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Group Affective Tone and Team Performance: A Week-Level Study in Project Teams

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Group affective tone is an emergent state that can be shared by group members during interdependent tasks. Groups can experience positive group affective tone (PGAT), a shared feeling of, e.g., excitement, enthusiasm, or activation, as well as negative group affective tone (NGAT), a shared feeling of, e.g., distress, anxiety, and hostility. So far, previous cross-sectional research suggests that PGAT and NGAT are related to team performance outcomes. However, little is known about how the dynamic and fluctuating group affective states are related to team performance over an extended period of time. Therefore, the current study investigated the relation between PGAT, NGAT, and performance over the course of 34 software engineering projects. We hypothesized that PGAT is positively related to team performance, whereas NGAT is negatively related to team performance. Based on the punctuated equilibrium model and the feeling-as-information theory, we expected that these associations become stronger in the second half of the project. Using week-level design with 165 participants in 34 software engineering teams, we repeatedly assessed PGAT, NGAT, and team performance over 14 weeks. Data were analyzed using multilevel structural equation modeling. As expected, PGAT was positively related to team performance, whereas NGAT was negatively related to team performance – between teams over the course of the projects as well as within teams over time. More importantly, the weekly relationships were stronger in the second half of the project. Our study indicates that weekly variations in group affective tone are more relevant after projects reach a temporal midpoint. We discuss theoretical and practical implications for project teams.

Keywords: affect-as-information, punctuated equilibrium model, team performance, project teams, group affective tone

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INTRODUCTION

Affective experiences have received increasing attention to understand social dynamics in groups and organizations (Barsade, 2002; Lehmann-Willenbrock et al., 2011b; Ceschi et al., 2014; Homan et al., 2015). Affects convey information about the social context (Keltner and Haidt, 1999; Schwarz, 2011; Hazy and Boyatzis, 2015), and shared feelings are considered to define "a group and distinguishes it from merely a collection of individuals" (Barsade, 2002, p. 644). More importantly, affective

responses of one group member can be influenced by other group members (Hareli and Rafaeli, 2008; Boyatzis et al., 2015).

To give the reader an illustrative idea of how affective experiences can impact team work, we invite you to imagine the three coworkers Andrew, Ann, and Arthur who develop software for an external customer. As a team, their work is strongly interdependent: while Ann and Arthur enthusiastically discuss new solutions for a specific code, Andrew immediately "gets infected" by their excitement and develops a new idea that builds on their discussion. In other words, Andrew shows increased interest, he is actively involved, smiles, and gets very excited about the project. In return, Ann and Arthur receive immediate feedback about Andrews' affective reaction, which literally spills over to them. Overall, the group shares a *positive group affective state*. Now, imagine the same team at a later point in time. Time pressure and customer requests make Ann nervous about whether they will meet the project deadline. In team discussions, she reacts irritable and her distress also impacts Andrew's and Arthur's mood. In this meeting, the team shares a *negative affective state* – a state that can ultimately result in conflicts and negatively impact the team's overall performance (cf., Cole et al., 2008; Gamero et al., 2008; Choi and Cho, 2011).

Overall, the current research paper investigates the relationship between group affective tone and team performance over the temporal course of several projects. Our study makes important contributions to the research field of group affect. First, we built on the feeling-as-information theory (Schwarz and Clore, 2003; Schwarz, 2011) to explain how specific affective states in project teams differently impact team performance. Second, we measured group affective tone and team performance over 14 weeks in order to better understand the dynamic variations of group affective states over time. Third, we tested whether two temporal projects phases, that is, the phase before and the phase after project midpoint (cf., Gersick, 1988, 1989), moderate the weekly relationship between group affective tone and team performance over time in project teams.

THEORETICAL BACKGROUND AND HYPOTHESES

Group Affective Tone and Group Performance

The aforementioned case scenario has summarized vividly what we know so far about the *reciprocal interpersonal influence of affect* during group work. Converging (i.e., similar and consistent) affective reactions between group members result in a state which is called *group affective tone* (George, 1990; Collins et al., 2013). Group affective tone can be distinguished in two independent dimensions: positive versus negative group affective tone (PGAT versus NGAT; George and King, 2007; Knight and Eisenkraft, 2015). PGAT reflects a state of positive activation (e.g., feeling enthusiastic or inspired versus feeling sad or bored), whereas NGAT reflects a state of negative activation (e.g., feeling nervous or distressed versus feeling calm or relaxed, cf., Watson et al., 1988).

From a theoretical point of view, the feeling-as-information theory (Schwarz and Clore, 1983, 2003) can help us to understand how affect might either positively or negatively impact team interactions. This theory assumes that people use their affective states to guide their cognitive judgment and evaluate their surroundings. In that sense, affective states impact cognitive processing (Clore and Huntsinger, 2007). For example, positive (in contrast to negative) affect helps to activate semantically related concepts [e.g., Hänze and Hesse (1993)], promotes heuristic judgments [e.g., Schwarz et al. (1991)], and fosters creative problem solving [e.g., Isen (1999)]. In other words, positive affect is expected to increase an openness to new ideas, visionary thinking (Boyatzis et al., 2015; Hazy and Boyatzis, 2015), and creativity (cf., Lyubomirsky et al., 2005). This global-versus-local effect of positive affect on cognitive processing should, thus, help group members to see the *bigger picture* (Gasper and Clore, 2002) when working on a complex task instead of focusing rigidly on details – some authors describe this effect as focusing on the forest and not the trees (Clore and Huntsinger, 2007).

Empirically, several studies also support this hypothesized beneficial effect of positive affective states on group behavior. That is, PGAT has shown positive associations with several behavioral outcomes of group work such as cooperation (Barsade, 2002; Sy et al., 2005), helping behavior (Chi et al., 2011), team proactivity (Wu and Wang, 2015), creativity (Grawitch et al., 2003; Shin, 2014), and team performance [e.g., Barsade (2002), Tanghe et al. (2010), Knight (2015)]. Overall, positive affect does not only influence information processing but also impacts the group's behavioral performance level (Knight and Eisenkraft, 2015). Therefore, we expect that project teams with high PGAT should be better in accomplishing their complex project tasks:

> Hypothesis 1: Between groups, PGAT is positively related to team performance.

In contrast to positive affect, negative affect in social interaction is seen to be "something to be got rid of" (Ketelaar and Tung Au, 2003, p. 431), that is, NGAT has been hypothesized to diminish team performance [e.g., Ashforth and Humphrey (1995), Greer and Jehn (2007), Cole et al. (2008), Bashshur et al. (2011)]. As negative affect indicates problems (Clore et al., 2001; Schwarz and Clore, 2003), teams focus on their difficulties, pay attention to negative feelings, and are, thus, distracted from their actual tasks (Greer and Jehn, 2007; Cole et al., 2008). In particular, strong negative affective experience, such as fear and anger, is assumed to narrow people's scope of attention (Fredrickson, 1998, 2001, 2004), inhibits an openness to new ideas (Hazy and Boyatzis, 2015), and results in less cooperation (Allred et al., 1997). Furthermore, NGAT is related to increased conflicts (Gamero et al., 2008; Choi and Cho, 2011), decreased pro-social behavior (George, 1990), and weaker team performance (Cole et al., 2008). The negative link between NGAT and team performance seems to be particularly valid for teams that work together for a longer period of time because shared

negative feelings are more likely to be attributed to sources within the group, reduce social integration, and consequently diminish team performance (cf., Knight and Eisenkraft, 2015). Consequently, we hypothesize:

> Hypothesis 2: Between project groups, NGAT is negatively related to team performance.

Looking More Closely at the Dynamic Relationship between Group Affective Tone and Team Performance

While project teams may show between-group variation in shared affective experiences, group affective tone is actually defined as a state construct, that is, it is not stable but dynamic and also varies over time as an emergent state (Collins et al., 2013). Despite the widely accepted dynamic nature of group affective tone as an emergent state (Collins et al., 2013), previous research on group affective tone is strongly based on cross-sectional designs, that is, previous studies have mostly neglected to study the temporal variations of group affective tone (Collins et al., 2013; Barsade and Knight, 2015) – a characteristic which is of central concern for the construct under investigation. PGAT and NGAT can vary not only between teams but also within teams over time. The current study aims to fill this research gap by capturing the specific dynamic nature of group affective tone by using a week-level design and measuring PGAT and NGAT across several weeks. Overall, the relationships between group affective tone and team performance should also be reflected within teams over time. Consequently, we expect:

> Hypothesis 3: Over time and within project teams, PGAT is positively related to team performance.

> Hypothesis 4: Over time and within project teams, NGAT is negatively related to team performance.

The Dynamic Effect of Project Phases on Group Affective Tone and Team Performance

One interesting aspect about project teams is that they are characterized by a so called *life cycle,* that is, a starting and end point defined by a deadline (Packendorff, 1995). The fact that project groups have a deadline makes them particularly unique because it frames the project work and provides them with temporal structure (cf., Chae et al., 2015). More importantly, while group affective tone – as a state construct – should vary over the course of a project, its relationship with team performance may also vary depending on temporal phases of the project itself. To better understand how group affective experiences and team performance are affected by these different project phases, we use the punctuated equilibrium model (Gersick, 1988, 1989). According to this model, projects can be divided into two phases which are separated by a midpoint (i.e., phase 1 – midpoint – phase 2). The first phase is characterized by inertia and little visible progress in team work. The midpoint serves as a temporal marker, that is, "an alarm clock [that increases] members' awareness that their time is limited" (Gersick, 1988, p. 34). At midpoint, project teams start to increase their pace and revise their strategy by taking multiple perspectives into account and also by focusing on task completion. Previous research has supported basic assumptions of the punctuated equilibrium model by showing that teams become more aware that time is limited when the deadline approaches [e.g., Okhuysen and Waller (2002), Waller et al. (2002), Chang et al. (2003)].

While the awareness of limited time can help the team to focus on task completion instead of focusing on task-unrelated problems [e.g., Karau and Kelly (1992)], it is not "not a guarantee of progress" (Gersick, 1988, p. 34). In other words, while time pressure can have positive effects on team work, it can also potentially harm a team's performance (cf., Maruping et al., 2015). We assume that the facilitating versus potentially harming function of that temporal midpoint is closely tied to affective experiences of the project team. Therefore, and in order to better understand the temporal interplay between group affective states, team performance, and project phase, we also build on the feelings-as-information theory (Schwarz and Clore, 2003; Schwarz, 2011). After midpoint, teams have stronger time pressure, and, in order to meet the deadline, they have to take multiple factors into account instead of "concentrating their work and attention on only a few factors" (Gersick, 1988, p. 33). With increasing pressure, feelings impact cognitive processing more strongly (Siemer and Reisenzein, 1998). Positive affect should serve better to increase the teams' attentional scope (Schwarz and Clore, 1983; Schwarz, 2011), that is, to see the bigger picture of the project (Gasper and Clore, 2002). Therefore, we expect that PGAT is stronger related to team performance in second half of the project in comparison to the first phase of the project. In contrast, negative affect narrows the attentional scope [e.g., Clore and Huntsinger (2007)] and we expect that – after midpoint – NGAT should exert stronger harm on team performance. Overall, we hypothesize:

> Hypothesis 5: In the second phase of a project, the association between PGAT and team performance is stronger than in the first phase.

> Hypothesis 6: In the second phase of a project, the association between NGAT and team performance is stronger than in the first phase.

MATERIALS AND METHODS

Procedure and Sample

We examined a sample of real project teams ($N = 34$) that took part in a software engineering course at a German university. The majority of the 165 team members were male (90.30%) which is representative of the profession examined. Participants had a mean age of 22.93 years (SD = 3.24).

Project task: each team had to develop a specific software product for a real costumer (e.g., a product data bank for an online sports retailer). For that purpose, teams had to accomplish multiple performance episodes over a period of 14 weeks. Teams had to interact with a customer and analyze and negotiate

requirements. Finally, they had to design the software architecture and implement their ideas. This task also included writing code and testing the overall software-quality. Overall, all teams had to solve an ill-defined task that requires creative problem solving. In doing so, teams were highly autonomous and had to manage task distributions and project progress.

We used a week-level design and captured group affective tone and team performance on a weekly basis. Participants received a web link to an online survey *via* email at the end of each week. Following the methodological procedure by Gersick (1988, 1989), the 14-week project was split into two phases. Week 1to 7 constituted the first phase and week 8 to 14 constituted the second phase of the project.

Measures

Positive and Negative Group Affective Tone

Affect was assessed with 12 items from *Positive And Negative Affect Schedule* (PANAS, Watson et al., 1988; German Version by Krohne et al., 1996). As we used a repeated measurement design, we used a short form in order to minimize participants' efforts – as recommended by Sonnentag et al. (2008). Every week, participants rated their affect for the preceding week on a 5-point response format (1 = *not at all* to 5 = *very much*). Positive affect and negative affect were measured by six items each (positive affect: "active," "interested," "excited," "strong," "inspired," "alert"; negative affect: "distressed," "upset," "irritable," "nervous," "jittery," "afraid"). Cronbach's alpha ranged from 0.75 to 0.92 for positive affect and from 0.78 to 0.93 for negative affect.

Team Performance

Team performance was assessed by means of a German measure of team productivity by Lehmann-Willenbrock et al. (2011a), based on Kirkman and Rosen (1999). This measure has been used in previous studies on real teams which worked together for a prolonged period of time [e.g., Lehmann-Willenbrock et al. (2011a), Sauer and Kauffeld (2013)]. The scale is composed of six items with a 5-point answering format from 1 "absolutely disagree" to 5 "absolutely agree" and captured the extent to which teams met or exceeded team goals of *on-time task completion*, *continuous improvement*, *product quality,* and *customer complaints* (e.g., "As a team, we meet our quantitative and qualitative goals"). Cronbach's alpha ranged from 0.85 to 0.95. The measurements of self-rated team performance in the final week also showed a significant relation with an expert rating of team performance at the end of the project ($r = 0.46$, $p < 0.01$).

In order to overcome common method bias, we tested whether positive affect, negative affect, and team performance measures represent separate constructs using Confirmatory Factor Analysis (CFA). We tested whether a three-factor model with the three independent factors positive affect, negative affect, and team performance, fitted better to our survey data than a single factor model in which the items from positive affect, negative affect, and team performance load on a single factor. Such a single factor model would indicate inflation by a common method bias (cf., Harman, 1976; Podsakoff et al., 2003; Malhotra et al., 2006). We used CFA for nested models controlling for between-person and between-group variation. Furthermore, we used person-mean centered data as usual in diary studies (cf., Bolger et al., 2003). The three-factor solution showed very good fit indices ($\chi^2 = 936.66$, df = 132; CFI = 0.96; RMSEA = 0.05; SRMR = 0.03), whereas the singe-factor solution did not show a sufficient fit ($\chi^2 = 2188.64$, df = 141; CFI = 0.69, RMSEA = 0.08; SRMR = 0.12). The three-factor solution shows a significantly better fit than all three models − as indicated by the Santorra–Bentler Test, a chi-square difference-based test for nested models (TRd = 2122690.11, df = 9, $p < 0.01$).

Overview of Statistical Analyses

For our analyses, individual measures of 165 team members were aggregated to the team level. Prior to this, we calculated the within-agreement r_{wg} (James et al., 1984, 1993) of positive affect, negative affect, and team performance. High r_{wg} values indicate consensus among team members within teams. As a common criterion, r_{wg} values equal to or greater than 0.70 are considered as sufficient agreement for data aggregation on the team level (Lance, 2006). The median r_{wg} values for positive affect, negative affect, and team performance were 0.78, 0.85, and 0.89, respectively. This justified aggregation of individual measures on the team level. For all following analyses, we used measures that were aggregated at the team level. We, first, calculated inter-correlations with SPSS 21 (IBM, 2012). As data were collected weekly across 14 weeks for all 34 teams, the weekly measurements are nested in teams. Data can be described in terms of a two-level structure. Level 1 (within level) compromises 476 measurements from 34 teams over a period of 14 weeks; we also call it week level. Level 2 (between level) represents the teams' latent mean scores across 14 weeks. To consider the multilevel structure, we used multilevel structural equation modeling (SEM) to test our hypotheses. Analyses were performed with Mplus version 7.1 (Muthén and Muthén, 1998-2013) using maximum likelihood estimation (MLR). All continuous predictors were grand-mean centered. We performed three models to predict team performance. The null model includes only the intercept as a predictor. Model 1 includes PGAT and NGAT as predictors at both levels. Predictors at level 1 represent weekly differences from teams' average scores, and predictors at level 2 represent teams' latent mean values across 14 weeks. In Model 2, the interaction terms of PGAT and project phases as well as negative team performance and project phases were added.

TABLE 1 | Descriptive statistics and inter-correlations for PGAT, NGAT, and team performance.

		M	SD	1	2	3
1	PGAT	2.91	0.47		−0.10*	0.44**
2	NGAT	1.78	0.51	−0.24		−0.56**
3	Team performance (self-rated)	3.70	0.55	0.54**	−0.67**	
4	Team performance (expert rating)	3.45	0.86	0.28†	−0.42**	0.28†

All data are at team level. PGAT, positive group affective tone; NGAT, negative group affective tone; correlations above the diagonal are within level, representing measurements (N = 476 nested in 34 teams) on a weekly basis, correlations below the diagonal are between level, representing teams' average values across the temporal course of the project; expert ratings of team performance were between level only.
*†p < 0.10, *p < 0.05, and **p < 0.01 (one-tailed).*

RESULTS

Descriptive statistics and inter-correlations for PGAT, NGAT, and team performance are presented in **Table 1**. Correlations below the diagonal show relationships at level 2, that is, correlations between teams' average values across weeks. Correlations above the diagonal show relationships at level 1, that is, correlations between weekly measurements. PGAT is positively related to team performance at the between level ($r = 0.54$, $p < 0.01$) and at the week level ($r = 0.44$, $p < 0.01$), whereas NGAT is negatively related to team performance at the between level ($r = -0.67$, $p < 0.01$) and at the week level ($r = -0.56$, $p < 0.01$).

In order to consider the multilevel structure of our data and test whether the two project phases (phase 1 versus phase 2) moderate the association between group affective tone and team performance (i.e., hypotheses 5 and 6), we used multilevel SEM to test our hypotheses (cf., **Table 2**). As shown in Model 1, PGAT was positively related to team performance at the between level ($b = 0.49$, SE $= 0.22$, $p < 0.01$). This result is in line with hypothesis 1. Furthermore, as expected by hypothesis 2, NGAT was negatively related to team performance at the between level ($b = -0.67$, SE $= 0.15$, $p < 0.01$).

Although we focused on the relationship between group affective tone and team performance across the course of project, we took advantage of the expert rated team performance at the end of project as a dependent variable. In a supplementary analysis, we also tested whether between-differences in the mean level of PGAT and NGAT across the project were related to the expert ratings of team performance at the end of the project. As shown in **Table 3**, PGAT between teams was positively related to expert ratings of team performance ($b = 0.44$, $p < 0.05$), and NGAT between teams was significantly negatively related to expert ratings of team performance ($b = -0.87$, $p < 0.01$). These findings provide further evidence in support of hypothesis 1 and hypothesis 2, respectively.

Finally, Model 1 in **Table 1** shows that PGAT was also positively related to team performance at the week level ($b = 0.35$, SE $= 0.05$, $p < 0.01$), supporting hypothesis 3, whereas NGAT was negatively related to team performance at the week level ($b = -0.42$, SE $= 0.06$, $p < 0.01$), supporting hypothesis 4.

Hypothesis 5 stated that the relationship between PGAT and team performance was higher in the second phase than in the first phase of team projects. In Model 3 (cf., **Table 2**), the interaction term of PGAT and project phase was significant and positive ($b = 0.15$, SE $= 0.07$, $p < 0.05$). This result supports hypothesis 5. Similarly, in Model 2, the interaction term of NGAT and project phase was significant and negative ($b = -0.22$, SE $= 0.08$, $p < 0.01$). This finding supports hypothesis 6, proposing a higher negative relationship between PGAT and team performance in the second phase. Visual representations for these interaction effects are presented in **Figures 1** and **2** (cf., Aiken and West, 2003; Hayes, 2013).

In **Figure 1**, the slopes of PGAT on team performance for the first and second phase of projects are shown. In the second phase, the slope between PGAT and team performance is steeper than in the first phase. This means that PGAT and team performance have a stronger association after project midpoint.

TABLE 2 | Multilevel analysis for team performance (self-rated) as dependent variable.

	Null Model		Model 1		Model 2	
	b	SE	*b*	SE	*b*	SE
Intercept	3.70**	0.08	3.70**	0.05	3.74**	0.49
Level 1 (week level)						
PGAT			0.35**	0.05	0.23*	0.08
NGAT			−0.42**	0.06	−0.29**	0.07
Project phase					−0.08	0.04
Project phase * PGAT					0.15*	0.07
Project phase * NGAT					−0.22**	0.08
Level 2 (team means across weeks)						
PGAT			0.49**	0.22	0.47†	0.31
NGAT			−0.67**	0.15	−0.68**	0.24
Level 1 intercept variance	0.11	0.01	0.08	0.01	0.08	0.01
Level 2 intercept variance	0.19	0.04	0.08	0.02	0.08	0.02
Level 1 R^2			0.26		0.37	
Level 2 R^2			0.61		0.42	

N = 476 measurements nested in 34 teams. Unstandardized regression coefficients are reported; Project phase dummy coded with 0 = first phase and 1 = second phase; PGAT, positive group affective tone; NGAT, negative group affective tone.
*All ps one-tailed; †p < 0.10, *p < 0.05, **p < 0.01.*

TABLE 3 | Additional analysis for team performance (expert rating) as dependent variable.

	b	SE
Intercept	3.72	1.22
PGAT	0.44*	0.27
NGAT	−0.87*	0.36

N = 34 teams. Unstandardized regression coefficients are reported; PGAT, positive group affective tone; NGAT, negative group affective tone.
*All ps one-tailed; *p < 0.05.*

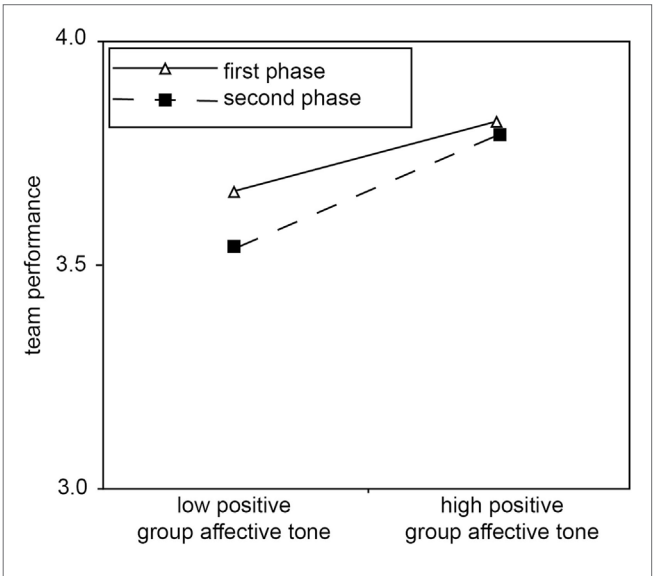

FIGURE 1 | Interaction between weekly positive group affective tone and project phase on team performance.

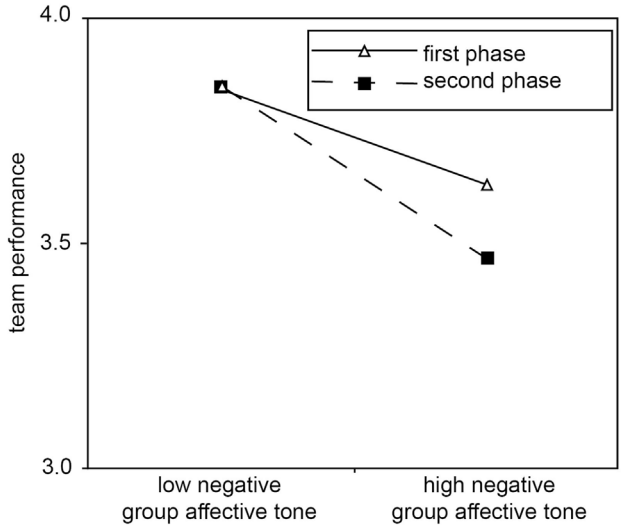

FIGURE 2 | Interaction between weekly negative group affective tone and project phase on team performance.

In **Figure 2**, the slopes of NGAT on team performance for the first and second phase of projects are depicted. In the second phase, the relationship between NGAT and team performance is stronger (i.e., more negative) than in the first phase.

DISCUSSION

The current study investigated how positive versus negative group affective states have a dynamic effect on team performances in project teams. To do so, we repeatedly (i.e., each week) measured group affective tone and team performance over the course of several software engineering projects. Overall, our analyses provide the following three main findings.

First, groups with overall high PGAT across the course of the software engineering project indicated better team performance, whereas groups with overall high NGAT showed reduced team performance. Concerning the relationship of PGAT and team performance, our study enlarges pervious findings that found a positive relationship (cf., Collins et al., 2013). We followed recent calls to investigate group affective tone in different contexts (cf., Barsade and Knight, 2015), particularly in a highly relevant field setting like software development in computer engineering. Our study contributes to the very few studies that examine shared affective processes in software engineering project teams (for an exception see Jung et al., 2012). More importantly, so far, there has been "less evidence of the detrimental effects of negative affective tone on performance" (Collins et al., 2013, p. 52) in general. Our study provides such evidences by linking NGAT and team performance.

Second, by looking at temporal and within-group variations of group affective tone, we showed that temporal variations of shared group affective experiences also relate to team performance over time, that is, affective variations from one week to the other immediately impacted a team's weekly performance over the entire course of the project. Therefore, our study substantiates the dynamic influence of group affective tone on weekly team performances (Collins et al., 2013).

Third, we investigated whether the temporal frame of the project itself moderates the relationship between group affective tone and team performance. By integrating assumptions from the affect-as-information theory (Schwarz and Clore, 2003; Schwarz, 2011) and the punctuated equilibrium model (Gersick, 1988, 1989) and using multilevel modeling, we showed that the weekly variations of group affective tone are stronger related to team performance in later phases of projects.

Theoretical Implications

First, the current study contributes to the literature on group affective tone by providing evidence for the relevance of shared affective responses on group performance outcomes. While previous studies have investigated the link between group affective tone and team performance in laboratory and field studies (cf., Barsade and Knight, 2015), only few studies have investigated real teams that work interdependently and for a prolonged period of time (cf., George and King, 2007; Klonek et al., 2016). In their review, Collins et al. (2013) stated that "groups can experience a variety of affective states over the life cycle of the group, as projects are generally completed over extended periods" (p. 55). The authors pointed out that previous findings rely mostly on cross-sectional studies and questioned whether PGAT are positively and NGAT are negatively related to group outcomes in the long-term [e.g., Collins et al. (2013)]. Our study shed light on the relationship between group affective tone and team performance over an extended period as we captured the complete life cycle of projects. We found that the mean level of PGAT across the project is positively related to team performance. That is, teams which have a higher level of PGAT show better performance than teams with low levels in PGAT. Conversely, the level of NGAT is associated with lower team performance.

Second, group affective tone is an emergent state which is considered to fluctuate over time (Marks et al., 2001; Collins et al., 2013). Therefore, we were interested whether temporal fluctuations of group affective tone also relate dynamically to a team's performance. By using multilevel modeling, we empirically showed that group affective tone is linked to team performance at the week level. Therefore, our study theoretically underpins the dynamic nature of group affective tone and extends empirical research that has used cross-sectional designs to capture group affective tone (cf., Collins et al., 2013). These kind of studies only compare teams with different levels of PGAT or NGAT at a single point of time but do not allow conclusions on how intra-team variations in PGAT or NGAT relate to team performance. We showed that the relationships between PGAT as well as NGAT and team performance were not only present on the between level – comparing teams with different levels of PGAT and NGAT – but also within teams over time. Variation in the level of PGAT (or NGAT) compared to one teams' average over the course of projects is linked to variation in team performance level. In other words, not only the absolute level of PGAT (or NGAT) matters but intra-team differences in PGAT (or NGAT) matter as well. This also supports the affect-as-information theory (Schwarz,

2011) claims that changes in affective states reflect changes in the environment and, in turn, affect cognitive processing (e.g., broaden or narrow attentional scope).

Third, we also took into consideration that the relationship between shared affect in groups might differently impact team performance across the course of the project. We make an important theoretical contribution by linking the feeling-as-information theory (Schwarz and Clore, 1983, 2003; Schwarz, 2011) with the punctuated equilibrium model (Gersick, 1988, 1989). Based on the feeling-as-information theory (Schwarz and Clore, 1983, 2003; Schwarz, 2011), we expected that group affective states are related to team performance because positive affective states broaden cognitive processing and foster creative thinking, whereas negative affective states narrow the groups' scope of attention, that is, impair their ability to see the bigger picture of their task. The punctuated equilibrium model (Gersick, 1988, 1989) states that project work becomes more complex after midpoint. Consequently, we expected the weekly relationships between PGAT as well as NGAT and team performance to be stronger in the second half of the project.

By investigating the temporal dynamic of the weekly relationship between group affective tone and team performance, we also followed calls to better understand the temporal dimension of group affective tone (Collins et al., 2013; Barsade and Knight, 2015) as well as to use longitudinal designs to study team dynamics (Klonek et al., 2016). The relationship between group affective tone and desirable outcomes, such as team performance, has been expected to vary or even change across the course of a project (Collins et al., 2013). While many hypotheses about team dynamic processes actually formulate static mechanisms (i.e., an increase in variable *X* will result in an increase in variable *Y*, cf., Leenders et al., 2016), we provide evidence that dynamic in contrast to static mechanisms might be particularly relevant for teams which "are inherently less temporally stable, such as project teams" (Leenders et al., 2016, p. 97). The results of our study support the argument that the strength of the association between group affective tone and team performance varies depending on the project phase. Theoretically, our study indicates that changes in weekly group affective tone are more important for teams that have worked together for a prolonged period of time. Relying on the affect-as-information theory (Schwarz, 2011), cognitive functioning may be more susceptible to affective influence after midpoint than before midpoint.

Practical Implication

Variations of group affective tone are related to team performance. As a consequence, organizations, project managers, and project teams should be aware of this relationship. This awareness can help them to potentially buffer the negative effects of NGAT on team performance. As projects usually start with a kick-off meeting, project managers have an opportunity to positively impact the affective climate between team members. That is, the kick-off meeting or early team interventions can serve specifically to increase PGAT and reduce NGAT. These early team interventions focus on the overall level of PGAT and NGAT. Our study showed that the average level across the course of projects is related to team performance. However, our study demonstrated that group affective tone matters also every week. Weekly variations in the level of PGAT as well as NGAT are related to weekly variations in team performances. This is important for practical implications. As a consequence, project teams should also be sensitized for changes in their group affective experiences. A continuous monitoring of PGAT and NGAT may help project leaders and project teams to intervene if NGAT increases. Based on the finding that the weekly relationship between group affective tone and team performance is strengthened in the second half of the project, we recommend to pay particular attention to variations of group affective tone after project teams have crossed midpoint. The punctuated equilibrium model suggests that team interventions around midpoint may help teams in successful transition from phase 1 to phase 2 (Gersick, 1989; Hackman and Wageman, 2005). Our study further suggests that team interventions in this second half of projects should particularly address how to pay attention and regulate group affective processes.

Limitations and Future Research

As any study, our study has several limitations that point out future research. First, we captured group affective tone as well as team performance based on global assessments without linking teams' affective state to a specific cause. This methodological approach is frequently used to operationalize affective tone in group research (George and King, 2007; Collins et al., 2013; Barsade and Knight, 2015), but it did not allow us to distinguish whether group affective tone can be attributed to internal causes (e.g., conflicts within the team) or external causes (e.g., unfair feedback from a customer). Since research suggests that NGAT can be beneficial for team performance if attributed to external factors but diminish team performance if attributed to internal factors (cf., Knight and Eisenkraft, 2015), future research should address this question. Furthermore, it is important to note that, in our study, teams had to accomplish a complex task that requires multiple performance episodes, including requirement analysis, software design, implementation, and quality checks. All projects started with an ill-defined problem that required creative rather than analytical thinking. However, task type can moderate the relationship between group affective tone and team performance. For example, in one experimental study NGAT has been found to be beneficial for specific short-term analytical tasks, but diminish creative performance (Klep et al., 2011). Future research could address this issue by using more specific performance measurements during project work. Second, our basic analysis used self-report measures of positive affect, negative affect, and team performance. While this is a very common research approach in the study of group affect (cf., Collins et al., 2013; Barsade and Knight, 2015; Knight and Eisenkraft, 2015), there is a possibility that the relationships between group affective tone and team performance are overestimated due to a common method bias (Podsakoff et al., 2012). However, CFA revealed that three focal constructs (positive affect, negative affect, and team performance) measured *via* questionnaires can be better modeled with three separate factors than one single factor. Furthermore, we showed that self-reported team performance at the end of the project also correlated with

expert ratings of team performance. Finally, PGAT and NGAT were also associated with these expert-rated team performance measures. These additional results further supported hypothesis 1 and hypothesis 2 and diminish the problems of common method bias. Nevertheless, we recommend future research to use a variety of methodological approaches when assessing affective states, such as combining observational codings of group affect with questionnaire measures [e.g., Barsade (2002), Lehmann-Willenbrock et al. (2011b)].

Third, team performance could also have influenced group affective processes, and we did not consider this reciprocal dynamic (cf., Hareli and Rafaeli, 2008) in our analyses. However, the literature on affect in groups has widely considered team performance as a consequence of PGAT and NGAT [e.g., Cole et al. (2008), Tanghe et al. (2010), Collins et al. (2013)]. Affect-as-information theory posits that affect influences cognitive processing and, in turn, impacts performance (Schwarz, 2011). Finally, experimental research has provided evidence that affective variations precede changes in team performance (Barsade, 2002). Since this type of research does support the internal validity of the affect-precedes-performance link, the current study contributed to the external validity of this finding. Therefore, we considered PGAT as well as NGAT as predictors of team performance.

Fourth, we did not investigate potential mediators of the relationships between group affective tone and team performance. Based on the feeling-as-information theory (Schwarz and Clore, 2003; Schwarz, 2011), we expected that cognitive processing may be accountable for the group affective tone and team performance link. Theorizing on group affective tone points out that multiple process variables may mediate the link between group affect and performance such as coordination (Sy et al., 2005), cooperation (Barsade, 2002), or communication (Rhee, 2006). Moreover, the mediation between group affective tone and team performance may also change over time. To address this question, complex research designs are necessary that capture multiple mediators at different time points. Therefore, we encourage future research to build on our study and repeatedly measure multiple constructs, such as group affective tone, cognitive processing, and team performance.

CONCLUSION

The current study showed that PGAT is positively, whereas NGAT is negatively, related to team performance in project teams. These relationships are present at two levels of analysis: within teams reflecting weekly relationships and between teams over the entire project. Based on the feeling-as-information theory (Schwarz and Clore, 1983, 2003; Schwarz, 2011) and the punctuated equilibrium model (Gersick, 1988, 1989), we showed that the associations between weekly variations in group affective tone and team performance become stronger in the second phase of projects, that is, after teams have reached project midpoint. Project teams should pay attention to weekly changes in their PGAT and NGAT, particularly, in the second phase of projects.

AUTHOR CONTRIBUTIONS

HP designed the study, analyzed the data, and wrote the manuscript. FK provided feedback and fine-tuned the paper. KS helped designing the study, including data collection, and provided feedback on the manuscript. SK helped designing the study, provided feedback, and fine-tuned the paper.

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