Suppes (Amsterdam: Elsevier), 49–55.
- Takano, Y. (1989). Methodological problems in cross-cultural studies of linguistic relativity. *Cognition* 31, 141–162. doi: 10.1016/0010-0277(89)90021-8
- Teigen, K. H., Juanchich, M., and Riege, A. H. (2013). Improbable outcomes: Infrequent or extraordinary? *Cognition* 127, 119–139. doi: 10.1016/j.cognition.2012.12.005
- Thompson, V. A., and Mann, J. M. (1995). Perceived necessity explains the dissociation between logic and meaning: the case of “only if”. *J. Exp. Psychol.* 21, 1554–1567. doi: 10.1037/0278-7393.21.6.1554
- Vidal, M., and Baratgin, J. (2017). A psychological study of unconnected conditionals. *J. Cogn. Psychol.* 29, 769–781. doi: 10.1080/20445911.2017.1305388
- Wagner, C. G. (2004). Modus tollens probabilized. *Br. J. Philos. Sci.* 55, 747–753. doi: 10.1093/bjps/55.4.747
- Wang, M. Y., and Gao, P. (2010). Effect of the representation of semantic relations of conditionals on conditional reasoning. *Acta Psychol. Sin.* 42, 1137–1147.
- Whorf, B. L. (1956). *Language, Thought and reality*. Cambridge: MIT Press.
- Wierzbicka, A. (1993). Les universaux de la grammaire. *Lang. Française* 98, 107–120.
- Yao, X. P. (2002). The legacy of human linguist whorf-read on “Language, thought, and reality. *Foreign Lang. Teach. Res.* 1, 75–77.

- Yeh, D., and Gentner, D. (2005). "Reasoning Counterfactually in Chinese: Picking up the Pieces," in *Proceedings of the Twenty-seventh Annual Meeting of the Cognitive Science Society*, California. 2410–2415.
- Zepp, R. (1983). A west African replication of the four-card problem. *J. Cross Cult. Psychol.* 4, 323–327. doi: 10.1177/0022002183014003005
- Zepp, R., Monin, J., and Lei, L. (1987). Common logical errors in English and Chinese. *Educ. Stud. Math.* 18, 1–17. doi: 10.1007/BF00367911

**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.

Copyright © 2022 Shao, Tikiri Banda and Baratgin. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.





# Fickle Judgments in Moral Dilemmas: Time Pressure and Utilitarian Judgments in an Interdependent Culture

Hirofumi Hashimoto<sup>1\*</sup>, Kaede Maeda<sup>2,3,4</sup> and Kaede Matsumura<sup>1</sup>

<sup>1</sup> Graduate School of Literature and Human Sciences, Osaka City University, Osaka, Japan, <sup>2</sup> Urban-Culture Research Center, Osaka City University, Osaka, Japan, <sup>3</sup> Japan Society for the Promotion of Science, Tokyo, Japan, <sup>4</sup> Graduate School of Letters, Yasuda Women's University, Hiroshima, Japan

## OPEN ACCESS

### Edited by:

Valerio Capraro,  
Middlesex University, United Kingdom

### Reviewed by:

Raul Matsushita,  
University of Brasília, Brazil  
Bastien Trémolière,  
UMR 5263 Cognition, Langues,  
Langage, Ergonomie (CLLE), France

### \*Correspondence:

Hirofumi Hashimoto  
hirofumihashimoto@outlook.com

### Specialty section:

This article was submitted to  
Cultural Psychology,  
a section of the journal  
Frontiers in Psychology

**Received:** 15 October 2021

**Accepted:** 03 January 2022

**Published:** 03 March 2022

### Citation:

Hashimoto H, Maeda K and  
Matsumura K (2022) Fickle  
Judgments in Moral Dilemmas: Time  
Pressure and Utilitarian Judgments  
in an Interdependent Culture.  
Front. Psychol. 13:795732.  
doi: 10.3389/fpsyg.2022.795732

In the trolley problem, a well-known moral dilemma, the intuitive process is believed to increase deontological judgments, while deliberative reasoning is thought to promote utilitarian decisions. Therefore, based on the dual-process model, there seems to be an attempt to save several lives at the expense of a few others in a deliberative manner. This study examines the validity of this argument. To this end, we manipulate decision-making time in the standard trolley dilemma to compare differences among 119 Japanese female undergraduates under three conditions: intuitive judgment, deliberative judgment, and judgment after a group discussion. The current results demonstrate that utilitarian judgments decreased from 52.9% in the intuition condition to 43.7% in the deliberation condition and 37.0% after the discussion. Additional analysis suggests that the decrease in utilitarian judgments may be related to psychological unwillingness to assume responsibility for the lives of others rather than to an increase in deontological judgments. Finally, these results are discussed from an adaptationist perspective.

**Keywords:** moral dilemma, utilitarian judgment, deontological judgment, responsibility, interdependence

## INTRODUCTION

In ethics, deontology and utilitarianism are understood as principles for the rightness of moral decision-making. Utilitarianism is a principle that emphasizes the consequences that actions have on people and posits that actions that lead to the greatest happiness for the greatest number are ethically right. Jeremy Bentham and John Stuart Mill are among the most prominent advocates. Utilitarianism is sometimes referred to as a species of consequentialism. In contrast, deontology, espoused by Immanuel Kant, focuses on duties defined by right and wrong. It posits that the ethical rightness of an action depends not on what consequences it brings but on the rightness of the act itself, that is, whether it is done in accordance with duty. In the “trolley problem” (Foot, 1978; Thomson, 1985), a well-known moral dilemma, people are forced to make a moral decision between these two ethical judgments, that is, harming one person (utilitarian judgments) or letting many people die (deontological judgments). Specifically, in the standard trolley dilemma, five workers working on the tracks are expected to be hit and killed by a runaway train with failed brakes. However, by pulling the lever to divert the runaway trolley onto the sidetrack, one can save the lives of the five workers in exchange for the life of another worker. Previous studies have

demonstrated that, in response to this trolley dilemma, people generally deem that it is morally appropriate to pull the lever to save five lives (e.g., Greene et al., 2001). Regarding the so-called standard footbridge dilemma, such utilitarian judgments that it is morally justified to push someone off a footbridge and into the path of an out-of-control trolley are less likely to be exhibited, but rather moral reasoning shifts to deontological judgments. Past research has attempted to explain why people react differently to these two moral dilemmas—trolley and footbridge dilemmas—from multiple perspectives.

One model that explains people's utilitarian and deontological judgments when faced with moral dilemmas is the dual-process model of thinking (Evans, 2008; Kahneman, 2011; Evans and Stanovich, 2013). According to the general explanation based on this dual-process model (e.g., Greene et al., 2001, 2008; Haidt, 2007), deontological judgments are assumed to be underpinned by System 1 thinking (the fast, automatic, and emotional process). On the other hand, utilitarian judgments are based on System 2 thinking (a slow, cognitive, and effortful process). Furthermore, the dual-process model assumes that intuition precedes deliberation; therefore, deontological judgments are explained as predating utilitarian judgments (Greene et al., 2004). This explanation is seemingly consistent with some empirical findings (see Capraro, 2019 for a review). More specifically, empirical support has been provided by a large number of research findings using functional magnetic resonance imaging (Greene et al., 2001, 2004), manipulating decision-making time (Suter and Hertwig, 2011) or cognitive load (Greene et al., 2008), and focusing on working memory (Moore et al., 2008). However, this explanation is still being debated from various perspectives and has not been sufficiently concluded. More recently, some research papers showed the conflicting findings (Tinghög et al., 2016; Baron and Gürçay, 2017; Gürçay and Baron, 2017) and others cast doubt on the assumption of the model that deontological judgment precedes utilitarian judgment (e.g., Bago and De Neys, 2019). However, these aggregated insights into “fickle” judgments in moral dilemmas have not sufficiently examined the socio-ecological environment. Therefore, the current paper examines moral judgments by focusing on two potential influencing factors: decision-making time and the socio-ecological environment.

We focus on both the dual-process theory and the socio-ecological environment because most prior studies that have applied the dual-process model to moral dilemma issues have been conducted in Western countries. However, the number of studies discussing cross-cultural differences has increased (Gold et al., 2014; Awad et al., 2020; but see also Hauser et al., 2007). According to these studies' findings, it has been suggested that people living in East Asian countries are more reluctant to sacrifice one person in the moral dilemma than their Western European counterparts. A leading hypothesis that could explain these cultural variations is the difference in relational mobility (Awad et al., 2020), especially the difference in the importance of reputation in socio-ecological environments (Yamamoto and Yuki, 2019). Yamamoto and Yuki focused on how actions (i.e., taking action and pulling the lever) and inactions (i.e., doing nothing and not pulling the lever) in the trolley problem

influenced individuals' potential reputation. Action entails the possibility of receiving more positive and negative reputations from others compared to inaction (DeScioli et al., 2011). If we emphasize the socio-ecological explanation here, it is essential to consider that societal or cultural differences exist regarding the category of reputation one must maintain. In low relational mobility societies (see Yuki and Schug, 2020), avoiding accumulating a negative reputation and thereby being disliked and excluded by close relatives are critical for survival and success than in high relational mobility societies (see also Yamagishi et al., 2008; Hashimoto and Yamagishi, 2015). The Japanese demonstrate they do not expect as much positive reputation from taking action (i.e., adopting utilitarian judgments) as Americans do (Yamamoto and Yuki, 2019). Based on the socio-ecological approach, it follows that Japanese people who live in a low relational mobility society, or an interdependent culture, are less likely to adopt utilitarian judgments. The reason for this is not that they are more likely to make deontological judgments, but that they do not adopt utilitarian judgments to avoid the responsibility (or the negative reputation that may result) of taking action. Thus, we speculate that the percentage of adopting utilitarian judgments among Japanese samples is lower than in previous studies. The reason for this may not be the predominance of deontological judgments. Instead, it may be the psychological unwillingness to assume responsibility for acting, thus leading to utilitarian judgments.

In summary, the current study's purpose is to examine whether the explanation of moral dilemmas based on the dual-process theory is culturally universally applicable. To this end, we focus on the potential influence of decision-making time on people's moral judgments and hypothesize that the effect of decision-making time can also be applicable even in an interdependent Japanese culture. More specifically, utilitarian judgments will decrease under time pressure, consistent with the dual-process theory of moral judgment (*Hypothesis 1*). We also assumed that the percentage of people who adopt utilitarian judgments is lower among Japanese individuals than in previous studies developed mainly in Western countries. This tendency is not due to the predominance of deontological judgments but results from a psychological unwillingness to assume responsibility for taking action (*Hypothesis 2*). To test these hypotheses, we conducted the study to manipulate decision-making time in the standard trolley dilemma to compare differences under three conditions: intuitive judgment, deliberative judgment, and judgment after a group discussion.

## MATERIALS AND METHODS

To test Hypothesis 1, we manipulated decision-making time in the trolley dilemma by comparing intuitive and deliberation processes. To examine the deliberation process more carefully, we also utilized a group discussion and exploratory examination of how the discussion can change people's moral judgments. For example, expressing one's opinion in a group discussion can lead to greater concern about what others think or feel. Therefore, the current study also examined fickle judgments

in moral dilemmas by utilizing group discussion. To test Hypothesis 2, we attempt to administer a new psychological scale measuring people's utilitarian thinking, deontological thinking, and psychological unwillingness to assume responsibility. Thus, we explore the psychological factors deeply involved in Japanese people's moral judgments.

## Participants

One hundred and nineteen female Japanese undergraduates (mean age = 19.17 years,  $SD = 0.92$ ) participated in this study. The participants were recruited from a lecture on introductory evolutionary psychology. Participants were informed that the decision to participate was voluntary and that they could stop participating at any point in the study. All students who attended the lecture agreed to participate.

## Procedure

The experimenter first distributed the instruction sheet to all the participants. Then, the standard trolley dilemma was briefly summarized and demonstrated using PowerPoint slides with some illustrations. Furthermore, the experimenter read the summary as shown below for all participants.

*"You are standing on the side of the tracks. A runaway train with broken brakes is rushing in your direction, and you see five people tied to the tracks. If you do nothing, the five people will be run over by the train and shall die. Fortunately, there is a lever on your side. If you pull it, you can surely divert the runaway trolley onto the sidetrack. However, one person is tied to the branch line. If the direction of the train is changed, the person will die. Do you think you should pull the lever? Or do you think you should do nothing and leave the five people to die?"*

After reading the above summary, participants were asked to note their judgment of whether they thought they should pull the lever in this situation within 5 s (the *intuition* condition); participants ticked one of six possible answers: "I absolutely think I should not pull it," "I think I should not pull it," "If anything, I think I should not pull it," "If anything, I think I should pull it," "I think I should pull it," and "I absolutely think I should pull it." Next, participants were asked to complete a 10-item questionnaire to examine how strongly they agreed with various thoughts regarding the trolley dilemma issue. This questionnaire was newly developed and administrated by us to distinguish the core principle, that is, utilitarian thinking (e.g., "I think it's better to save five lives than one."), deontological thinking (e.g., "I think it's better to protect a person's dignity."), and unwillingness to assume responsibility (e.g., "I don't want to be responsible for harming one person."). These items were based on the assumption that the stronger the degree of utilitarian thinking, the more likely the decision will be to pull the lever. Conversely, the stronger the degree of deontological thinking or unwillingness to assume responsibility, the less likely that the lever would be pulled (Table 1 displays the 10-items).

After answering these questionnaire items, participants were asked to make the same moral judgment again with no time restrictions (the *deliberation* condition). This procedure has a lot in common with the so-called "two-response paradigm," developed to distinguish and compare intuitive judgments

from deliberative judgments (e.g., Thompson et al., 2011; Bago and De Neys, 2019). After the participants answered all the questions, they were instructed to put their questionnaires into an envelope. After confirming that all the participants had finished answering the questionnaire, the experimenter asked them to form groups of three or four people. The participants were also asked to exchange their opinions in their groups, such as whether they should pull the lever. We distributed a worksheet to each group to check whether the participants had exchanged views. The participants were asked to explain why they thought the lever should be pulled. The groups included acquaintances, friends of the participants, and individuals who had never met each other. As this experiment emphasized the exchange of opinions with others, we asked the participants to form groups of three or four people regardless of whether they knew each other or had never met before. There were 36 groups in total, and all groups engaged in discussion for approximately 5 min. After the group discussion, participants were asked to make the same decision again (the *group discussion* condition). There were six possible answers, as in the intuition and deliberation conditions. After the group discussion and making a third decision, the participants answered the 10-item questionnaire again, concluding the experiment. The entire experiment took approximately 40 min.

## Hypothesis Testing

The purpose of the current study is to examine how people's judgments in moral dilemmas change when they use their intuition and deliberation and discuss with others. There were six possible answers; therefore, based on participants' responses, we used a binary variable (i.e., the utilitarian judgments to pull the lever or the deontological judgments not to pull it) for the analysis, as well as assigned each a quantitative variable from 1 ("I absolutely think I should not pull it.") to 6 ("I absolutely think I should pull it.") and analyze the change between the conditions from these two indicators. To this end, an analysis of variance and *post hoc* multiple comparison tests were conducted. First, an exploratory factor analysis with Promax rotation was conducted to evaluate the questionnaire's internal reliability. Then a multiple regression analysis was performed to determine people's judgments depending on each condition. Finally, the subscale scores of the questionnaire were used as the independent variables and moral judgments in each condition as the dependent variables.

## RESULTS

Changes in judgments between the three conditions (intuition, deliberation, and group discussion) are shown in Figure 1. The results demonstrate that utilitarian judgments decreased from 52.9% (mean = 3.43,  $SD = 1.24$ ) in the intuition condition to 43.7% (mean = 3.15,  $SD = 1.15$ ) in the deliberation condition, and then to 37.0% (mean = 2.96,  $SD = 1.15$ ) in the group discussion condition. An analysis of variance, with condition as the independent variable and the mean scores of each utilitarian judgment as the dependent variable, shows the main effect of

**TABLE 1 |** Factor loadings of the subscales of the thinking scale regarding the trolley dilemma issues.

Subscale/Item	Factor 1	Factor 2	Factor 3	Communality
<b>Factor 1: Deontological thinking (I: <math>\alpha = 0.77</math>, GD: <math>\alpha = 0.88</math>)</b>				
It is better to protect the dignity of one person.	0.71/0.82	-0.20/-0.16	0.02/0.21	0.40/0.50
One person should not be victimized to save five others.	0.70/0.60	0.07/0.21	-0.12/-0.27	0.61/0.75
It is not good to take away the human right of one person.	0.68/0.95	0.01/-0.01	0.17/0.07	0.43/0.86
Pulling the lever is violating one's basic human right.	0.64/0.80	0.13/0.12	0.04/-0.09	0.50/0.83
<b>Factor 2: Unwillingness to assume responsibility (I: <math>\alpha = 0.75</math>, GD: <math>\alpha = 0.87</math>)</b>				
I do not want to be responsible for victimizing one person.	-0.17/-0.18	1.09/0.98	0.08/-0.02	1.00/0.79
I am likely to regret victimizing one person.	0.15/0.06	0.54/0.86	-0.07/0.12	0.42/0.74
I cannot sacrifice one person because of my personal decision.	0.32/0.08	0.35/0.75	-0.09/0.02	0.38/0.62
<b>Factor 3: Utilitarian thinking (I: <math>\alpha = 0.75</math>, GD: <math>\alpha = 0.79</math>)</b>				
It is better to save five lives than one.	0.06/0.18	-0.08/-0.01	0.76/0.78	0.60/0.56
It is better for society that five people survive than one.	0.14/0.11	0.15/0.06	0.75/0.77	0.50/0.54
The sacrifice of one person is unavoidable.	-0.14/-0.15	-0.09/0.05	0.64/0.75	0.53/0.62

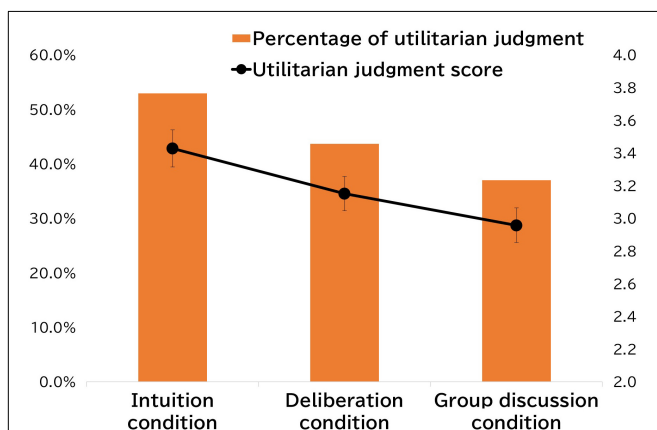
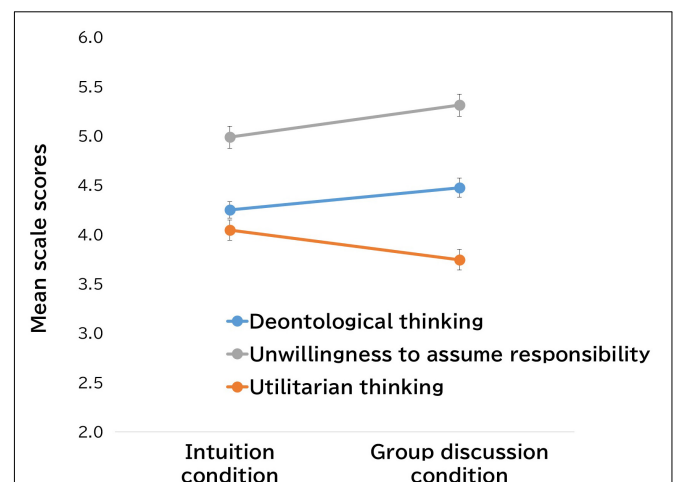
"I" represents the intuition condition, and "GD" represents the group discussion condition. The order of the items is in accordance with the results of the intuition condition.

condition [ $F(2,236) = 17.08$ ,  $p < 0.001$ , partial  $\eta^2 = 0.13$ ]. The additional multiple comparison analysis shows that there is a significant difference between the intuition and deliberation conditions [ $t(118) = 3.59$ ,  $p < 0.001$ ], the intuition and group discussion conditions [ $t(118) = 4.86$ ,  $p < 0.001$ ], and the deliberation and group discussion conditions [ $t(118) = 2.94$ ,  $p < 0.01$ ]. Given that deliberation is more likely to work better over time, these results contradict previous research (e.g., Suter and Hertwig, 2011) because they suggest that deliberation impedes utilitarian judgments.

The thinking scale regarding the trolley dilemma issue that we newly administrated was also analyzed to explore the patterns described above in more detail. As noted in the Procedure section above, this scale was administered after answering the trolley dilemma question in the intuition and the group discussion conditions, respectively. As predicted, the analysis yields three factors. We name Factor 1 "Deontological Thinking," Factor 2, "Unwillingness to Assume Responsibility," and Factor 3 "Utilitarian Thinking." The subscale factor loadings are presented in Table 1. The mean scores of these

subscales after the intuition and group discussion conditions are shown in Figure 2. As shown in this figure, the mean scores of the Unwillingness to Assume Responsibility Scale are high and increase over time [ $t(118) = 3.93$ ,  $p < 0.001$ ]. Deontological Thinking Scale scores also show increased scores over time [ $t(118) = 3.38$ ,  $p < 0.001$ ]; conversely, the Utilitarian Thinking Scale scores show a downward trend [ $t(118) = 3.74$ ,  $p < 0.001$ ]. These results are consistent with the pattern shown in Figure 1.

As shown in Table 2, the multiple regression results consistently demonstrate that the higher the score on the Utilitarian Thinking Scale, the more likely one is to adopt utilitarian judgments (intuitive judgments:  $\beta_s \geq 0.40$ ,  $p < 0.01$ ; deliberative judgments:  $\beta_s \geq 0.44$ ,  $p < 0.01$ ; judgments after group discussion:  $\beta_s \geq 0.42$ ,  $p < 0.01$ ), although this result itself was not surprising. Comparatively, the higher the score on the Unwillingness to Assume Responsibility Scale (intuitive judgments:  $\beta_s \leq -0.25$ ,  $p < 0.01$ ; deliberative

**FIGURE 1 |** The fickle moral judgment for the conditions using two indicators.**FIGURE 2 |** The change in mean scale scores regarding the trolley dilemma.



**TABLE 2 |** Regression analyses to predict intuitive judgments, deliberative judgments, and the judgments after group discussion by the thinking scale regarding the moral dilemma.

		<i>M (SD)</i>	Intuitive judgments	Deliberative judgments	Judgments after group discussion
After intuition condition	Deontological thinking	4.25 (0.91)	−0.02	−0.10	−0.06
	Unwillingness to assume responsibility	4.99 (1.23)	−0.41**	−0.33**	−0.24**
	Utilitarian thinking	4.04 (1.12)	0.47**	0.44**	0.42**
	<i>R</i> <sup>2</sup>		0.48**	0.41**	0.30**
After group discussion condition	Deontological thinking	4.47 (1.06)	−0.04	−0.12	−0.20*
	Unwillingness to assume responsibility	5.31 (1.21)	−0.25**	−0.23**	−0.24**
	Utilitarian thinking	3.74 (1.14)	0.40**	0.48**	0.55**
	<i>R</i> <sup>2</sup>		0.28**	0.38**	0.55**

\*\**p* < 0.01, \**p* < 0.05.Standardized regression coefficients ( $\beta$ 's) are demonstrated.

judgments:  $\beta_s \leq -0.23$ ,  $p < 0.01$ ; judgments after group discussion:  $\beta_s \leq -0.24$ ,  $p < 0.01$ ), the more likely participants are to adopt deontological judgments. However, there are no consistent and significant effects for the Deontological Thinking scale.

## DISCUSSION

Previous studies based on the dual-process model have assumed that the intuitive process increases deontological judgments. In contrast, deliberative reasoning promotes utilitarian decisions (e.g., Greene et al., 2001). Therefore, there seems to be an attempt to save several lives at the expense of a few others in a deliberative manner. This understanding is consistent with some previous findings (e.g., Suter and Hertwig, 2011) demonstrating that moral judgments have been influenced by manipulations of decision-making time; specifically, the deontological judgments were more pronounced under time pressure. If the arguments of previous studies are valid, results would conspicuously show deontological judgments through an intuitive process. Therefore, the current study attempted to examine the validity of this argument and found contradictory patterns. Deliberation makes it more challenging to make utilitarian judgments; thus, Hypothesis 1 is not supported. Additional analysis suggests that a decrease in utilitarian judgments may be related to psychological unwillingness to assume responsibility for the lives of others rather than to an increase in deontological judgments. Thus, Hypothesis 2 is partly supported. These results suggest that Japanese individuals living in an interdependent culture may not pull the lever because of their deontological thinking. Instead, they do not take action because of their unwillingness to assume this responsibility, which suggests that the label of “deontological” judgments may be inappropriate.

The current study's findings may contradict previous studies but are entirely consistent with the claim that utilitarian judgments can be intuitively generated (Bago and De Neys, 2019). As Bialek and De Neys (2017) also point out, some empirical studies showed that intuitive utilitarianism is by no means an exceptional case. Our contention from the current results is that

how fickle moral judgments are through people's deliberation would be related to the nature of society (e.g., Yamagishi and Hashimoto, 2016). Specifically, our findings imply that social environments where people are particularly concerned about the negative publicity of others can modify utilitarianism insofar as utilitarian judgments can lead to negative reactions from others. Although more research findings are needed to examine the implications of the current study, at the very least, our results suggest that when deliberation changes moral judgment, we must also consider the evaluations of those around us that moral judgment brings.

The current results also suggest that the potential responsibility of Japanese individuals' actions in moral dilemmas may be emphasized (or may include East Asians) compared to Westerners. To illustrate, recent studies (e.g., Awad et al., 2020) suggest that East Asians are more resistant to sacrificing one person in a typical trolley problem. However, the explanation as to why such cultural differences arise has yet to be adequately explained. Inspired by Yamamoto and Yuki (2019), the current study focuses on the potential reputation that actions or inactions in moral dilemmas bring and emphasizes that psychological unwillingness may be the reason why utilitarian judgments are retained in the trolley problem. This explanation seems plausible. Many studies demonstrate that Japanese (or East Asians) tend to adopt strategies that meet the expectations of others as a default instead of behaving according to their preference because they are concerned about negative reputations among others (Yamagishi et al., 2008, 2012; Hashimoto and Yamagishi, 2013, 2016). Although this socio-ecological factor-based explanation sounds plausible, future study is needed to determine whether this explanation is valid.

Although this study yields important insights, several limitations need to be addressed. First, a more effective way to examine the differentiation between intuition and deliberation should be developed. We tested the dual-process model with a within-participant factorial design in the current study. However, by asking the same questions repeatedly, additional confounding factors, excluding intuition and deliberation, may have been included in the participants' answers. Thus, future research should implement a between-participant factorial design to

overcome this limitation. Second, since the current study was conducted at a women's university, the sample was extremely limited to young Japanese female students. It is possible that men and women differ in their propensity to endorse moral utilitarianism (Fumagalli et al., 2010; Youssef et al., 2012; Lotto et al., 2014; Arutyunova et al., 2016), although it is also suggested that the difference exists only in personal, but not in impersonal moral dilemmas (Friesdorf et al., 2015; Capraro and Sippel, 2017). It must be noted that such a limited sample may have resulted in very few utilitarian responses (slightly above 50%). Therefore, future studies with a broader range of subjects should be done.

Despite these limitations, the current study contributes to understanding culture-specific moral judgments. As the results suggest, East Asians may make moral judgments in a way that avoids responsibility for taking action; thus, interpreting inaction in the trolley problem as deontological judgments must be reviewed. An integrative study of cultural and evolutionary psychology based on an adaptive perspective would be a useful way to test these possibilities.

## DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## REFERENCES

- Arutyunova, K. R., Alexandrov, Y. I., and Hauser, M. D. (2016). Sociocultural influences on moral judgments: east-west, male-female, and young-old. *Front. Psychol.* 7:1334. doi: 10.3389/fpsyg.2016.01334
- Awad, E., Dsouza, S., Shariff, A., Rahwan, I., and Bonnefon, J. F. (2020). Universals and variations in moral decisions made in 42 countries by 70,000 participants. *Proc. Natl. Acad. Sci. U.S.A.* 117, 2332–2337. doi: 10.1073/pnas.1911517117
- Bago, B., and De Neys, W. (2019). The intuitive greater good: testing the corrective dual process model of moral cognition. *J. Exp. Psychol. Gen.* 148, 1782–1801. doi: 10.1037/xge0000533
- Baron, J., and Gürçay, B. (2017). A meta-analysis of response-time tests of the sequential two-systems model of moral judgment. *Mem. Cogn.* 45, 566–575. doi: 10.3758/s13421-016-0686-8
- Bialek, M., and De Neys, W. (2017). Dual processes and moral conflict: evidence for deontological reasoners' intuitive utilitarian sensitivity. *Judgm. Decis. Mak.* 12:148.
- Capraro, V. (2019). *The Dual-Process Approach to Human Sociality: A Review*. Available online at SSRN: <https://ssrn.com/abstract=3409146> [accessed on Jun 24, 2019].
- Capraro, V., and Sippel, J. (2017). Gender differences in moral judgment and the evaluation of gender-specified moral agents. *Cogn. Process.* 18, 399–405. doi: 10.1007/s10339-017-0822-9
- DeScioli, P., Christner, J., and Kurzban, R. (2011). The omission strategy. *Psychol. Sci.* 22, 442–446. doi: 10.1177/0956797611400616
- Evans, J. S. B. T. (2008). Dual-processing accounts of reasoning, judgment, and social cognition. *Annu. Rev. Psychol.* 59, 255–278. doi: 10.1146/annurev.psych.59.103006.093629
- Evans, J. S. B. T., and Stanovich, K. E. (2013). Dual-process theories of higher cognition: advancing the debate. *Perspect. Psychol. Sci.* 8, 223–241. doi: 10.1177/1745691612460685
- Foot, P. (1978). "The problem of abortion and the doctrine of the double effect," in *Virtues and Vices and Other Essays in Moral Philosophy*, ed. P. Foot (Berkeley: University of California Press), 19–32.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Yasuda Women's University. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

HH wrote the whole part of the manuscript. All authors contributed to the study design, collected and analyzed the data, contributed to this article, and approved the submitted version.

## FUNDING

This study was supported by Grants-in-Aid 21K02992 from the Japan Society for the Promotion of Science.

## ACKNOWLEDGMENTS

We would like to thank Ms. Airi Sayama and Ms. Yuka Kumai for their help in collecting data.

- Friesdorf, R., Conway, P., and Gawronski, B. (2015). Gender differences in responses to moral dilemmas: a process dissociation analysis. *Pers. Soc. Psychol. Bull.* 41, 696–713. doi: 10.1177/0146167215575731
- Fumagalli, M., Ferrucci, R., Mameli, F., Marcegaglia, S., Mrakic-Sposta, S., Zago, S., et al. (2010). Gender-related differences in moral judgments. *Cogn. Process* 11, 219–226. doi: 10.1007/s10339-009-0335-2
- Gold, N., Colman, A. M., and Pulford, B. D. (2014). Cultural differences in responses to real-life and hypothetical trolley problems. *Judgm. Decis. Mak.* 9, 65–76.
- Greene, J. D., Morelli, S. A., Lowenberg, K., Nystrom, L. E., and Cohen, J. D. (2008). Cognitive load selectively interferes with utilitarian moral judgment. *Cognition* 107, 1144–1154. doi: 10.1016/j.cognition.2007.11.004
- Greene, J. D., Nystrom, L. E., Engell, A. D., Darley, J. M., and Cohen, J. D. (2004). The neural bases of cognitive conflict and control in moral judgment. *Neuron* 44, 389–400. doi: 10.1016/j.neuron.2004.09.027
- Greene, J. D., Sommerville, R. B., Nystrom, L. E., Darley, J. M., and Cohen, J. D. (2001). An fMRI investigation of emotional engagement in moral judgment. *Science* 293, 2105–2108. doi: 10.1126/science.1062872
- Gürçay, B., and Baron, J. (2017). Challenges for the sequential two-system model of moral judgment. *Think. Reason.* 23, 49–80. doi: 10.1080/13546783.2016.1216011
- Haidt, J. (2007). The new synthesis in moral psychology. *Science* 316, 998–1002. doi: 10.1126/science.1137651
- Hashimoto, H., and Yamagishi, T. (2013). Two faces of interdependence: harmony seeking and rejection avoidance. *Asian J. Soc. Psychol.* 16, 142–151. doi: 10.1111/ajsp.12022
- Hashimoto, H., and Yamagishi, T. (2015). Preference-expectation reversal in the ratings of independent and interdependent individuals: a USA-Japan comparison: preference-expectation reversal. *Asian J. Soc. Psychol.* 18, 115–123. doi: 10.1111/ajsp.12094
- Hashimoto, H., and Yamagishi, T. (2016). Duality of independence and interdependence: an adaptationist perspective. *Asian J. Soc. Psychol.* 19, 286–297. doi: 10.1111/ajsp.12145

- Hauser, M., Cushman, F., Young, L., Kang-xing Jin, R., and Mikhail, J. (2007). A dissociation between moral judgments and justifications. *Mind Lang.* 22, 1–21. doi: 10.1111/j.1468-0017.2006.00297.x
- Kahneman, D. (2011). *Thinking, Fast and Slow*. New York, NY: Farrar, Straus and Giroux.
- Lotto, L., Manfrinati, A., and Sarlo, M. (2014). A new set of moral dilemmas: norms for moral acceptability, decision times, and emotional salience. *J. Behav. Decis. Mak.* 27, 57–65. doi: 10.1002/bdm.1782
- Moore, A. B., Clark, B. A., and Kane, M. J. (2008). Who shalt not kill? Individual differences in working memory capacity, executive control, and moral judgment. *Psychol. Sci.* 19, 549–557. doi: 10.1111/j.1467-9280.2008.02122.x
- Suter, R. S., and Hertwig, R. (2011). Time and moral judgment. *Cognition* 119, 454–458. doi: 10.1016/j.cognition.2011.01.018
- Thompson, V. A., Prowse Turner, J. A., and Pennycook, G. (2011). Intuition, reason, and metacognition. *Cogn. Psychol.* 63, 107–140. doi: 10.1016/j.cogpsych.2011.06.001
- Thomson, J. J. (1985). The trolley problem. *Yale L. J.* 94, 1395–1415.
- Tinghög, G., Andersson, D., Bonn, C., Johannesson, M., Kirchler, M., Koppel, L., et al. (2016). Intuition and moral decision-making: the effect of time pressure and cognitive load on moral judgment and altruistic behavior. *PLoS One* 11:e0164012. doi: 10.1371/journal.pone.0164012
- Yamagishi, T., and Hashimoto, H. (2016). Social niche construction. *Curr. Opin. Psychol.* 8, 119–124. doi: 10.1016/j.copsyc.2015.10.003
- Yamagishi, T., Hashimoto, H., Cook, K. S., Kiyonari, T., Shinada, M., Mifune, N., et al. (2012). Modesty in self-presentation: a comparison between the USA and Japan. *Asian J. Soc. Psychol.* 15, 60–68. doi: 10.1111/j.1467-839X.2011.01362.x
- Yamagishi, T., Hashimoto, H., and Schug, J. (2008). Preferences versus strategies as explanations for culture-specific behavior. *Psychol. Sci.* 19, 579–584. doi: 10.1111/j.1467-9280.2008.02126.x
- Yamamoto, S., and Yuki, M. (2019). What causes cross-cultural differences in reactions to the Trolley Problem? A cross-cultural study on the roles of relational mobility and reputation expectation. *JPN. J. Soc. Psychol.* 35, 61–71. doi: 10.14966/jssp.1733
- Youssef, F. F., Dookeeram, K., Basdeo, V., Francis, E., Doman, M., Mamed, D., et al. (2012). Stress alters personal moral decision making. *Psychoneuroendocrinology* 37, 491–498. doi: 10.1016/j.psyneuen.2011.07.017
- Yuki, M., and Schug, J. (2020). Psychological consequences of relational mobility. *Curr. Opin. Psychol.* 32, 129–132. doi: 10.1016/j.copsyc.2019.07.029

**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.

Copyright © 2022 Hashimoto, Maeda and Matsumura. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.



# Zhongyong Thinking Style and Resilience Capacity in Chinese Undergraduates: The Chain Mediating Role of Cognitive Reappraisal and Positive Affect

Shisi Zhou<sup>1</sup> and Xueping Li<sup>2\*</sup>

<sup>1</sup> Department of Psychology, Institute of Education, China West Normal University, Nanchong, China, <sup>2</sup> College of Preschool and Primary Education, China West Normal University, Nanchong, China

## OPEN ACCESS

### Edited by:

Hiroshi Yama,  
Osaka City University, Japan

### Reviewed by:

Guyonne Rogier,  
Sapienza University of Rome, Italy  
Gen Nakao,  
Otemon Gakuin University, Japan  
Arezou Lashkari,  
Shahid Beheshti University, Iran

### \*Correspondence:

Xueping Li  
xuepl2001@163.com

### Specialty section:

This article was submitted to  
Cultural Psychology,  
a section of the journal  
Frontiers in Psychology

**Received:** 12 November 2021

**Accepted:** 13 May 2022

**Published:** 20 June 2022

### Citation:

Zhou S and Li X (2022)  
Zhongyong Thinking Style  
and Resilience Capacity in Chinese  
Undergraduates: The Chain Mediating  
Role of Cognitive Reappraisal  
and Positive Affect.  
Front. Psychol. 13:814039.  
doi: 10.3389/fpsyg.2022.814039

Previous studies have suggested that the Zhongyong thinking style (influenced by Chinese culture) is associated with psychological features. However, little is known about the direct association between Zhongyong thinking and resilience and the underlying mechanisms of this relationship in Chinese culture. The present study aimed to investigate the association between Zhongyong thinking and undergraduates' resilience and to assess whether cognitive reappraisal and positive effects mediated this association. A sample of undergraduates ( $n = 1,356$ , 70.4% female, mean age = 19 years) was recruited for this study and the participants completed the Zhongyong Thinking Style Scale (ZYTS), the Emotion Regulation Questionnaire (ERQ), the Positive Affect and Negative Affect Scale (PANAS), and the Resilience-11. Results indicated that the Zhongyong thinking style was positively and significantly associated with resilience. Undergraduates' resilience was affected by Zhongyong thinking partly through 3 different pathways: the mediating role of cognitive reappraisal, the mediating role of positive effect, and the mediating chain role of both cognitive reappraisal and positive effect. These findings might provide a deeper understanding of the protective factors for resilience among Chinese undergraduates.

**Keywords:** Zhongyong thinking, resilience, culture, cognitive reappraisal, positive effect

## INTRODUCTION

Resilience has been a focus of research in psychological and behavioral sciences in the last decade. Most previous conceptual approaches to understand resilience have considered it to be an individual trait, regarding resilience as a predisposition to succeed (Ungar, 2013). However, those researches fail to acknowledge the various influential factors, such as historical, social, and cultural influences on indigenous communities (Kirmayer et al., 2011). These factors connected with resilience are constructed from original cultural knowledge, indigenous philosophies, and beliefs (Thomas et al., 2015). Despite the various definitions of resilience, resilience can be recognized as an essential aspect of a better psychological and physical state (Smith et al., 2008; Osório et al., 2016), which can help individuals maintain mental health and fight depressive symptoms, anxiety, and other emotions (Iimura, 2022; Lau, 2022). Chinese undergraduates have been concerned a lot about the high incidence of mental health problems (Jiang et al., 2015). It is necessary to explore the relationship between resilience and the influential factors among Chinese undergraduates.



Zhongyong thinking is the most influential thinking style in China that originated from Chinese traditional philosophical culture, like Confucianism, and it initially functioned as a supreme morality and then evolved into a basic cognitive principle that Chinese people use to confront society (Chiu, 2000; Yang et al., 2016). For instance, Wu and Lin (2005) defined Zhongyong thinking as considering things from multiple aspects and making appropriate decisions for the whole situation. Studies have implied that Zhongyong thinking can influence people's resilience under Chinese background (Cheng, 2009; Zheng et al., 2020). So Zhongyong thinking as a cultural-related variable that may connect with resilience needs to be investigated.

In addition, a few studies have reported some factors that predict the level of resilience, and the factors were also related to Zhongyong thinking. Guo and Zeng (2012) proved that individuals with high Zhongyong thinking tend to show greater cognition reappraisal. Yang et al. (2016) demonstrated that Zhongyong thinking played an important role in maintaining subjective well-being among contemporary Chinese young adults. Moreover, research revealed that individuals with high cognition reappraisal tend to show high resilience (Holl et al., 2017), and also positive effect is found correlated with resilience (Dewi and Ruidahasi, 2020).

No doubt, these previous studies have greatly enriched our understanding of resilience and its antecedents are observed. Individuals who maintain high Zhongyong thinking under the Chinese culture background are often likely to use the cognition reappraisal strategy and keep inner harmonious to be a positive emotional state, while cognition reappraisal and positive effect are essential factors for cultivating resilience. However, few studies verified the direct relation between Zhongyong thinking and resilience, and we know less about the mediators in the association. To bridge this gap, we explore the effect of Zhongyong thinking on resilience, and we sought to assess the role of cognition reappraisal and the positive effect between Zhongyong thinking and resilience in a sample of mainland Chinese undergraduates.

## Zhongyong Thinking and Resilience

Deeply influenced by the Chinese traditional philosophical traditions, including Confucianism, Chinese culture has had a distinctive morality and value system from the earliest times to the present day. With the development of cultural psychology, Spencer-Rodgers et al. (2010) explained that the thinking styles have cultural differences, especially between the West and the East. Many researchers have attempted to define the thinking style of the East, and they focused on the reconciliation of the two perspectives and the acceptance of contradictions (Peng and Nisbett, 1999). Holistic thinking and dialectical thinking were listed in these researches which emphasize on comparing East Asians and Westerners (Nisbett and Miyamoto, 2005; Choi et al., 2007; Spencer-Rodgers et al., 2010; Zhang et al., 2015). These thinking styles, to some extent, may relate to Zhongyong thinking, but the foundational theory and the starting point of the constructs were different (Please see the Note in the end for further discussion). China is a cultural and historical country in East Asia, and the effect of traditional Chinese culture

and religion was not immutable and stationary. Zhongyong was known as a kind of high standard morality in ancient times. With the development of psychology, researchers have found that Zhongyong thinking is a system that involves values, behaviors, and perceptions, and people decide how to choose, execute, and correct their actions depending on this system (Yang et al., 2016). The concept of Zhongyong thinking is widely used in China. When Wu and Lin (2005) studied about Zhongyong thinking, they defined Zhongyong thinking as a process that takes situations into account from multiple aspects and accountable decisions are made for both personal feelings and the feelings of others considering different views. Therefore, the three features (multiple thinking, holism, and harmoniousness) are included. It is well established that Zhongyong thinking is related to individuals' mental health under Chinese culture background, and Yang et al. (2016) demonstrated that Zhongyong thinking was significantly associated with an emotion system in a sample of 8,278 Chinese students.

The study of resilience has gone through a long process accompanied by many different views. Some perspectives define resilience as a trait that is comparatively stable and present in an individual at birth (Connor and Davidson, 2003; Lucken and Gress, 2010). The concept that resilience is like a skill or a quality people can develop and cultivate has also drawn much attention in the literature (Buzzanell, 2010). Others emphasize the social ecological understanding of resilience which is nested in various spheres of culture, political processes, family structure, and the community (Leadbeater et al., 2005; Ungar, 2013). Based on the social ecological theory of resilience, the factors that are congruent with cultural norms are important. Resilience is an important factor in advancing individuals' mental health. For instance, research suggests that resilience may help individuals to deal with the negative psychological effects of traumatic events, including the Covid pandemic (Liao et al., 2021). It is therefore necessary to advance theory development about resilience and the relation between resilience and influential factors.

The correlation between Zhongyong thinking rooted in Chinese traditional culture and resilience should not be ignored. From Cheng's (2009) research, we know that the thinking style influenced by Chinese traditional culture in China has a positive relationship with coping flexibility, and individuals need to have flexibles cognition appraisals in coping with different stressful events. Furthermore, it has been reported that the thinking style rooted in Chinese traditional culture significantly mediates the relationship between culture and resilience (Zheng et al., 2020). The belief that Zhongyong thinking may effect resilience capacity is implied in these findings.

According to the studies, it can be predicted that Zhongyong thinking should play a crucially effective role in promoting resilience in China.

## Cognitive Reappraisal as a Mediator

Emotion regulation refers to the process when the emotion arouses, maintains, and recovers individual uses to influence the occurring, experiencing, and expressing of emotion (Gross, 2000; Gross, 2007). Cognitive reappraisal is a strategy that individuals often selectively reinterpret events by changing the subjective

appraisals to reframe an emotional stimulus (Gross and John, 2003). Previous experimental evidence shows that social cognition has a substantial impact on an individual's emotion regulation (Westerhof-Evers et al., 2019), and the differences in emotion regulation strategies exist in the different cultures (Miyamoto et al., 2014; Ip et al., 2021). Meanwhile, the thinking style rooted in eastern culture as a basic cognition has drawn lots of attention (Spencer-Rodgers et al., 2010). Evidence showed that Zhongyong thinking significantly correlates with cognitive reappraisal strategy under the Chinese cultural background (Guo and Zeng, 2012). Literature suggests that cognitive reappraisal correlated with healthier emotion and better well-being (Cutuli, 2014).

*Cognitive reappraisal* is an effective emotion regulation strategy which is an essential aspect to enhance resilience. Many findings have supported that an individual's emotion regulation strategy was correlated with resilience (Mestre et al., 2017; Vaughan et al., 2019). For instance, Zhang et al. (2020) evaluated the relationship between resilience and emotion regulation among preschool left-behind children. The results revealed that children with higher cognitive reconstruction had a lower risk of low resilience. Moreover, studies showed that the cognitive reappraisal strategy could serve as a path to explain resilient development among mentally healthy individuals with and without experience of childhood abuse and neglect (Holl et al., 2017).

In summary, we assume that the more the individuals with a higher Zhongyong thinking style obtain under cultural background, the more cognitive reappraisal strategy the individuals may use. Furthermore, more use of cognitive reappraisal promotes higher resilience, suggesting that cognitive reappraisal may function as a mediator in the association between Zhongyong thinking and resilience.

## Positive Effect as a Mediator

Another potential mediator in the association between Zhongyong thinking and resilience is positive effect which is an essential feature of subjective well-being and mental health. Positive effect is defined as individuals' propensity to experience positive emotions and deal with challenges and interpersonal relationship in a positive way (Lopez et al., 2018). Lots of studies showed that positive effect could predict or promote a large number of desirable outcomes besides resilience (Davidson et al., 2010; Rackoff and Newman, 2020). For example, Buchanan (2014), who first pointed out that there were protective factors to promote the development of resilience and risk ones, stated that positive emotions like well-being, inner calm, especially experienced in early childhood, could help children achieve resilience. Furthermore, as revealed by Dewi and Ruidahasi (2020), maintaining positive effect could enhance resilience in the rehabilitation institution.

When we focus on Zhongyong thinking and emotion, the "zhong" and "he" always draw our attention. "Zhong" refers to mater the extremes but deploy the mean, and "he" is related to the aspiration of the harmonious and coexistent directions (Wu and Lin, 2005). However, the opinion Zhongyong thinking encourages the characteristic of "finding the good in the bad" is

less mentioned, and this characteristic can promote individuals' positive emotion. In Yang et al.'s (2016) longitudinal studies, the training of Zhongyong thinking in group psychotherapy to reduce Chinese students' depression symptoms was approved. Moreover, cross-sectional studies revealed that higher level of Zhongyong thinking was interrelated with fewer depressive and anxiety symptoms (Zhan et al., 2013).

Underpinning these works, we assume that the higher Zhongyong thinking level Chinese college students have, the more positive effect they may obtain and this results in a more positive effect which can lead to more resilience. Therefore, it is reasonable to infer that positive effect may also mediate the association between Zhongyong thinking style and Chinese college students' resilience.

## Cognitive Reappraisal and Positive Effect

It is known that emotion regulation plays a crucial part in influencing an individual's psychological and health problems (Ramirez-Ruiz et al., 2020). Deficits in regulating emotion strategies may lead to disorders in psychology and psychiatry (Pappaanni et al., 2020). From a systematic emotion-regulation strategies view, tons of published researches focused on maladaptive emotion regulation strategy, and evidence showed the strategy was positively associated with and anxiety, depression, and stress (Ramirez-Ruiz et al., 2020). While the association between emotion regulation and positive psychological concepts had been given less attention in the literature (Ramirez-Ruiz et al., 2020), even positive psychology came a long way. Fortunately, there were still some researches that could be listed. Schanowitz and Nicassio (2006) found that more use of positive reappraisal can predict higher positive effect. Exploring the relationship between perceived stress and positive effect, Teixeira et al. (2021) presented evidence that functional cognitive reappraisal had a mediating effect on the association.

Following these studies, we posit that cognitive reappraisal is directly related to positive effect, which subsequently improves resilience.

## The Current Study

It is the first study to directly investigate the relationship between Zhongyong thinking and resilience although researches have implied the culture-related factor connected with resilience. Also it has been suggested that although cognitive reappraisal and positive effect connect with Zhongyong thinking and

**TABLE 1 |** Descriptive statistics and bivariate correlation ( $n = 1,356$ ).

	<i>Mean</i>	<i>SD</i>	<b>1</b>	<b>2</b>	<b>3</b>
1. Zhongyong thinking	68.3	11.6	—		
2. Cognitive reappraisal	29.0	5.6	0.46**	—	
3. Positive effect	30.8	5.8	0.28**	0.38**	—
4. Resilience	52.7	8.3	0.49**	0.61**	0.53**

*SD, standard deviation.*

\*\* $p < 0.01$ .

**TABLE 2 |** Multiple linear regression results for testing the mediating role of cognition reappraisal and positive effect in the relationship between Zhongyong thinking and resilience ( $n = 1,356$ ).

Predictor variable	Outcome variable	<i>R</i>	<i>R</i> <sup>2</sup>	<i>F</i>	$\beta$	<i>t</i>	Boot LLCI	Boot ULCI
<b>Equation 1</b>								
Zhongyong thinking	Cognitive reappraisal	0.47	0.22	373.00	0.23	19.31***	0.205	0.248
<b>Equation 2</b>								
Zhongyong thinking	Positive effect	0.40	0.16	127.79	0.07	4.74***	0.040	0.094
Cognitive reappraisal					0.33	11.32***	0.271	0.385
<b>Equation 3</b>								
Zhongyong thinking	Resilience	0.72	0.51	476.67	0.16	10.30***	0.129	0.189
Cognitive reappraisal					0.55	16.80***	0.490	0.619
Positive effect					0.47	15.98***	0.414	0.530

The 95% confidence intervals do not overlap with zero.

BootLLCI and BootULCL were 95% confidence interval lower and 95% confidence interval upper calculated by the bias-corrected bootstrap method for testing indirect effects.

\*\*\* $p < 0.001$ .

**TABLE 3 |** Indirect effect of cognitive reappraisal and positive effect ( $n = 1,356$ ).

	Effect	Boot SE	Boot LLCI	Boot ULCI	Ratio of indirect to total effect	Ratio of indirect to direct effect
Total indirect effect	0.19	0.014	0.164	0.220	54%	120%
Indirect effect 1	0.13	0.011	0.102	0.147	36%	78%
Indirect effect 2	0.03	0.004	0.026	0.045	9%	22%
Indirect effect 3	0.03	0.007	0.018	0.046	9%	20%

Indirect effect 1 was Zhongyong thinking→cognitive reappraisal→resilience.

Indirect 2 was Zhongyong thinking→positive effect→resilience.

Indirect 3 was Zhongyong thinking→cognitive reappraisal→positive effect→resilience.

Boot SE, Boot LLCI, and Boot ULCL were estimated standard error, 95% confidence interval lower and 95% confidence interval upper through bias-corrected percentile bootstrap method used for testing indirect effects.

The 95% confidence intervals did not overlap with zero.

resilience, the underlying mechanisms of the relationship between Zhongyong thinking and resilience remains unclear. We took efforts to understand deeper the relationship between Zhongyong thinking and resilience and sought to expand the literature by specifying the mechanisms underlying the association between Zhongyong thinking and resilience by considering the mediating effect of cognitive reappraisal and positive effect.

In summary, in this study we investigated the relationship between Zhongyong thinking and resilience and tested the mediating effects of cognitive reappraisal and positive effect in this relationship using a sample of Chinese undergraduates. Considering the previous empirical researches and theoretical studies, we proposed four hypotheses: (1) Zhongyong thinking significantly connect with resilience; (2) cognitive appraisal mediate the relationship between Zhongyong thinking and resilience; (3) positive effect mediate the relationship between Zhongyong thinking and resilience; (4) cognitive appraisal and positive effect play a chain mediating effect on the relationship between Zhongyong thinking and resilience.

## MATERIALS AND METHODS

### Participants

The participants of this study were undergraduates who came from different provinces in China. A sample of 1,382 college

students was recruited from three universities in mainland China. Excluding 16 uncompleted questionnaires (missing items were more than 15% of the total items) and 10 unreasonable answers, 1,356 ( $n = 1,356$ ) valid questionnaires comprised the study sample (valid response rate was 100%). They ranged in age from 18 to 26. In this sample, 70.4% of the participants were women and 29.6% of the participants were men. The Han nationality was 1,294 (95.4%) and the minorities were 61 (4.5%).

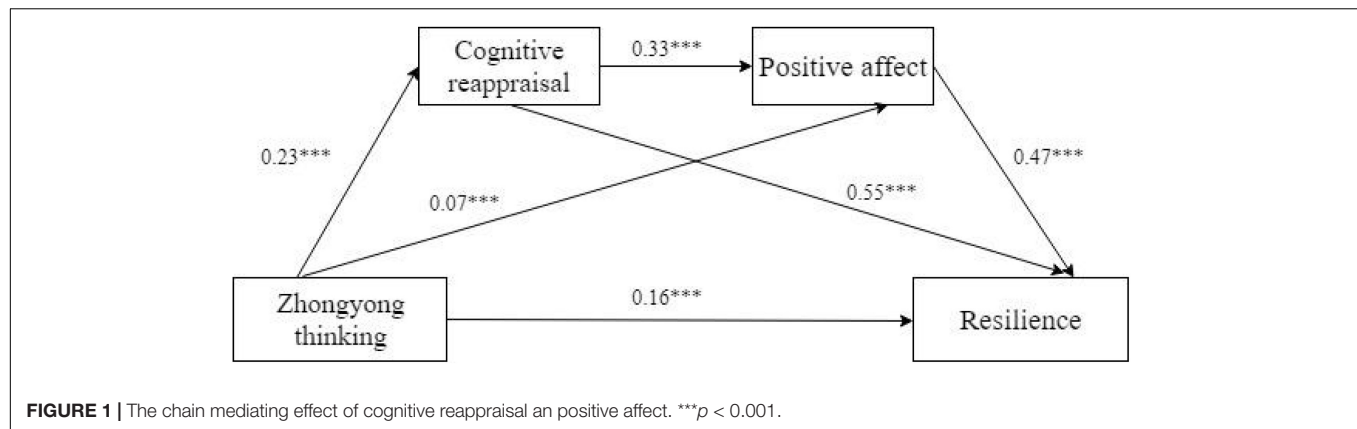
### Procedure

The Institutional Review Boards (IRBS) approved the present research to begin the study. After research administrator orally explained the same instruction on how to manage the questionnaires and expounded the purpose of the present study, all students took part in this survey voluntarily in the classroom. To protect their personal information, we collected the data anonymously. The effectiveness of data collection was ensured. Each participant was paid 3RMB payments for their participation. Altogether, the instruments took approximately 30 min to complete.

### Measures

#### Zhongyong Thinking Style

The Zhongyong thinking Style Scale (ZYTS; Wu and Lin, 2005) was used to measure participants' Zhongyong thinking levels. Three dimensions of Zhongyong thinking are measured



**TABLE 4 |** Multiple linear regression results for testing the mediating role of cognitive reappraisal and positive effect in the relationship between Zhongyong thinking and resilience ( $n = 1,356$ ).

Predictor variable	Outcome variable	<i>R</i>	<i>R</i> <sup>2</sup>	<i>F</i>	$\beta$	<i>T</i>	Boot LLCI	Boot ULCI
<b>Equation 1</b>								
Zhongyong thinking	Cognitive reappraisal	0.46	0.22	373.00	0.22	19.31***	0.20	0.25
<b>Equation 2</b>								
Zhongyong thinking	Positive effect	0.28	0.07	116.60	0.14	10.80***	0.12	0.17
<b>Equation 3</b>								
Zhongyong thinking	Resilience	0.72	0.51	476.67	0.16	10.30***	0.13	0.19
Cognitive reappraisal					0.55	16.80***	0.49	0.62
Positive effect					0.47	15.98***	0.41	0.53

95% confidence intervals do not overlap with zero.

Boot LLCI and Boot ULCL were 95% confidence interval lower and 95% confidence interval upper calculated by the bias-corrected bootstrap method for testing indirect effects.

The alternative chain model of Zhongyong thinking  $\rightarrow$  positive effect  $\rightarrow$  cognitive reappraisal  $\rightarrow$  resilience was also significant, but considering the result of the parallel results, the effect-regulation model, and the length of the article, this study only concentrated on the chain model of Zhongyong thinking  $\rightarrow$  cognitive reappraisal  $\rightarrow$  positive effect  $\rightarrow$  resilience rather than the alternative chain model.

**TABLE 5 |** The comparison of the mediating effect of the cognitive reappraisal and positive effect in the relationship between Zhongyong thinking and resilience ( $n = 1,356$ ).

	Effect	Boot SE	Boot LLCI	Boot ULCI	Ratio of indirect to total effect	Ratio of indirect to direct effect
Total effect	0.35	0.02	0.308	0.392	—	—
Direct effect	0.16	0.02	0.123	0.194	—	—
Total indirect effect	0.19	0.01	0.165	0.220	54%	120%
Mediating effect of CR	0.06	0.01	0.104	0.148	35%	78%
Mediating effect of PA	0.13	0.01	0.052	0.082	19%	42%

CR, cognitive appraisal; PA, positive effect.

Mediating effect of CR was Zhongyong thinking  $\rightarrow$  cognitive reappraisal  $\rightarrow$  resilience.

Mediating effect of PA was Zhongyong thinking  $\rightarrow$  positive effect  $\rightarrow$  resilience.

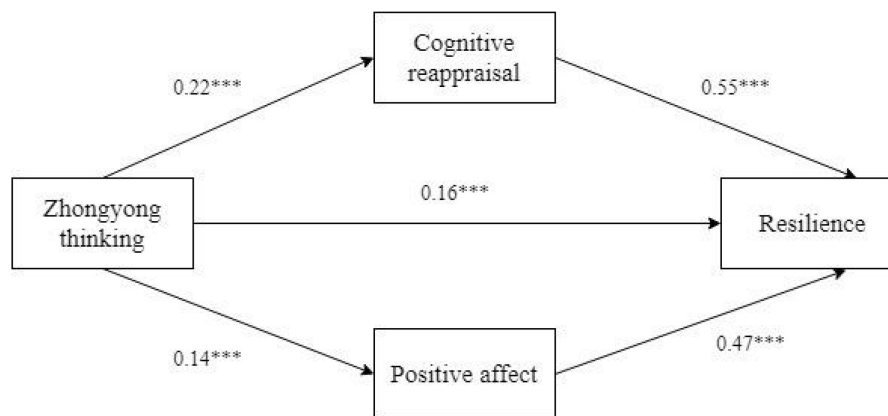
Boot SE, Boot LLCI and Boot ULCL were estimated standard error, 95% confidence interval lower and 95% confidence interval upper through bias-corrected percentile bootstrap method used for testing indirect effects.

The 95% confidence intervals did not overlap with zero.

on the 13-item scale. They are multi-thinking, holism, and harmoniousness. The items were hypothetical opinion-expression situations and participants needed to evaluate their thinking process in these situations. Here are some examples of the items: “When discuss with others I will thinking about the conflicting opinions from others” “I always consider things from multiple aspects” (Multi-thinking); “I will try to find a balance between others’ views and my own opinion” “I will

adjust my thoughts after taking into account others’ suggestions” (Holism); “When making decisions, I will take the atmosphere of harmoniousness into account” (Harmoniousness). Each item is rated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). Item scores are summed to yield a total score ranging from 7 to 91, with higher scores demonstrating higher Zhongyong thinking. Participants were invited to evaluate their thinking process in a The ZYTS has been widely used among the





**FIGURE 2 |** The mediating effect of cognitive reappraisal and positive effect in a parallel model. \*\*\* $p < 0.001$ .

Chinese and has shown good reliability and validity (Hu et al., 2012; Sun et al., 2014), and the internal consistency (Cronbach's alpha) of this study was 0.80.

### Resilience

Participants completed the Chinese version of Resilience-11 (Gao et al., 2013) to assess an individual's resilience. The RS-11 is translated and modified from the original English version of RS-11 (Wagnild and Young, 1993). It is an 11-item tool, and each item is rated on a 7-point Likert scale. Total scores range from 11 to 77, and higher scores demonstrate higher levels of resilience. Good reliability and validity of the revised Chinese version have been tested and shown for Chinese samples, and Cronbach's alpha coefficient is 0.83.

### Emotion Regulation Questionnaire

In this study, the emotion regulation was measured by the Emotion Regulation Questionnaire (Gross and John, 2003), which consists of two dimensions, cognitive reappraisal, and expression suppression. The Chinese version of the revised emotion regulation questionnaire has been previously validated (Wang et al., 2007). This scale is a 10-items, 7-point Likert-type self-report instrument aimed to evaluate the participants' inclinations to regulate their emotions. The higher the score is the more the frequency of emotion regulation strategy the people use. The reliability coefficients of the dimensions of cognitive reappraisal and expressive suppression are 0.85 and 0.77 (Wang et al., 2007). In the current study, the Cronbach's alpha coefficients were 0.92 for cognitive reappraisal, 0.84 for expression suppression, and 0.92 for the whole emotion regulation questionnaire.

### Positive Effect and Negative Effect Scale

The positive effect and negative effect scale (PANAS) is a self-report questionnaire with 20 emotion items that have been used to measure positive effect (PA) and negative effect (NA). Participants had to indicate the extent to which they have felt each effect (e.g., "active" and "hostile") using a 5-point Likert scale. The Chinese version of the scale has shown high internal

consistency, and adequate internal consistency and validity have been demonstrated in lots of previous studies (Huang and Yang, 2003; Zhang et al., 2004). In this study, the Cronbach's alpha coefficients for the positive effect and negative effect sub-scale were 0.91 and 0.81, respectively.

### Analytical Methods

We conducted statistical analyses by using SPSS (version 21.0) and AMOS (version 24.0). First, Pearson correlation was tested to investigate the association between Zhongyong thinking, cognitive reappraisal, positive effect, and resilience. Multiple comparisons were corrected using a FDR method with a corrected threshold of  $q < 0.05$ . Second, we conducted serial mediation analysis with the bootstrapping method, in which the indirect effect of Zhongyong thinking on resilience through cognitive reappraisal, through positive emotion, and through both cognitive reappraisal and positive emotion was tested. This bootstrapping analysis with 5,000 iterations was conducted using PROCESS Macro (Preacher and Hayes, 2008) to test the significance of the indirect effect of the mediator. It was believed that the absence of zero in the confidence interval (CI) indicates the significance of the point estimate ( $p < 0.05$ ; Hooper et al., 2008). Third, a series of hierarchical multiple regressions were conducted in Zhongyong thinking and resilience. The standardized predictive variable and responding variable (Zhongyong thinking and resilience) were required in a regression equation. The incremental change in  $R^2$  and  $F$ -value was used to evaluate the main effect of the study variables.

## RESULTS

### Preliminary Data Analyses

Univariate and multivariate normality was assessed by the values of skewness and kurtosis. Skewness values ranged from  $-1.14$  to  $0.01$  and kurtosis values ranged from  $0.34$  to  $2.73$  (for Zhongyong thinking, cognitive reappraisal, positive effect, and resilience, respectively), which indicated that there was no severe violation of normal distribution ( $Sk < |3|$  and  $Ku < |10|$ ; Kline, 2005).

## Common Methods Bias Analyses

Common method deviation might occur since all the collected questionnaires were from university students' self-reports. The Harman single factor method was conducted in this study so that the common methodological deviations can be tested and avoided. The results showed that there were 8 factors whose characteristic value was greater than 1, and the interpretation rate of the first factor was 24.86%, less than 40%. Hence, the influence of common method deviation in the questionnaires collected in this study can be excluded.

## Bivariate Correlations Between Variables of Interest

As shown in **Table 1**, significant correlations were found between Zhongyong thinking, cognitive reappraisal, positive effect, and resilience. After FDR adjustment, Zhongyong thinking were significantly and positively correlated with resilience ( $r = 0.49$ ,  $p < 0.01$ ,  $q$  of FDR  $< 0.05$ ), cognitive reappraisal ( $r = 0.46$ ,  $p < 0.01$ ,  $q$  of FDR  $< 0.05$ ), and positive effect ( $r = 0.28$ ,  $p < 0.01$ ,  $q$  of FDR  $< 0.05$ ). Cognitive reappraisal was positively related to positive effect ( $r = 0.38$ ,  $p < 0.01$ ,  $q$  of FDR  $< 0.05$ ) and resilience ( $r = 0.61$ ,  $p < 0.01$ ,  $q$  of FDR  $< 0.05$ ). Moreover, positive effect was positively correlated with resilience ( $r = 0.53$ ,  $p < 0.01$ ,  $q$  of FDR  $< 0.05$ ).

## The Chain Mediation Effects Analyses

There were three equations which were used to test the mediating role of the cognitive reappraisal and positive effect in the relationship between Zhongyong thinking and resilience. As shown in **Table 2** Zhongyong thinking had a directly and positively significant impact on the level of undergraduates' resilience ( $\beta = 0.16$ ,  $p < 0.001$ ) in equation 3, cognitive reappraisal ( $\beta = 0.23$ ,  $p < 0.001$ ) in equation 1, and positive effect ( $\beta = 0.07$ ,  $p < 0.001$ ) in equation 2. Furthermore, there was a significant direct prediction from cognitive reappraisal to positive effect ( $\beta = 0.33$ ,  $p < 0.001$ ) in equation 2. Finally, cognitive reappraisal ( $\beta = 0.55$ ,  $p < 0.001$ ) and positive effects ( $\beta = 0.47$ ,  $p < 0.001$ ) could predict the resilience positively and significantly in equation 3. Based on the theory of Rosnow and Rosenthal (1996), the results of Cohen's Standard,  $d$  and  $R^2$  in **Table 3** showed that equation 3 had a large effect.

**Table 3** and **Figure 1** show the results of the chain mediating effect of cognitive appraisal and positive effect. The total indirect effect was 0.19 and accounted for 54% of the total effect (0.35) and 120% of the direct effect (0.15) in the relationship between Zhongyong thinking and resilience. The indirect mediating effects of cognitive appraisal and positive effect on the relationship between Zhongyong thinking and resilience were significant and there were three different pathways contained in the total indirect effects. According to the indirect effects 1,2 and 3 in **Table 3**, we found that Zhongyong thinking influenced the resilience of Chinese undergraduates partly through the mediator of cognitive reappraisal, through the mediating function of positive effect and through the chain mediating role of both cognitive reappraisal and positive effect. Moreover, it was, respectively, accounted for 36%, 9%, and 9%

of total effect by indirect effects 1,2, and 3. The 95% CI did not include zero, confirming all significant indirect effects.

Furthermore, three equations testing and comparing the mediating effects of cognitive appraisal and positive effect in the relationship between Zhongyong thinking and resilience were used in this study. **Table 4** shows that Zhongyong thinking could directly and significantly positively predict resilience ( $\beta = 0.16$ ,  $p < 0.001$ ) of Chinese undergraduates in equation 3, cognitive appraisal ( $\beta = 0.22$ ,  $p < 0.001$ ) in equation 1, and positive effect ( $\beta = 0.14$ ,  $p < 0.001$ ) in equation 2. In addition, cognitive appraisal ( $\beta = 0.55$ ,  $p < 0.001$ ) and positive effect ( $\beta = 0.47$ ,  $p < 0.001$ ) had a significant and positive predictive power on resilience in equation 3. Based on the theory of Rosnow and Rosenthal (1996), the results of Cohen's standard,  $d$  and  $R$ , in **Table 3** showed that equation 3 had a large effect.

**Table 5** and **Figure 2** show the results of comparing the mediating effect of the cognitive reappraisal and positive effect in a parallel model. The indirect effect of cognitive appraisal was 0.06, accounting for 35% of the total effect (0.35) and 78% of the direct effect (0.16) in the association between Zhongyong thinking and resilience. The indirect effect of the positive effect was 0.13 and it accounted for 19% of the total effect (0.35) and 42% of the direct effect (0.16). The 95% CI did not include zero, confirming all significant indirect effects. Therefore, the indirect effect of positive effect (0.13) was stronger than that of cognitive reappraisal (0.06), which meant both cognitive reappraisal and positive effect were considered to be mediators of Zhongyong thinking in resilience, and the positive effect played a more important role than cognitive reappraisal.

## CONCLUSION

There were two purposes of the present study. Firstly, to investigate whether Zhongyong thinking was a significant predictor of resilience among Chinese undergraduates. Secondly, to explore the crucial role of cognitive reappraisal and the positive effect on the relationship between Zhongyong thinking and resilience in a sample of Chinese undergraduates. The results of multiple linear regressions in this study showed that Zhongyong thinking is positively related to resilience. Mediation analysis indicated that not only cognitive appraisal but also positive effect could partly mediate the relationship between Zhongyong thinking and resilience, but also there is a chain mediating effect of "Zhongyong thinking–cognitive appraisal–positive effect–resilience."

The preliminary evidence showed that Zhongyong thinking had a significant positive effect on resilience (as shown in **Table 1**), which was also approved in the mediation analysis in **Table 5**. This positive correlation between Zhongyong thinking and resilience consolidates the relationship between the two factors. Cheng (2009) reported that as individuals had a higher capacity for dialectical thinking, they tended to display more flexibility in coping with different stressful events. Research from a cross-cultural report has implied that the thinking style which was rooted in Chinese traditional culture may effect resilience capacity in the cultural context (Zheng et al., 2020).

Consistent with our expectations, the results showed that Zhongyong thinking influenced resilience *via* three pathways: cognitive reappraisal, positive effect, and the chain mediating effect of cognitive appraisal and positive effect, which benefits us to gain a deeper comprehension of the mechanism between Zhongyong thinking and resilience. First, the partial mediation role of cognitive reappraisal on the association between Zhongyong thinking and resilience is supported. The result of correlation analysis indicated that cognitive reappraisal had a significant, positive relationship with Zhongyong thinking and resilience. This result was consistent with previous studies that mentioned the thinking style, characterized as multi-thinking, holism, and harmoniousness, played an important role in influencing the usage of emotion regulation strategy (Yang and Li, 2014), the experience, and expression of emotion (Spencer-Rodgers, 2004). The prerequisite for mediation analysis related to the results of the correlation analysis was satisfied (Baron and Kenny, 1986). From the further investigation of the mediation role of cognitive appraisal on the relationship between Zhongyong thinking and resilience, the findings indicated that when students developed a high level of the culturally rooted Zhongyong thinking style, they were more likely to use the cognitive appraisal strategy which was positively associated with resilience. The possible reasons for it might be as follows: Zhongyong thinking not only emphasizes the interpersonal harmoniousness in daily life but also stresses the multithinking which is a tendency of considering various possibilities from multiple perspectives when making decisions or expressing opinions. This tendency may promote people to develop a cognition that is not stubborn or unmodifiable, and the cognition tendency is propitious to people using cognitive reappraisal strategy, which also needs changeable and not obstinate subjective appraisals to the emotionally concerning situation.

Our results not only supported the mediating role of cognition appraisal but also verified the mediating effect of positive effect underlying the Zhongyong thinking–resilience relationship. The complexity and contradiction of Chinese emotional experience influenced by Chinese culture and rooted in Chinese thinking style had been mentioned in many theoretical discussions (Goetz et al., 2008; Spencer-Rodgers et al., 2010), and there were a few statistical and experimental researches investigating the correlation between effect and Zhongyong thinking. Recently, a study focused on the emotional distress of Chinese college students provided that Zhongyong thinking correlated negatively with depression and anxiety (Hou et al., 2020), which partially showed the support for our finding. In addition, positive effect is a protector of resilience and mediates the relationship. Together, there was some evidence that positive effect can have a mediating role between Zhongyong thinking and resilience. These findings implied that Zhongyong thinking influenced resilience through 2 pathways: the effect of Zhongyong thinking on resilience mediated by cognition reappraisal and the effect of Zhongyong thinking on resilience mediated by positive effect.

Moreover, we also found another significant path of Zhongyong thinking→cognition reappraisal→positive effect→resilience. This mediation model illustrated that cognition reappraisal acted as a mediator between Zhongyong

thinking and positive effect, while positive effect mediated the link between cognition reappraisal and resilience. There were statistical and experimental studies, which confirmed the findings that individuals who developed high Zhongyong thinking were likely to use the cognitive reappraisal strategy more frequently (Guo and Zeng, 2012), in return, more usage of cognitive reappraisal were associated with a higher level of positive effect (Wante et al., 2017). In addition, that positive effect plays a mediation role in the relationship between cognition reappraisal and resilience also can be supported. Based on the emotion regulation theory of Gross and John (2003), individuals with more usages of cognition reappraisal tended to experience more positive effect. The studies also supported the positive correlation between cognition reappraisal and positive effect (Yang and Li, 2014; Oikawa et al., 2017), while positive effect is a protective factor that can promote individuals' resilience (Lord et al., 2015). Evidence of experiencing positive effect can mediate the relationship between adolescents' perceived parenting styles, and resilience can also partially verify our finding (Nikmanesh et al., 2020). That is to say, the chain mediation effect of cognitive appraisal and positive effect indicated that Chinese undergraduates with a higher level of Zhongyong thinking would report more usage of cognition reappraisal, which may result in a higher level of positive effect and ultimately lead to an increased possibility of resilience.

Above all, the present study not only found that Zhongyong thinking could account for resilience but also explored the underlying mechanisms between Zhongyong thinking and resilience among Chinese undergraduates. These findings indicated that Zhongyong thinking affected undergraduates' resilience partly through three different pathways: the mediator of cognitive reappraisal, the mediator of positive effect, and the chain mediating role of both cognitive reappraisal and positive effect. To our knowledge, this is the first time to investigate the mechanism in the relationship between Zhongyong thinking and resilience. Furthermore, the findings are useful for clinicians or psychotherapists working with Chinese undergraduates. Resilience is an important factor that promotes individuals' mental health, considering the culture-related Zhongyong thinking in the therapeutic settings is also valuable for these undergraduates' lack of resilience.

## Limitations and Future Direction

It is important to note the limitations of this study. First, the cross-sectional design was used in this study, so it may have an influence on revealing the casual associations among variables. In future studies, using a longitudinal design is helpful to supply a developmental perspective. The second limitation was that there may be other variables that acted as a mediator in the relationship between Zhongyong thinking and resilience. Even though there was a lack of research to imply that negative effect and suppression mediated the relationship, the fact that negative effect and suppression are related to resilience cannot be ignored. Factors that may function in the relationship should be further illustrated in future studies. Third, a cross-culture research is needed to investigate the relationship between Zhongyong thinking and resilience and mediating effects outside China

to deeply understand the relationship from different aspects. Furthermore, the data obtained by self-report measurements may lack objectivity due to self-report bias and social desirability. Based on Chinese culture, Zhongyong thinking is a complex and dynamic thinking process, and there are opinions that it are doubtful to measure Zhongyong thinking by self-report questionnaires. However, Wu and Lin (2005) insisted that Zhongyong thinking is a conscious thinking process in which individuals could consciously balance the external information and internal demands and integrate a cultural-based behavioral criterion, and it is practicable to introspect and report by individuals. Future researchers could measure these variables in behavioral experiments or event recording methods.

Despite these limitations, the present study makes contributions that should not be ignored. This study is the first to explore the association between Zhongyong thinking and resilience among Chinese students. Compared with the personal trait theory, which argued individuals were born with resilience and shaped by different personal traits, the results of the study highlight the consideration of environmental and cultural factors to influence the development of resilience for Chinese college students. It is also worth mentioning our efforts, including exploring the mediating mechanisms or processes underlying the relationship between Zhongyong thinking and resilience, testing the paths from Zhongyong thinking, cognition reappraisal, and positive effect to resilience.

## Implications

As the number of domestic and international conflicts increased and the risk of disease and disaster grew, the incidence of psychological problems is likely to continue to rise. There are more opportunities for therapists and mental health professionals from diverse countries to exchange effective resources and communicate with each other because of the mixing and gathering of cultures. It is noteworthy that the cultivating of therapists and mental health professionals need to be aware of the function of traditional cultural heritage and well adapted to home culture so that they can provide appropriate care.

## Note

With the development of Culture Psychology, results of studies have proved that human mind is not universal cross-culture and the differences existing between Westerners and Easterners have drawn lots of attention in the past decades. Holistic thinking and dialectical thinking, which I mentioned in front, were listed in these culture-related researches because Zhongyong thinking also originates from culture, and some researches have mixed these concepts up. Holistic thinking and dialectical thinking, to some extent, may relate with Zhongyong thinking, but the foundational theory and start pointing of the constructs were different. First of all, for measuring Holistic thinking, Choi et al. (2007) developed Analysis–Holism Scale to compare East Asians and Westerners in a theoretical model of analytic vs. holistic thinking, and in Analysis–Holism Scale Choi et al. (2007) created a task

such that one has to choose only one of the two alternative solutions to compare holistic and analytic thinking the two different thinking styles. But for Zhongyong thinking, a traditional Confucius interpersonal style with emphasis on interpersonal harmony and connect, the theoretical foundation of the scale benefits from Chinese traditional culture and philosophical thought without comparing different cultures, and in Zhongyong thinking Scale there are not alternative solutions in the items to compare different thinking styles, it only focuses on Zhongyong thinking itself. So these differences mean a lot to these concepts. Secondly, Spencer-Rodgers et al. (2010) call Easterners' dialecticism naive dialecticism, which represents three aspects of Easterners' minds. There are researchers using Dialectical Self Scale among Japanese to investigate culture differences (Zhang et al., 2015). As for Zhongyong Thinking Scale, it comes from Chinese traditional culture and there are no researches proved that it can be used in other countries for now. Thirdly, if Holistic thinking and dialectical thinking, to some extent, can express the thinking of East Asians, and China as a historical and cultural country in East Asia so that some characteristics of these concepts sounding like the same and some similarities existing in these concepts may be judged reasonable, differences of these concepts should not be ignored.

## DATA AVAILABILITY STATEMENT

The original contributions presented in this study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author/s.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by China West Normal University. All subjects gave written informed consent in accordance with the Declaration of Helsinki.

## AUTHOR CONTRIBUTIONS

SZ: acquisition of data, investigation, analysis and interpretation of data, drafting the manuscript, and software. XL: critical manuscript revision, development or design of methodology, and creation of models. Both authors contributed to the article and approved the submitted version.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2022.814039/full#supplementary-material>



## REFERENCES

- 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.
- Buchanan, A. (2014). Risk and protective factors in child development and the development of resilience. *Open J. Soc. Sci.* 02, 244–249. doi: 10.4236/jss.2014.24025
- Buzzanell, P. M. (2010). Resilience: talking, resisting, and imagining new normalcies into being. *J. Commun.* 60, 1–14. doi: 10.1111/j.1460-2466.2010.01469.x
- Cheng, C. (2009). Dialectical thinking and coping flexibility: a multi method approach. *J. Pers.* 77, 471–494. doi: 10.1111/j.1467-6494.2008.00555
- Chiu, C. (2000). Assessment of Zhong-yong(dialectic) thinking: preliminary findings from across-regional study. *Hong Kong J. Soc. Sci.* 18, 33–55.
- Choi, I., Koo, M., and Choi, J. A. (2007). Individual differences in analytic versus holistic thinking. *Pers. Soc. Psychol. Bull.* 33, 691–705. doi: 10.1177/0146167206298568
- Connor, K. M., and Davidson, J. R. (2003). Development of a new resilience scale: the Connor-Davidson Resilience Scale (CD-RISC). *Depress. Anxiety* 18, 76–82. doi: 10.1002/da.10113
- Cutuli, D. (2014). Cognitive reappraisal and expressive suppression strategies role in the emotion regulation: an overview on their modulatory effects and neural correlates. *Front. Syst. Neurosci.* 8:175. doi: 10.3389/fnsys.2014.00175
- Davidson, K. W., Elizabeth, M., and William, W. (2010). Don't worry, be happy: positive affect and reduced 10-year incident coronary heart disease: the canadian nova scotia health survey. *Eur. Heart J.* 31, 1065–1070. doi: 10.1093/eurheartj/ehp603
- Dewi, M., and Ruidahasi, T. (2020). "The role of self-efficacy, positive affect and social support on drug residents' resilience," in *Paper Presented at Proceedings of the 1st International Conference on Religion and Mental Health*, Vol. 9, (Ghent: EAI). 18–19. doi: 10.4108/EAI.18-9-2019.2293454
- Gao, Z. H., Yang, S. Q., Margraf, J., and Zhang, X. C. (2013). Chinese version of Wagnild-Young resilience (RS-11) used in China. *Chin. J. Health Psychol.* 09, 1324–1326. \*v.
- Goetz, J., Spencer-Rodgers, J., and Peng, K. (2008). "Dialectical emotions: how cultural epistemologies influence the experience and regulation of emotional complexity," in *Handbook of Motivation and Cognition Across Cultures*, eds R. Sorrentino and S. Yamguchi (Cambridge, MA: Academic press). 517–538.
- Gross, J. J. (2000). Emotion regulation: affective, cognitive, and social consequences. *Psychophysiology* 39, 281–291.
- Gross, J. J. (ed.) (2007). *Handbook of Emotion Regulation*. New York, NY: Guilford Press.
- Gross, J. J., and John, O. P. (2003). Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *J. Pers. Soc. Psychol.* 85, 348–362. doi: 10.1037/0022-3514.85.2.348
- Guo, K., and Zeng, W. (2012). Effect of Zhong Yong thinking style on the relationship between emotion regulations and emotion. *Chin. J. Health Psychol.* 20, 1101–1103.
- Holl, J., Pap, I., Südhof, J., Wolff, E., Staben, K., and Wolff, S. (2017). Trauma, resiliency and emotions regulation [Trauma, Resilience, and Emotion Regulation]. *Psychother. Psychosom. Med. Psychol.* 67, 83–90. doi: 10.1055/s-0042-120271
- Hooper, D., Coughlan, J., and Mullen, M. R. (2008). Structural equation modeling: guidelines for determining model fit. *Electron. J. Bus. Res. Methods* 6, 53–60.
- Hou, Y., Xiao, R., Yang, X., Chen, Y., and Zhang, X. (2020). Parenting style and emotional distress among Chinese college students: a potential mediating role of the Zhongyong thinking style. *Front. Psychol.* 11:1774. doi: 10.3389/fpsyg.2020.01774
- Hu, X., Liao, B., and Xu, J. (2012). Study of the relationships of employee Zhong yong thinking, organizational harmony and employee performance. *J. Southwest Univ.* 38, 166–176.
- Huang, L., and Yang, T. Z. (2003). Applicability of the positive and negative affect scale in Chinese [in Chinese]. *Chin. Ment. Health J.* 17, 54–56.
- Iimura, S. (2022). Sensory-processing sensitivity and COVID-19 stress in a young population: the mediating role of resilience. *Pers. Individ. Diff.* 184:111183. doi: 10.1016/j.paid.2021.111183
- Ip, I., Miller, A. L., Karasawa, M., Hirabayashi, H., Kazama, M., Wang, L., et al. (2021). Emotion expression and regulation in three cultures: Chinese, Japanese, and American preschoolers' reactions to disappointment. *J. Exp. Child Psychol.* 201:104972. doi: 10.1016/j.jecp.2020.104972
- Jiang, C. X., Li, Z. Z., Chen, P., and Chen, L. Z. (2015). Prevalence of depression among college-goers in mainland China. *Medicine* 94:e2071. doi: 10.1097/MD.0000000000002071
- Kirmayer, L. J., Dandeneau, S., Marshall, E., Phillips, M. K., and Williamson, K. J. (2011). Rethinking resilience from indigenous perspectives. *Can. J. Psychiatry* 56, 84–91. doi: 10.1177/070674371105600203
- Kline, R. B. (2005). *Principles and Practice of Structural Equation Modeling* 2nd Edn. New York, NY: The Guilford Press.
- Lau, W. (2022). The role of resilience in depression and anxiety symptoms: a three-wave cross-lagged study. *Stress Health*. doi: 10.1002/smi.3136 [Epub ahead of print].
- Leadbeater, B., Dodgen, D., and Solarz, A. (2005). "The resilience revolution: a paradigm shift for research and policy," in *Resilience in Children, Families, and Communities: Linking Context to Practice and Policy*, eds R. D. Peters, B. Leadbeater, and R. J. McMahon (New York, NY: Kluwer). 47–63. doi: 10.5694/mja2.51020
- Liao, J., Liu, L., Fu, X., Feng, Y., Liu, W., Yue, W., et al. (2021). The immediate and long-term impacts of the COVID-19 pandemic on patients with obsessive-compulsive disorder: a one-year follow-up study. *Psychiatry Res.* 306:114268. doi: 10.1016/j.psychres.2021.114268
- Lopez, S. J., Pedrotti, J. T., and Snyder, C. R. (2018). *Positive Psychology: The Scientific and Practical Explorations of Human Strengths*. Thousand Oaks, CA: Sage.
- Lord, J. H., Rumburg, T. M., and Jaser, S. S. (2015). Staying positive: positive affect as a predictor of resilience in adolescents with type 1 diabetes. *J. Pediatr. Psychol.* 40, 968–977. doi: 10.1093/jpepsy/jsv042
- Lucken, L. J., and Gress, J. L. (2010). "Early adversity and resilience in emerging adulthood," in *Handbook of Adult Resilience*, eds J. Reich, A. Zautra, and J. Hall (New York, NY: Guilford). 238–258.
- Mestre, J. M., Núñez-Lozano, J. M., Gómez-Molinero, R., Zayas, A., and Guil, R. (2017). Emotion regulation ability and resilience in a sample of adolescents from a Suburban Area. *Front. Psychol.* 8:1980. doi: 10.3389/fpsyg.2017.01980
- Miyamoto, Y., Ma, X., and Petermann, A. G. (2014). Cultural differences in hedonic emotion regulation after a negative event. *Emotion* 14, 804–815. doi: 10.1037/a0036257
- Nikmanesh, Z., Oshorak, N., and Molla, M. D. (2020). The Mediating role of positive and negative affect in the association of perceptions of parenting styles with resilience among adolescents with addicted parents. *Iran. J. Psychiatry* 15, 297–304. doi: 10.18502/ijps.v15i4.4295
- Nisbett, R. E., and Miyamoto, Y. (2005). The influence of culture: holistic versus analytic perception. *Trends Cogn. Sci.* 9, 467–473. doi: 10.1016/j.tics.2005.08.004
- Oikawa, M., Nakano, A., and Tabuchi, R. (2017). A comparison of the effects of different perspectives in terms of reappraisal sub types on affect: positive reappraisal and putting into perspective. *Psychology* 08, 2047–2057. doi: 10.4236/psych.2017.812131
- Osório, C., Probert, T., Jones, E., Young, A. H., and Robbins, I. (2016). Adapting to Stress: understanding the neurobiology of resilience. *Behav. Med.* 43, 307–322. doi: 10.1080/08964289.2016.1170661
- Pappaian, E., De Pisapia, N., Siugzdaite, R., Crescentini, C., Calcagni, A., Job, R., et al. (2020). Less is more: morphometric and psychological differences between low and high reappraisers. *Cogn. Affect. Behav. Neurosci.* 20, 128–140. doi: 10.3758/s13415-019-00757-5
- Peng, K., and Nisbett, R. E. (1999). Culture, dialectics, and reasoning about contradiction. *Am. Psychol.* 54, 741–754. doi: 10.1037/0003-066X.54.9.741
- 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.
- Rackoff, G. N., and Newman, M. G. (2020). Reduced positive affect on days with stress exposure predicts depression, anxiety disorders, and low trait positive affect 7 years later. *J. Abnorm. Psychol.* 129, 799–809. doi: 10.1037/abn0000639

- Ramirez-Ruiz, B., Quinn, K., and Ferreira, N. (2020). Emotion-regulation strategies in older people: a systematic review. *Work. Older People* 24, 1–18. doi: 10.1108/wwop-09-2019-0026
- Rosnow, R., and Rosenthal, R. (1996). Statistical procedures and the justification of knowledge in psychological science. *Am. Psychol.* 44, 1276–1284.
- Schanowitz, J. Y., and Nicassio, P. M. (2006). Predictors of positive psychosocial functioning of older adults in residential care facilities. *J. Behav. Med.* 29, 191–201. doi: 10.1007/s10865-005-9034-3
- Smith, B. W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., and Bernard, J. (2008). The brief resilience scale: assessing the ability to bounce back. *Int. J. Behav. Med.* 15, 194–200. doi: 10.1080/10705500802222972
- Spencer-Rodgers, J. (2004). Dialectical self-esteem and east-west differences in psychological well-being. *Pers. Soc. Psychol. Bull.* 30, 1416–1432. doi: 10.1177/0146167204264243
- Spencer-Rodgers, J., Williams, M. J., and Peng, K. (2010). Cultural differences in expectations of change and tolerance for contradiction: a decade of empirical research. *Pers. Soc. Psychol. Rev.* 14, 296–312. doi: 10.1177/1088868310362982
- Sun, X., Yan, M., and Chu, X. (2014). Passive mood and work behavior: the cross-level mediating effect of Zhong-Yong. *Acta Psychol. Sin.* 46, 1704–1718.
- Teixeira, R. J., Brandão, T., and Dore, A. R. (2021). Academic stress, coping, emotion regulation, affect and psychosomatic symptoms in higher education. *Curr. Psychol.* 01, 1–10. doi: 10.1007/s12144-020-01304-z
- Thomas, D., Mitchell, T., and Arseneau, C. (2015). Re-evaluating resilience: from individual vulnerabilities to the strength of cultures and collectivities among indigenous communities. *Resilience* 4, 116–129. doi: 10.1080/21693293.2015.1094174
- Ungar, M. (2013). Resilience, trauma, context, and culture. *Trauma Violence Abuse* 14, 255–266. doi: 10.1177/1524838013487805
- Vaughan, E., Koczwara, B., Kemp, E., Freytag, C., Tan, W., and Beatty, L. (2019). Exploring emotion regulation as a mediator of the relationship between resilience and distress in cancer. *Psycho Oncol.* 28, 1506–1512. doi: 10.1002/pon.5107
- Wagnild, G. M., and Young, H. M. (1993). Development and psychometric evaluation of the resilience scale. *J. Nurs. Meas.* 1, 165–178.
- Wang, L., Liu, H., and Li, Z. (2007). Reliability and validity of emotion regulation questionnaire Chinese revised version. *China J. Health Psychol.* 15, 503–505. doi: 10.11817/j.issn.1672-7347.2022.210549
- Wante, L., Beveren, M. V., Theuwis, L., and Braet, C. (2017). The effects of emotion regulation strategies on positive and negative affect in early adolescents. *Cogn. Emot.* 32, 988–1002. doi: 10.1080/02699931.2017.1374242
- Westerhof-Evers, H. J., Visser-Keizer, A. C., Fasotti, L., and Spikman, J. M. (2019). Social cognition and emotion regulation: a multifaceted treatment (t-scemo) for patients with traumatic brain injury. *Clin. Rehabil.* 33, 820–833. doi: 10.1177/0269215519829803
- Wu, C., and Lin, Y. C. (2005). Development of a Zhong-Yong thinking style scale. *Indig. Psychol. Res. Chin. Soc.* 24, 247–300.
- Yang, L., and Li, M. T. (2014). The Review of acceptance, cognitive reappraisal, expression suppression in emotion regulation strategies. *Adv. Psychol.* 4, 80–88. doi: 10.12677/AP.2014.41015
- Yang, X., Zhang, P., Zhao, J., Zhao, J., Wang, J., Chen, Y., et al. (2016). Confucian culture still matters: the benefits of Zhongyong thinking (doctrine of the mean) for mental health. *J. Cross. Cult. Psychol.* 47, 1097–1113.
- Zhan, G., Hualing, C., and Ganqi, T. (2013). The relationship between Zhong-Yong thinking and depression symptoms. *Chin. J. Health Psychol.* 21, 1298–1300. doi: 10.13342/j.cnki.cjhp.2013.09.001
- Zhang, B., Galbraith, N., Yama, H., Wang, L., and Manktelow, K. I. (2015). Dialectical thinking: a cross-cultural study of Japanese, Chinese, and British students. *J. Cogn. Psychol.* 27, 771–779. doi: 10.1080/20445911.2015.1025792
- Zhang, J., Tang, D., Wang, D., Peng, H., and Hua, M. (2004). Positive affection and negative affection of the elderly and their related factors [in Chinese]. *Chin. J. Clin. Psychol.* 14, 194–196.
- Zhang, J., Wu, Y., Qu, G., Wang, L., Wu, W., Tang, X., et al. (2020). The relationship between psychological resilience and emotion regulation among preschool left behind children in rural China. *Psychol. Health Med.* 26, 595–606. doi: 10.1080/13548506.2020.1849748
- Zheng, P., Gray, M. J., Duan, W. J., Ho, S., and Clapp, J. D. (2020). An exploration of the relationship between culture and resilience capacity in trauma survivors. *J. Cross Cult. Psychol.* 51:002202212092590. doi: 10.1177/0022022120925907

**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.

Copyright © 2022 Zhou and Li. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.



## OPEN ACCESS

## EDITED BY

Kosuke Takemura,  
Shiga University, Japan

## REVIEWED BY

Robert Stüber,  
New York University Abu Dhabi,  
United Arab Emirates  
Hiroki Ozono,  
Kagoshima University, Japan

## \*CORRESPONDENCE

Hirofumi Hashimoto  
hirofumihashimoto@outlook.com

## SPECIALTY SECTION

This article was submitted to  
Cultural Psychology,  
a section of the journal  
Frontiers in Psychology

RECEIVED 14 October 2021

ACCEPTED 11 July 2022

PUBLISHED 22 August 2022

## CITATION

Maeda K, Kumai Y and Hashimoto H  
(2022) Potential influence of decision  
time on punishment behavior and its  
evaluation.  
*Front. Psychol.* 13:794953.  
doi: 10.3389/fpsyg.2022.794953

## COPYRIGHT

© 2022 Maeda, Kumai and Hashimoto.  
This is an open-access article  
distributed under the terms of the  
[Creative Commons Attribution License](#)  
(CC BY). The use, distribution or  
reproduction in other forums is  
permitted, provided the original  
author(s) and the copyright owner(s)  
are credited and that the original  
publication in this journal is cited, in  
accordance with accepted academic  
practice. No use, distribution or  
reproduction is permitted which does  
not comply with these terms.

# Potential influence of decision time on punishment behavior and its evaluation

Kaede Maeda<sup>1</sup>, Yuka Kumai<sup>2</sup> and Hirofumi Hashimoto<sup>3\*</sup>

<sup>1</sup>Department of Psychology, College of Contemporary Psychology, Rikkyo University, Niiza, Japan,

<sup>2</sup>Graduate School of Letters, Yasuda Women's University, Hiroshima, Japan, <sup>3</sup>Graduate School of Literature and Human Sciences, Osaka Metropolitan University, Osaka, Japan

Previous studies on whether punishers are rewarded by reputational gains have yielded conflicting results. Some studies have argued that punitive behaviors potentially result in a positive evaluation, while others have found the opposite. This study aims to clarify the conditions that lead to the positive evaluation of costly punishment. Study 1 utilized one-round and repeated public goods game (PGG) situations and manipulated decision time for participants' punitive behavior toward the non-cooperative person in the situation. We also asked participants to report their impression evaluations of punitive behavior toward non-cooperative people. Moreover, utilizing the second- and third-party punishment games, Study 2 manipulated the decision time of participants' punitive behavior toward the self-interested person and asked them to evaluate the punitive behavior. The results showed that those who punished intuitively were not likely to be evaluated positively. However, punishers were rewarded when the decision to punish was made after deliberation or made by those who were not direct victims. These findings extend previous research on the evaluation of punitive behavior and reveal that deliberative punishment is evaluated positively occasionally.

## KEYWORDS

**punishment, time pressure, evaluation, social dilemma, second-party punishment, third-party punishment**

## Introduction

Punishing free riders in a social dilemma has been considered the key to understanding large-scale human cooperation (Yamagishi, 1986, 1988; Fehr and Gächter, 2000). However, it is still unclear whether evaluations of punishers benefit their reputation. A possible reason as to why researchers are particularly intrigued by the evaluations that punishment behavior induces is to analyze whether costly punishment leads to reputational gains and the adaptiveness of the punishment (Barclay, 2006;

Abbreviations: PGG, public goods game; SPPG, second-party punishment game; TPPG, third-party punishment game.

Kurzban et al., 2007). Although theoretical models assume that reputational gains allow punishment to evolve (Panchanathan and Boyd, 2004), experimental studies present conflicting evidence. Punishers are more likely to be seen as trustworthy by others and be chosen as partners to play future games (Barclay, 2006; Nelissen, 2008). Horita (2010) also showed that punishers were trusted more than non-punishers, although they were chosen less frequently than non-punishers to receive rewards. In contrast, Kiyonari and Barclay (2008) demonstrated that evaluations of punishers were not improved in a public goods game (PGG). To systematically discuss these seemingly conflicting results regarding the evaluation of punishers, more empirical studies are needed to clarify the conditions under which punishers are evaluated positively (or negatively). In this paper, through two studies, we aim to clarify the conditions that lead to positive evaluation of costly punishment by distinguishing whether such punishment behaviors are based on intuition or deliberation.

Specifically, we focused on the following aspects. First, we examined the differences between intuitive and deliberative decision-making. Recent theoretical and empirical studies based on the dual-process theory (Evans, 2008; Kahneman, 2011; Evans and Stanovich, 2013) have pointed to the possibility that decisions may differ depending on whether they are based on intuition or deliberation (see Hallsson et al., 2018; Capraro, 2019; for a review). For example, Rand and Nowak (2013) have suggested that intuitive decision-making may promote reciprocal cooperative behavior. As cooperative behavior is potentially based on an intuitive response, punitive behavior against unfairness may also be based on intuition. There is some empirical evidence that the punitive behavior against unfairness exhibited in ultimatum games is based on intuitive judgments (e.g., Cappelletti et al., 2008; Wang et al., 2011). Even in situations such as PGGs, an experiment by Mischkowski et al. (2018) showed decreased punishment behavior over time. These results are in accordance with the dual-process theory in that punishment behavior is driven by an intuitive or emotional (e.g., anger or anger-related negative emotion) response to unfairness, which is then suppressed by deliberation. Given these findings and the dual-process model, we assume that the length of time allowed for participants' decision-making affects their punitive behaviors and potentially impacts the impression evaluation of punishers. Second, Barclay (2006) states that the evaluation of punishers in an economic game depends on either repeated interactions or only one-round of interaction. According to this argument, we assume that the game type (one-round or repeated PGG situation) affects the evaluation of punitive behavior because reputation is inconsequential in a one-round game. Third, we also focused on whether or not the punishers are the direct victims in the situation; this study uses the term "party-ness" to describe that the punisher is a direct victim. Raihani and Bshary (2015) concluded that punishment by direct victims tends to be perceived as an act of

retaliation and, therefore, may be feared by others (see also, Kriss et al., 2016; Stüber, 2020). In contrast, third-party punishment enforcers may be considered socially desirable individuals who aim for group-beneficial norm compliance and cooperation. Thus, the context of the punisher's party-ness may influence punitive behavior and its evaluation.

The present study is divided into two parts. Study 1 incorporates the potential effect of game type (one-round or repeated PGG situation) and decision time (intuition vs. deliberation) as an independent variable and examines its effects on punishment behavior and its evaluation. Specifically, we utilize one-round and repeated PGG situations and assess the potential influence of decision time on punishment behavior and its evaluation. Study 2 utilizes the second-party punishment game (SPPG)<sup>1</sup> and third-party punishment game (TPPG; Fehr and Gächter, 2002; Fehr and Fischbacher, 2004) to manipulate whether or not the punishers are the direct victims and examine the potential influence of decision time and party-ness (SPPG vs. TPPG) on punishment behavior and its evaluation. These two studies consider seemingly identical punishment behavior by dividing it into intuition- and deliberation-based punishment and argue the adaptive value of punishment behavior by analyzing the impression evaluation of these two types, thereby extending existing research on the potential reputational gains of punitive behavior. To the best of our knowledge, there are no studies that analyze the impression evaluation of these two types of punishment. We believe that our study can help clarify previously inconsistent evaluations of punishment behavior, depending on whether punishment is based on intuitive or deliberative decision-making.

## Materials and methods

### Study 1: Potential effect of time pressure on the evaluation of punishers in public goods game

#### Participants

Ninety-one Japanese female undergraduates (mean age = 18.85 years,  $SD = 0.73$ ) participated in this study. The participants were recruited from the attendees of a lecture on the introduction to social research. Forty-four participants were randomly assigned to the one-round PGG condition and 47 to the repeated PGG condition. After the lecture, participants were informed that their decision to participate was voluntary, and they were free to withdraw their consent at any point in

<sup>1</sup> To compare the conditions of whether the punishers are the direct victims in the games or not, we utilized a slightly modified dictator game with the punishment option (i.e., SPPG). The primary difference between the SPPG and TPPG lies in the party-ness; that is, whether participants were direct victims or not (third-parties).



this study. All the students who attended the lecture agreed to participate. In order to create a reasonable distance between individual participants and to guarantee the anonymity of their decision-making, the participants were moved to a larger classroom for each condition, after which the experiment was started. In this study, we used monetary rewards to incentivize participants; the instructions emphasized that 15% of the participants would be given the amount determined by their actual decision-making in the one-round or repeated PGG experiment through a prepaid card, called “QUO card,” which can be used for payment at affiliated stores.

## Procedure

Study 1 was conducted in a classroom setting. First, the experimenter distributed the instruction sheet to the participants. The general rules of PGG were explained in detail on the screen and instruction sheet. Participants were divided into groups of four comprising students who did not know each other. They were all given JPY 800 and asked how much they wanted to contribute to their group. Participants were told that the total amount of money contributed to the group would be doubled by an experimenter and divided equally among group members. After the experimenter confirmed that all participants understood these rules, each participant was given a decision sheet in an envelope and asked to decide the contribution amount. Subsequently, participants assigned to the one-round PGG condition were informed: “this experiment is a one-time event.” Participants assigned to the repeated PGG condition were informed: “this experiment will be repeated several times in the future with the same group.”<sup>2</sup>

One week later, the same participants gathered in each classroom. The experimenter explained that the PGG experiment with the punishment stage was a continuation of the previous week’s experiment and let the participants know the results of their group members’ decision-making. Regardless of the contribution, each participant was provided the same information through the feedback sheet. The information, handwritten on this feedback sheet, was fake and implied that there were selfish participants in their group. The stated result was that (a) the total amount contributed by the four participants to the group was JPY 1,200; (b) the doubled amount, JPY 2,400, would be divided equally (each participant would receive JPY 600); and (c) one group member did not contribute to the group and kept the entire JPY 800, and therefore, this person would receive JPY 1,400.<sup>3</sup>

2 Participants in the repeated PGG condition were informed that the second period of the PGG would be conducted 1 week later to intimate that the game would be repeated. However, they did not actually repeat the game.

3 Since each participant’s contribution to the PGG was not the same, even if the same information was provided, strict control of the experiment was difficult. It is undeniable that participants’ cooperative tendencies may have influenced punishment behavior and the evaluation

The procedure for the subsequent experiments is as follows: (1) punishment decision-making task within 5 s (intuition condition); (2) evaluation task of intuitive and deliberative (non-) punishers, respectively; and (3) punishment decision-making task without a time limit (deliberation condition). This order of events was determined with the intention of shortening the overall time of the experiment; the manipulation of decision-making time (i.e., intuition and deliberation conditions) was a within-subjects design. After reading the feedback sheet, participants were asked to decide and note down how much money they would use as punishment against the selfish person within 5 s (i.e., the intuition condition).<sup>4</sup> The efficiency of the punishment was three times the amount the participant paid for the punishment. The participants made their decisions by ticking one of the five possible options: “Pay JPY 0 and deduct JPY 0 from the person,” “Pay JPY 100 and deduct JPY 300 from the person,” “Pay JPY 200 and deduct JPY 600 from the person,” “Pay JPY 300 and deduct JPY 900 from the person,” and “Pay JPY 400 and deduct JPY 1,200 from the person.” Thereafter, in this situation, we asked the participants to evaluate the punishers (i.e., those who paid JPY 400 so that the selfish person would lose JPY 1,200) and the non-punishers (i.e., those who paid JPY 0 so that the selfish person would lose JPY 0) by choosing from nine options, ranging from −4 (a very bad impression) to 4 (a very good impression). Here, we distinguished between those who punished intuitively and those who did so deliberately. More specifically, we presented the person “who decided to deduct immediately” and the person “who decided to deduct after careful consideration.” When the participants had completed their evaluation, they were asked again, without a time limit, to make their decisions about punishment after careful deliberation (i.e., the deliberation condition). After the experiment and data collection was completed, participants received a debriefing; here, we informed the participants that regardless of their actual decision-making in the PGG, we gave false feedback to create a situation where each participant was informed that there was only one selfish person (the person to be punished) in their group.

## Results and discussion of study 1

To examine whether the mean contribution amount differed between the conditions, we conducted a *t*-test. We found no difference between the one-round and repeated PGG conditions

of punishment. However, this is unlikely to be a major issue because this potential problem did not occur in Study 2 which utilized a one-time game and still found similar tendencies.

4 Following Maeda and Hashimoto (2020)’s experimental procedure, we limited decision-making in the intuition condition to 5 s. By giving detailed instructions on when to turn the questionnaire over and close it, the experimenter controlled the decision-making time (5 s) for participants to answer to the decision-making sheet. It should be noted here that the classroom setting could not be strictly limited to a 5-s period. However, there is no doubt that the participants in this intuition condition were made sensitive to the time pressure.

[ $t(88) = 1.55, p = 0.12, d = 0.32$ ]. The mean amount deducted from the selfish person's payoff by participants in the one-round PGG condition was JPY 518.18 in the intuition condition and JPY 368.18 in the deliberation condition. In the repeated PGG condition, the mean amount was JPY 504.26 in the intuition condition and JPY 440.43 in the deliberation condition. We conducted a  $2$  (game type: one-round and repeated)  $\times 2$  (decision time: intuition and deliberation) mixed-factor ANOVA for the mean amount deducted from the selfish person's payoff. The results were statistically significant for the main effect of decision time [ $F(1,89) = 6.63, p = 0.01, \eta_p^2 = 0.07$ ], although the main effect of game type [ $F(1,89) = 0.20, p = 0.66, \eta_p^2 = 0.002$ ] and the interaction effect of game type and decision time [ $F(1,89) = 1.08, p = 0.30, \eta_p^2 = 0.01$ ] were not significant (Figure 1). We performed an additional multiple comparison analysis to clarify the main effect of decision time, and found a significant difference in the mean amount deducted by the participants in the one-round PGG [ $t(89) = 2.51, p = 0.01, d = 0.54$ ]. These results suggest that time pressure significantly increased the amount spent on punishment only in the one-round PGG.

The results of impression evaluation of (non-) punishers also had interesting implications (Figure 2). We conducted a  $2$  (game type: one-round and repeated)  $\times 2$  (decision time: intuition and deliberation)  $\times 2$  (punisher: punisher or non-punisher) ANOVA for evaluation scores. The results revealed a main effect of decision time [ $F(1,89) = 43.55, p < 0.001, \eta_p^2 = 0.33$ ] and punisher [ $F(1,89) = 17.95, p < 0.001, \eta_p^2 = 0.17$ ], and an interaction effect of decision time  $\times$  punisher [ $F(1,89) = 19.09, p < 0.001, \eta_p^2 = 0.18$ ]. As shown in Figure 2, punishment based on deliberate decision-making was more likely to be evaluated positively than that based on intuitive decision-making. There was no significant effect of game type [ $F(1,89) = 0.07, p = 0.79, \eta_p^2 = 0.001$ ] or related interaction effects of game type.<sup>5</sup>

## Study 2: Potential effect of time pressure on the evaluation of punishers in second-party punishment game and third-party punishment game

### Participants

In Study 2, 46 Japanese female undergraduates (mean age = 19.83 years,  $SD = 0.71$ ) participated. Participants were recruited from a lecture on cultural psychology. Twenty-three participants were randomly assigned to the SPPG condition and 23 to the TPPG condition. The experiment was conducted

in a classroom setting and offered monetary rewards to incentivize participants; 15% of the participants would be given the money based on their actual decision-making through a prepaid (QUO) card.

### Procedure

#### Instructions for the second-party punishment game condition

Using the first instruction sheet, the experimenter explained the general rules of the dictator game: (1) participants were randomly paired to play the game and assigned as either the proposer or the recipient; (2) the proposer, given JPY 1,200 by the experimenter, freely decided on a share between JPY 0 and JPY 1,200 for the recipient. After the explanation of the general rules in the first instruction sheet, the participants were informed that they had been assigned the role of recipient and given the second instruction sheet, which was distributed individually in envelopes; (3) in this instruction sheet, participants were informed that the recipients would be given JPY 400 by the experimenter; (4) the recipient could deduct an amount from the proposer's payoff by paying any amount above JPY 400; and (5) the amount to be deducted would be three times the amount paid by the recipient. After confirming that the participants understood the rules of this game, they were given a feedback sheet (which was, like Study 1, fake) and were informed that the proposer decided to keep the JPY 1,200 for themselves.

#### Instructions for the third-party punishment game condition

As with the SPPG condition, during the first set of instructions, the general rules of the experiment were explained: (1) participants were randomly divided into groups of three and assigned as proposer, recipient, and third-party; (2) the proposer, given JPY 1,200 by the experimenter, freely decided on a share between JPY 0 and JPY 1,200 for the recipient. After the explanation of the general rules in the first instruction sheet, the participants were informed that they were assigned the role of the third-party and given the second instruction sheet, which was distributed individually in envelopes; (3) this instruction sheet informed the participants that the third-parties would be given JPY 400 by the experimenter; (4) the third-party could deduct an amount from the proposer's payoff by paying any amount from JPY 400; and (5) the amount to be deducted was three times the amount paid by the third party. After confirming that the participants understood the rules of this game, they were given a (fake) feedback sheet and informed that the proposer had decided to keep the JPY 1,200 for themselves.

### Intuitive and deliberative punishment

After being informed of the proposer's decision, the recipients in the SPPG condition and third-parties in the TPPG condition were asked to note down their decision on how much money they would use to punish the selfish proposer within

<sup>5</sup> There were no significant interaction effects of game type  $\times$  decision time [ $F(1,89) = 0.97, p = 0.33, \eta_p^2 = 0.011$ ], game type  $\times$  punisher [ $F(1,89) = 0.06, p = 0.81, \eta_p^2 = 0.001$ ], and game type  $\times$  decision time  $\times$  punisher [ $F(1,89) = 0.44, p = 0.51, \eta_p^2 = 0.005$ ].

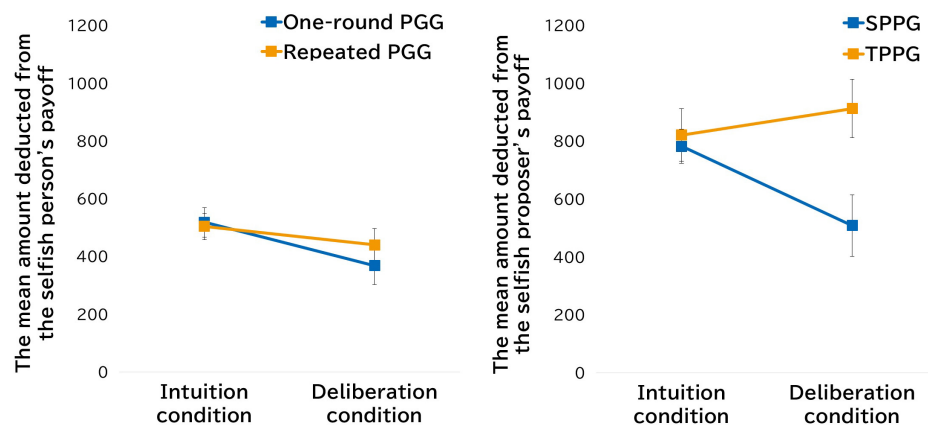


FIGURE 1

Conditional differences in mean amount spent for punishment in Study 1 and Study 2.

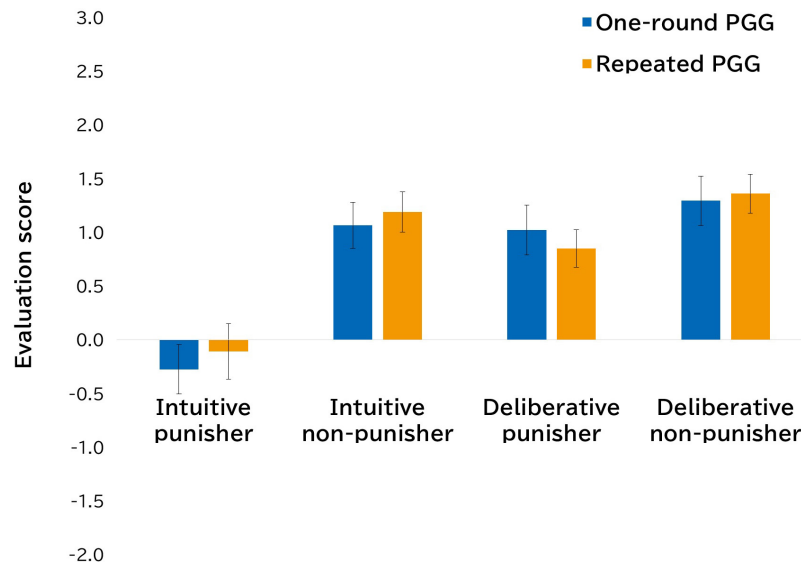


FIGURE 2

Conditional differences in mean evaluation scores of intuitive (non-) punisher and deliberative (non-) punisher (Study 1).

5 s (intuition condition); participants made their decisions by ticking one of five possible options: “Pay JPY 0 and deduct JPY 0 from the person,” “Pay JPY 100 and deduct JPY 300 from the person,” “Pay JPY 200 and deduct JPY 600 from the person,” “Pay JPY 300 and deduct JPY 900 from the person,” and “Pay JPY 400 and deduct JPY 1,200 from the person.” Furthermore, like in Study 1, we asked the participants to report their evaluations of those who punished (i.e., those who paid JPY 400 so that the selfish proposer would lose JPY 1,200) and those who did not punish (i.e., those who paid JPY 0 so that the selfish proposer would lose JPY 0) in this situation. Study 2 also distinguished between intuitive and deliberate punishment, asking the participants to rate each type by choosing from nine options from -4 (a very bad impression) to 4 (a very good

impression). In addition, like Study 1, the participants were asked again, without a time limit, to make their decisions about punishment after careful deliberation (i.e., the deliberation condition); manipulation of the decision-making time was a within-participant design. As Study 1, participants received a debriefing after the experiment and data collection was finished.

## Results and discussion of study 2

The mean amount deducted from the proposer's payoff for participants playing the SPPG was JPY 782.61 in the intuition condition and JPY 508.70 in the deliberation condition. In the TPPG, the mean amount deducted was JPY 821.74 in the intuition condition and JPY 913.04 in the deliberation condition (Figure 1). We conducted a 2 (game type: SPPG

and TPPG)  $\times$  2 (decision time: intuition and deliberation) mixed-factor ANOVA for the mean amount deducted from the proposer's payoff. The results showed a main effect of game type [ $F(1,44) = 4.96, p = 0.03, \eta_p^2 = 0.10$ ] and an interaction effect of game type  $\times$  decision time [ $F(1,44) = 5.04, p = 0.03, \eta_p^2 = 0.10$ ], although the main effect of game type [ $F(1,44) = 1.26, p = 0.27, \eta_p^2 = 0.03$ ] was not significant. We performed an additional multiple comparison analysis and found significant differences in the mean amount for participants playing the SPPG [ $t(44) = 2.38, p = 0.02, d = 0.84$ ], suggesting that the amount deducted from the proposer's payoff in the SPPG decreases when deliberation is employed, compared with when intuitive judgment is employed. Furthermore, like Study 1, we conducted a 2 (game type: SPPG and TPPG)  $\times$  2 (decision time: intuition and deliberation)  $\times$  2 (punisher: punisher or non-punisher) ANOVA for the evaluation scores. The results revealed a main effect of decision time [ $F(1,44) = 9.31, p < 0.01, \eta_p^2 = 0.17$ ], an interaction effect of game type  $\times$  punisher [ $F(1,44) = 17.43, p < 0.01, \eta_p^2 = 0.28$ ], and an interaction effect of decision time  $\times$  punisher [ $F(1,44) = 7.48, p < 0.01, \eta_p^2 = 0.15$ ].<sup>6</sup> The interaction of decision time  $\times$  punisher replicated the findings of Study 1, which demonstrated generally positive evaluations of punishment based on deliberation (Figure 3). In addition, the game type  $\times$  punisher interaction effect suggested that the punisher in the TPPG is evaluated more positively, which

indicates that punishers may be rewarded when the decision to punish is made by those who are not direct victims (i.e., TPPG).

## Discussion

Punishing those who violate group-beneficial norms plays an essential role in promoting human cooperation (Fehr and Gächter, 2002). However, it is currently ambiguous whether engaging in the costly punishment can lead to a favorable evaluation. In this study, we assumed that it is important to clarify that punishment behaviors that appear the same on the surface can be evaluated differently depending on whether they are based on intuition or deliberation. Thus, we focused on the potential influence of decision time in the evaluation of punishers in economic games and examined the role of decision time in punishment behavior and its evaluation. Our results demonstrated that (1) intuitive punishers were not likely to be positively evaluated; (2) punishers may be rewarded only when the decision to punish was made after careful deliberation or when the decision was made by those who were not the direct victims (i.e., TPPG). Therefore, based on these results, one possible reason why punishment is evaluated positively (or negatively) involves whether the evaluator perceives the costly punisher to be deliberate (or intuitive). Such an evaluation-axis may well sort out the inconsistencies in the evaluation of punishers in previous studies. However, our results suggesting that the punisher can expect to obtain a good reputation after the deliberation need careful interpretation. If this is the case, then deliberation should promote punishment behavior. However, our results did not consistently demonstrate that deliberation

<sup>6</sup> There were no significant main effects of game type [ $F(1,44) = 0.04, p = 0.85, \eta_p^2 = 0.001$ ] and punisher [ $F(1,44) = 3.56, p = 0.07, \eta_p^2 = 0.075$ ]. There were also no significant interaction effects for game type  $\times$  decision time [ $F(1,44) = 1.41, p = 0.24, \eta_p^2 = 0.031$ ] and game type  $\times$  decision time  $\times$  punisher [ $F(1,44) = 0.41, p = 0.53, \eta_p^2 = 0.009$ ].

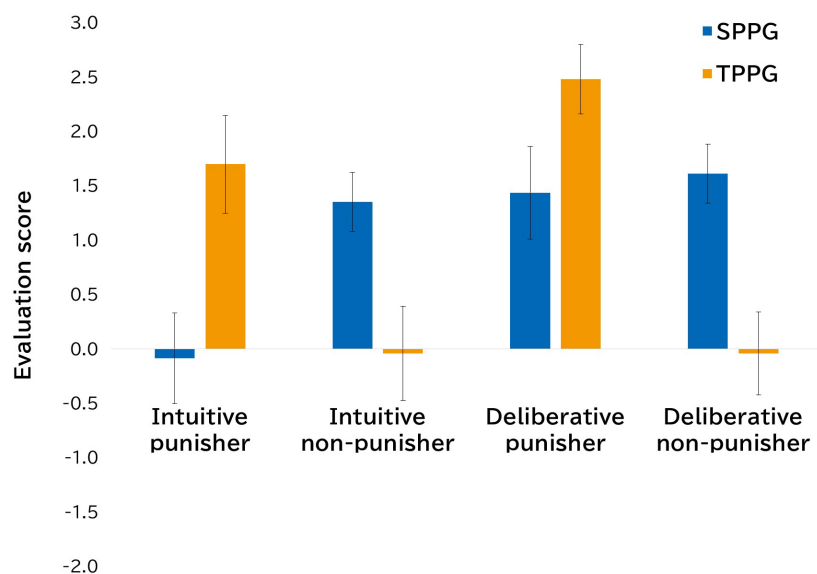


FIGURE 3

Conditional differences in mean evaluation scores of intuitive (non-) punisher and deliberative (non-) punisher (Study 2).



promotes punishment behavior; in fact, we observed the opposite tendencies. One possible reason for this is that participants who made deliberation-based decision may have punished less because they believed that a punisher would be more likely to be perceived by others as intuitive (in fact, punishers tend to decide intuitively; Cappelletti et al., 2008; Wang et al., 2011; Mischkowski et al., 2018), and therefore, it was better not to punish non-cooperators to avoid a bad reputation. Needless to say, we cannot strongly argue that this interpretation is correct; further study is needed. Furthermore, although their applicability needs to be thoroughly examined in the future, these findings contribute to research on the evaluation of punishment by distinguishing whether such punishment behaviors are based on intuition or deliberation.

The findings of this study are consistent with Raihani and Bshary (2015). In their framework, the punishment signal can be either cooperative or competitive. Whether the signal is interpreted as cooperative or competitive depends on the observer's estimates of the punisher's motivation, and the punisher's reputation is determined by the estimation of their motivation. Furthermore, observers might fear competitive punishers; therefore, they are not evaluated favorably. In contrast, cooperative punishers are regarded more favorably and receive a positive evaluation; they are more likely to be chosen as partners (Mifune et al., 2020; Tateishi et al., 2021). It should be also noted that, in the present study, neither the punishers nor non-punishers received negative evaluations in Study 1 and 2,<sup>7</sup> especially when such punishment was the result of the punishers' deliberation. However, in the case of spontaneous punishment based on intuition, evaluations depend on whether punitive behavior is regarded as competitive or cooperative. Although the reasons why deliberative punishment is more likely to receive favorable evaluations need to be examined in more detail, these results are of interest and have the potential to reformulate Raihani and Bshary's framework in the light of the dual-process theory.

Several issues remain to be addressed. First, while we conducted studies focusing only on whether punishment is given or not, prior research (e.g., FeldmanHall et al., 2014) suggests that people prefer compensation (e.g., compensating the victim for bad things to his or her benefit) to punishment (e.g., subtracting from the benefits of the person who did the bad thing). Furthermore, although the current study focused only on the effects of decision time, other studies (e.g., Gordon and Lea, 2016) regarding evaluations of (non-) punishers indicate that people with a high status may receive positive evaluations when they punish. As for punishment efficiency, a previous study (Nelissen, 2008) reported that the greater the cost of punishment, the more positive the evaluation. It is necessary

to consider the possibility that punishment efficiency affects punitive behavior and its evaluation. It is noteworthy that our participants were asked to make a judgment about punishment behavior under time pressure (intuition condition) and then make the same judgment again with no time limit (deliberation condition). This procedure has much in common with the "two-response paradigm" that has been developed to distinguish and compare intuitive and deliberative judgments (e.g., Thompson et al., 2011; Bago and De Neys, 2019; Hashimoto et al., 2022). Although the findings are interesting, there is a potential limitation in that the deliberation condition always follows the intuitive one. If we assume that participants' understanding is deepened through repeated decision-making, then the later deliberation condition may lead to more "rational" decision-making, regardless of time pressure. It should also be noted that the present study asked participants to evaluate the punishers prior to the deliberation condition. Therefore, future studies are needed to determine whether these results can be replicated using a between-participant design or counterbalancing the conditions. Another limitation is that this study utilized the Likert scale to evaluate impressions of punishers. Future studies need to conduct more precise impression evaluation measurements, such as using specific adjectives (trustworthy, etc.) in addition to reporting only good or bad impressions, or whether to choose a person as a partner in an experimental game under conditions of monetary reward incentives. Additionally, it should be noted that we used deception in our experiment. It is undeniable that this manipulation may have influenced the participants' evaluations, and therefore, future studies without deception are necessary. Finally, it is also potentially problematic that the generalizability of our results is limited to young Japanese female students. Prior research demonstrates that the Japanese tend to avoid negative evaluations in social contexts (e.g., Hashimoto and Yamagishi, 2013, 2016) and adopt strategies to appease people who meet the expectations of others by default (Yamagishi et al., 2008, 2012; Hashimoto and Yamagishi, 2015); these tendencies are more pronounced in the Japanese youth (Hashimoto, 2021). Thus, Japanese youth, who tend to focus on avoiding negative evaluations, may be less likely to consider the potential positive effects of punishment. Therefore, it is necessary to conduct systematic cross-cultural research on Japanese adults in general.

## 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 human participants were reviewed and approved by the Yasuda Women's University.

<sup>7</sup> One-sample *t*-tests of the evaluation scores in Study 1 and Study 2, which were conducted as an additional exploratory analysis, demonstrated that none of the results ( $t_s \leq 1.19$  in Study 1;  $t_s \leq 0.21$  in Study 2) were significantly below the theoretical median (0).

The patients/participants provided their written informed consent to participate in this study.

## Author contributions

KM, YK, and HH contributed to the study design, analyzed data, and wrote the whole part of the manuscript. KM and YK conducted data collection. All authors contributed to the article and approved the submitted version.

## Funding

This study was supported by Grants-in-Aid 21K02992 and 21KK0042 from the Japan Society for the Promotion of Science.

## References

- Bago, B., and De Neys, W. (2019). The intuitive greater good: testing the corrective dual process model of moral cognition. *J. Exp. Psychol. Gen.* 148, 1782–1801. doi: 10.1037/xge0000533
- Barclay, P. (2006). Reputational benefits for altruistic punishment. *Evol. Hum. Behav.* 27, 325–344. doi: 10.1016/j.evolhumbehav.2006.01.003
- Cappelletti, D., Güth, W., and Ploner, M. (2008). Being of two minds: an ultimatum experiment investigating affective processes. *Jena Econ. Res.* 2008:48.
- Capraro, V. (2019). The dual-process approach to human sociality: a review. *SSRN J.* doi: 10.2139/ssrn.3409146
- Evans, J. S. (2008). Dual-processing accounts of reasoning, judgment, and social cognition. *Annu. Rev. Psychol.* 59, 255–278. doi: 10.1146/annurev.psych.59.103006.093629
- Evans, J. S., and Stanovich, K. E. (2013). Dual-process theories of higher cognition: advancing the debate. *Perspect. Psychol. Sci.* 8, 223–241. doi: 10.1177/1745691612460685
- Fehr, E., and Fischbacher, U. (2004). Third-party punishment and social norms. *Evol. Hum. Behav.* 25, 63–87. doi: 10.1016/S1090-5138(04)00005-4
- Fehr, E., and Gächter, S. (2000). Cooperation and punishment in public goods experiments. *Am. Econ. Rev.* 90, 980–994.
- Fehr, E., and Gächter, S. (2002). Altruistic punishment in humans. *Nature* 415, 137–140.
- FeldmanHall, O., Sokol-Hessner, P., Van Bavel, J. J., and Phelps, E. A. (2014). Fairness violations elicit greater punishment on behalf of another than for oneself. *Nat. Commun.* 5:5306. doi: 10.1038/ncomms6306
- Gordon, D. S., and Lea, S. E. G. (2016). Who punishes? The status of the punishers affects the perceived success of, and indirect benefits in “Moralistic” punishment. *Evol. Psychol.* 14:1474704916658042.
- Hallsson, B. G., Siebner, H. R., and Hulme, O. J. (2018). Fairness, fast and slow: a review of dual process models of fairness. *Neurosci. Biobehav. Rev.* 89, 49–60. doi: 10.1016/j.neubiorev.2018.02.016
- Hashimoto, H. (2021). Cross-generational differences in independence and interdependence: discrepancies between their actual and ideal selves in the Japanese cultural context. *Front. Psychol.* 12:676526. doi: 10.3389/fpsyg.2021.676526
- Hashimoto, H., Maeda, K., and Matsumura, K. (2022). Fickle judgments in moral dilemmas: time pressure and utilitarian judgments in an interdependent culture. *Front. Psychol.* 13:795732. doi: 10.3389/fpsyg.2022.795732
- Hashimoto, H., and Yamagishi, T. (2013). Two faces of interdependence: harmony seeking and rejection avoidance. *Asian J. Soc. Psychol.* 16, 142–151. doi: 10.1111/ajsp.12022
- Hashimoto, H., and Yamagishi, T. (2015). Preference-expectation reversal in the ratings of independent and interdependent individuals: a USA–Japan comparison: preference-expectation reversal. *Asian J. Soc. Psychol.* 18, 115–123. doi: 10.1111/ajsp.12094
- Hashimoto, H., and Yamagishi, T. (2016). Duality of independence and interdependence: an adaptationist perspective. *Asian J. Soc. Psychol.* 19, 286–297. doi: 10.1111/ajsp.12145
- Horita, Y. (2010). Punishers may be chosen as providers but not as recipients. *Lett. Evol. Behav. Sci.* 1, 6–9.
- Kahneman, D. (2011). *Thinking, Fast and Slow*. New York, NY: Farrar, Straus & Giroux.
- Kiyonari, T., and Barclay, P. (2008). Cooperation in social dilemmas: free riding may be thwarted by second-order reward rather than by punishment. *J. Pers. Soc. Psychol.* 95, 826–842. doi: 10.1037/a0011381
- Kriss, P. H., Weber, R. A., and Xiao, E. (2016). Turning a blind eye, but not the other cheek: on the robustness of costly punishment. *J. Econ. Behav. Organ.* 128, 159–177. doi: 10.1016/j.jebo.2016.05.017
- Kurzban, R., DeScioli, P., and O'Brien, E. (2007). Audience effects on moralistic punishment. *Evol. Hum. Behav.* 28, 75–84.
- Maeda, K., and Hashimoto, H. (2020). Time pressure and in-group favoritism in a minimal group paradigm. *Front. Psychol.* 11:603117. doi: 10.3389/fpsyg.2020.603117
- Mifune, N., Li, Y., and Okuda, N. (2020). The evaluation of second- and third-party punishers. *Lett. Evol. Behav. Sci.* 11, 6–9.
- Mischkowski, D., Glöckner, A., and Lewisch, P. (2018). From spontaneous cooperation to spontaneous punishment – distinguishing the underlying motives driving spontaneous behavior in first and second order public good games. *Organ. Behav. Hum. Decis. Process.* 149, 59–72. doi: 10.1016/j.obhdp.2018.07.001
- Nelissen, R. M. A. (2008). The price you pay: cost-dependent reputation effects of altruistic punishment. *Evol. Hum. Behav.* 29, 242–248. doi: 10.1016/j.evolhumbehav.2008.01.001
- Panchanathan, K., and Boyd, R. (2004). Indirect reciprocity can stabilize cooperation without the second-order free rider problem. *Nature* 432, 499–502. doi: 10.1038/nature02978
- Raihani, N. J., and Bshary, R. (2015). The reputation of punishers. *Trends Ecol. Evol.* 30, 98–103. doi: 10.1016/j.tree.2014.12.003
- Rand, D. G., and Nowak, M. A. (2013). Human cooperation. *Trends Cogn. Sci.* 17, 413–425. doi: 10.1016/j.tics.2013.06.003
- Stüber, R. (2020). The benefit of the doubt: willful ignorance and altruistic punishment. *Exp. Econ.* 23, 848–872. doi: 10.1007/s10683-019-09633-y

## 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.

Tateishi, W., Onoda, R., and Takahashi, N. (2021). How do the estimated motives of punisher affect their reputation? Examination using multiple punishment types. *Jpn. J. Soc. Psychol.* 36, 96–103.

Thompson, V. A., Prowse Turner, J. A., and Pennycook, G. (2011). Intuition, reason, and metacognition. *Cogn. Psychol.* 63, 107–140. doi: 10.1016/j.cogpsych.2011.06.001

Wang, C. S., Sivanathan, N., Narayanan, J., Ganegoda, D. B., Bauer, M., Bodenhausen, G. V., et al. (2011). Retribution and emotional regulation: the effects of time delay in angry economic interactions. *Organ. Behav. Hum. Decis. Process.* 116, 46–54.

Yamagishi, T. (1986). The provision of a sanction system as a public good. *J. Pers. Soc. Psychol.* 51, 110–116. doi: 10.1037/0022-3514.51.1.110

Yamagishi, T. (1988). The provision of a sanctioning systems in the United States and Japan. *Soc. Psychol. Q.* 51, 265–271. doi: 10.2307/2786924

Yamagishi, T., Hashimoto, H., Cook, K. S., Kiyonari, T., Shinada, M., Mifune, N., et al. (2012). Modesty in self-presentation: a comparison between the USA and Japan. *Asian J. Soc. Psychol.* 15, 60–68. doi: 10.1111/j.1467-839X.2011.01362.x

Yamagishi, T., Hashimoto, H., and Schug, J. (2008). Preferences versus strategies as explanations for culture-specific behavior. *Psychol. Sci.* 19, 579–584. doi: 10.1111/j.1467-9280.2008.02126.x

# Advantages of publishing in Frontiers



## OPEN ACCESS

Articles are free to read  
for greatest visibility  
and readership



## FAST PUBLICATION

Around 90 days  
from submission  
to decision



## HIGH QUALITY PEER-REVIEW

Rigorous, collaborative,  
and constructive  
peer-review



## TRANSPARENT PEER-REVIEW

Editors and reviewers  
acknowledged by name  
on published articles

## Frontiers

Avenue du Tribunal-Fédéral 34  
1005 Lausanne | Switzerland

**Visit us:** [www.frontiersin.org](http://www.frontiersin.org)

**Contact us:** [frontiersin.org/about/contact](http://frontiersin.org/about/contact)



## REPRODUCIBILITY OF RESEARCH

Support open data  
and methods to enhance  
research reproducibility



## DIGITAL PUBLISHING

Articles designed  
for optimal readership  
across devices



## FOLLOW US

@frontiersin



## IMPACT METRICS

Advanced article metrics  
track visibility across  
digital media



## EXTENSIVE PROMOTION

Marketing  
and promotion  
of impactful research



## LOOP RESEARCH NETWORK

Our network  
increases your  
article's readership