Are We All on the Same Temporal Page? The Moderating Effects of Temporal Team Cognition on the Polychronicity Diversity—Team Performance Relationship

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Integrating research on polychronicity, team diversity, and team cognition, we hypothesized that shared temporal cognition (overlapping knowledge) and temporal transactive memory systems (differentiated knowledge) would moderate the effects of polychronicity diversity on team performance. Results from 71 teams in an Indian organization revealed opposing moderating effects in that shared temporal cognition attenuated, but temporal transactive memory systems amplified, the negative effects of polychronicity diversity on team performance. Shared temporal cognition also exerted a strong, positive effect on team performance. Study results provide support for the continued examination of polychronicity diversity and temporal team cognition.

Keywords: polychronicity, team diversity, transactive memory, team cognition

Increasing attention is being drawn to a previously unexplored form of diversity operating in teams: time-based individual differences (e.g., Mohammed & Harrison, 2013; Mohammed & Nadkarni, 2011). Individuals often enter teams with diverse temporal orientations, which have been recognized as deeply ingrained, fundamental parameters of individual differences (Bluedorn & Denhardt, 1988). Practically, time-based characteristics are one of the most task-relevant attributes in today's business world, where effective time management is an imperative for organizations (e.g., Clemens & Dalrymple, 2005; Pearce, 2011). Theoretically, temporal diversity has been proposed as the underlying mechanism contributing to the temporal problems specified in McGrath's (1991) time, interaction, and performance (TIP) theory (Mohammed & Nadkarni, 2011). Empirically, temporal differences have been shown to be an important form of deep-level diversity, with relevance for team conflict (Mohammed & Angell, 2004) and team performance (Gevers, Claessens, van Eerde, & Rutte, 2009; Mohammed & Nadkarni, 2011).

The present study adds to a small number of studies testing temporal heterogeneity in teams and extends prior findings in two key ways. First, we expand the range of temporal individual differences previously investigated with respect to diversity. Thus

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far, research has explored heterogeneity on three temporal individual differences: time urgency (chronic hurriedness and the need to control deadlines), pacing style (pattern of effort distribution over time in working toward deadlines), and future time perspective (cognitive temporal bias toward being future oriented; Gevers, Claessens, et al., 2009; Mohammed & Angell, 2004; Mohammed & Nadkarni, 2011). Whereas these temporal characteristics describe how quickly work is done (time urgency), how activities are spaced over time (pacing style), and how likely individuals are to concentrate on the past, present, or future (time perspective), none capture patterns of simultaneity in how work is accomplished. Simultaneity or preference for multitasking is important to investigate because it has been identified as a fundamental life strategy representing underlying core assumptions about time usage (Bluedorn, 2002). According to Kaplan (2009), the "decision to work on one versus multiple tasks has consequences that transcend traditional work outcomes (e.g., performance, satisfaction), but also drives the way in which life, including work, is perceived and experienced" (p. 105). Capturing this notion, polychronicity is defined as the preference for doing several tasks simultaneously rather than sequentially (Bluedorn, Kalliath, Strube, & Martin, 1999). As such, the construct represents a significant feature of time-based tendencies relevant to team tasks that is unaddressed by other temporal constructs. Polychronicity is increasingly recognized as an "important employee trait that has specific and clear relevance to the eclectic and fast-paced" work environment (Arndt, Arnold, & Landry, 2006, p. 320).

As a time-based characteristic unique from other temporal individual differences, polychronicity diversity is important to examine because teams have been described as "multitasking units that perform multiple processes simultaneously and sequentially to orchestrate goal-directed task work" (Marks, Mathieu, & Zaccaro, 2001, p. 356). Because organizations often form teams with the expectation that they will simultaneously coordinate multiple projects (Kaplan, 2009; O'Leary, Mortensen, & Woolley, 2011), teams

are increasingly expected to juggle numerous and diverse tasks under time-pressured and dynamic conditions (e.g., O'Leary et al., 2011; Tannenbaum, Mathieu, Salas, & Cohen, 2012; Waller, 1997). This increased emphasis on multitasking in teams renders the preference to complete tasks in a simultaneous (polychronic) versus sequential (monochronic) manner germane to understanding team performance. Despite its significance for collective settings, our understanding of how polychronicity operates in teams is markedly deficient because polychronicity has been mainly examined at the individual level (e.g., Conte & Gintoft, 2005; Hecht & Allen, 2005).

Studies addressing group polychronicity not only are sparse but also have mainly examined mean-level effects, assuming that team members possess comparable temporal preferences (e.g., Mohammed, Rizzuto, Hiller, Neuman, & Chen, 2008; Souitaris & Maestro, 2010; Waller, Giambatista, & Zellmer-Bruhn, 1999). We challenge this assumption by addressing the performance effects of teams composed of a diverse mix of monochronic and polychronic members. Examining diversity may uncover multifaceted effects of team polychronicity beyond the simple additive effects of mean.

A second way in which the current study extends prior work is by introducing a new category of moderator of the temporal diversity-team performance relationship: team cognition. Diversity of temporal individual differences is considered to be a double-edged sword for team performance, with the potential to yield both negative outcomes (e.g., increased dissatisfaction, conflict, and process loss; decreased cohesion and coordination) and positive outcomes (e.g., expanded range of backgrounds and taskrelevant expertise, temporal synergy; Bartel & Milliken, 2004; Mohammed & Harrison, 2013). Consistent with a theoretical framework suggesting moderation, the limited empirical work on temporal diversity has found insignificant main effects, but significant interactive effects, on team effectiveness (Gevers, Claessens, et al., 2009; Mohammed & Angell, 2004; Mohammed & Nadkarni, 2011). Building on this prior work, we also hypothesize moderation but expand to consider the role of how knowledge is collectively represented within the team.

To date, studies have explored mean pacing style (Gevers, Claessens, et al., 2009), team processes (Mohammed & Angell, 2004), and team temporal leadership (Mohammed & Nadkarni, 2011) as moderators of the relationship between temporal diversity and team outcomes. Specifically, pacing style diversity had a negative effect on performance in teams with an early action style but a positive effect on performance in teams with a deadline action style (Gevers, Claessens, et al., 2009). In a second study, team processes aided in weakening the negative effects of time urgency diversity on relationship conflict (Mohammed & Angell, 2004). Most recently, the effect of time urgency and pacing style diversity on team performance was more positive when team temporal leadership (team leader behaviors that aid in coordinating and managing the pacing of task accomplishment) was high (Mohammed & Nadkarni, 2011). A missing category from this list of moderators is team cognition, a central construct in the team literature (e.g., Mathieu, Maynard, Rapp, & Gilson, 2008; Mohammed, Ferzandi, & Hamilton, 2010) that has been recognized as one of the hallmarks of expert teams (e.g., Salas, Rosen, Burke, Goodwin, & Fiore, 2006). This omission is especially regrettable because the manner by which knowledge is represented in the team could serve as an organizing mechanism to leverage member

diversity. In a previous study examining team performance as the dependent variable, a formal team leader helped to amplify the positive effects and/or mitigate the negative effects of pacing style and time urgency diversity in a top-down manner (Mohammed & Nadkarni, 2011). However, what remains to be explored is whether temporal team cognition, as a bottom-up construct emerging from members (e.g., DeChurch & Mesmer-Magnus, 2010), could fulfill a similar purpose for polychronicity diversity effects on team performance.

Given the time-based nature of polychronicity, we focused on temporal team cognition. Temporality has not been well developed in the team cognition literature, despite numerous calls for greater integration (e.g., Mohammed, Tesler, & Hamilton, 2012; Standifer & Bluedorn, 2006). Therefore, we investigated two types of temporal team cognition: shared temporal cognition (STC; common understanding of the time-related aspects of executing collective tasks) and temporal transactive memory systems (temporal TMS; the set of unique knowledge domains held by specific members combined with a shared understanding of who knows what and when that knowledge is needed in the team). These two constructs were selected because they represent a major point of differentiation among types of team cognition: knowledge as overlapping/ convergent (STC) or differentiated/complementary (temporal TMS) among team members (e.g., DeChurch & Mesmer-Magnus, 2010; Mohammed et al., 2010). Thus, the current study extends prior research by contrasting the extent to which members "on the same temporal page," or possessing unique knowledge needed at different points in time, helps to minimize the negative effects and maximize the positive effects of polychronicity diversity on team performance.

We tested our model on 71 teams in a medium-sized business process outsourcing company in India, a temporally relevant context in which members were tasked with juggling multiple client demands under tight deadlines. Our results contribute to existing research in several ways. First, as the first to examine polychronicity diversity in teams, our study highlights the need to move away from a purely mean-based examination of team-level polychronicity and to recognize polychronicity as an important form of deeplevel diversity in teams. Second, our study specifies the conditions (STC and temporal TMS) under which polychronicity diversity can enhance or hamper team performance. The contingent relationship of team polychronicity diversity on performance found in our study is notable, because "showing that polychronicity matters - or more likely showing under what conditions it matters" has been identified as "a key task for future polychronicity research" (König & Waller, 2010, p. 185). Third, by delineating the moderating effects of two distinct forms of team cognition, we respond to repeated calls to combine overlapping (shared temporal cognition) and differentiated (temporal TMS) team cognition in the same study

¹ As we later elaborate, the notion of a TMS incorporates both differentiated and shared knowledge (e.g., Lewis, 2003; Lewis & Herndon, 2011). However, as the differentiated knowledge aspect of a TMS has been repeatedly emphasized as the key factor distinguishing a TMS from other forms of cognition (e.g., DeChurch & Mesmer-Magnus, 2010; Lewis & Herndon, 2011; Mohammed, Ferzandi, & Hamilton, 2010; Ren & Argote, 2011), we follow suit by relying on this feature as the central point of difference between STC and temporal TMS. As we discuss later, our empirical findings also support this emphasis on distributed knowledge.

(e.g., DeChurch & Mesmer-Magnus, 2010; Salas & Wildman, 2009).

Theoretical Background

Polychronicity

Polychronicity captures a significant feature of time-based tendencies that is unaddressed by other temporal differences in that it describes a proclivity toward patterns of simultaneity in how work is accomplished, whereas pacing style describes how activities are spaced over time (e.g., early, steady, deadline). Although polychronicity captures the preference for engaging in more than one task simultaneously rather than actual multitasking behaviors (e.g., König & Waller, 2010; Poposki & Oswald, 2010), empirical evidence suggests that polychronic individuals enjoy and engage more in multitasking (König, Oberacher, & Kleinmann, 2010; Poposki & Oswald, 2010) and exhibit superior performance (Madjar & Oldham, 2006) and fewer errors in multitasking activities (Zhang, Goonetilleke, Plocher, & Liang, 2005) than do monochronics.

On one end of the continuum, highly monochronic individuals engage in the "pattern of focusing on one task at a time, interpreting other potential tasks and events as interruptions, and attempting to shield one's chosen task from such interference" (Bluedorn, 2002, p. 52). On the other end of the continuum, highly polychronic individuals prefer to work on several tasks concurrently, either at exactly the same time (e.g., eating and reading) or switching back and forth between activities (e.g., writing a paper, texting a friend, answering a phone call; Bluedorn, 2002) within a short time frame (one hour or less; König & Waller, 2010). Polychronicity is regarded as a stable trait based on high test–retest reliability coefficients (e.g., Conte & Jacobs, 2003; Conte, Rizzuto, & Steiner, 1999).

Polychronicity Diversity and Team Performance

Research on temporal individual differences (e.g., Bartel & Milliken, 2004; Eisenhardt, 2004) and team diversity (e.g., Mannix & Neale, 2005; van Knippenberg & Schippers, 2007) suggests that polychronicity diversity is likely to be a double-edged sword for team performance (e.g., Bluedorn, 2002; Mohammed & Harrison, 2013). Building on the similarity-attraction paradigm in the team diversity literature (e.g., Mannix & Neale, 2005; van Knippenberg & Schippers, 2007), we argue that the fundamental differences between the preferences of high and low polychronic members could adversely affect team performance in several ways. First, the schedules and task priorities of monochronic and polychronic team members are often contradictory. Due to their preference for task closure and for devoting their undivided attention to the task at hand, monochronics excel at deadline adherence, whereas polychronics struggle with punctuality (e.g., Bluedorn, Kaufman, & Lane, 1992; Conte & Jacobs, 2003). Polychronics are adept at intermixing unscheduled and scheduled events, whereas monochronics view unscheduled events as interruptions until the task they are currently working on is completed. These conflicting tendencies may increase dissatisfaction among team members, lower cohesion, and decrease motivation and commitment to achieving task goals (e.g., Bartel & Milliken, 2004; Blount &

Janicik, 2002), each of which can reduce team performance (e.g., Beal, Cohen, Burke, & McLendon, 2003; Chen & Kanfer, 2006). Resolving these conflicts can translate into further process losses in the team (suboptimal ways that groups operate, Steiner, 1972) when members get distracted from task completion and insufficient time remains to deliver high quality and quantity of output (McGrath, 1991).

Second, because working interdependently with others holding markedly different polychronic orientations can be taxing, team members may gravitate toward others who share their preferences for sequential or simultaneous task accomplishment and avoid those who manage time differently (e.g., Mohammed & Harrison, 2013). Such divisions within work teams can decrease coordination and cooperation (Bartel & Milliken, 2004), lowering team performance (e.g., Rico, Sanchez-Manzanares, Gil, & Gibson, 2008).

Conversely, the differences between monochronic and polychronic team members could benefit team performance in multiple ways. First, the information processing perspective advocates that diversity fosters enhanced performance by providing an expanded range of backgrounds, information, and task-relevant expertise (e.g., van Knippenberg & Schippers, 2007). Switching back and forth between tasks expands the range and sources of information to which polychronics are exposed, whereas concentrating on a single task at a time fosters attentiveness and depth of understanding (Mohammed & Harrison, 2013). The combination of information breadth and depth enriches the knowledge pool needed for effective team performance.

Second, complementary models of person-environment fit (e.g., Muchinsky & Monahan, 1987) argue that the advantages of diversity may manifest when behaviors or working styles are complementary. According to Leroy (2009),

schedules, priorities, as well as large, demanding tasks often require employees to dedicate their full attention to the work at hand without being distracted by other unrelated tasks or projects.... Yet, in order to make enough progress on each project, meet their deadlines, and respect their schedule, time must be shared and people must regularly transition among their projects. That is, they must frequently stop working on one task, finished or unfinished, to switch to and fully focus on another. (p. 168)

This dilemma is effectively handled by combining the flexibility of polychronic members who prefer to simultaneously juggle numerous competing responsibilities with the focus of monochronic members who prefer to sequentially devote undivided attention to a task. Thus, in complex team environments that require multiple performance criteria, high polychronicity diversity may be beneficial when the strengths of monochronics (achieving superior quality by focusing on a single course of action) and those of polychronics (increasing the quantity of outputs by managing several projects concurrently) are integrated toward maximizing the amount and accuracy of team output.

The potential for two-sided effects of polychronicity diversity highlights the importance of identifying relevant moderators in understanding the complex relationship between polychronicity diversity and team performance. As such, we extend the nascent temporal diversity research by introducing a new category of moderator: team cognition. The time-interaction-performance (TIP) theory advocates the need for organizing mechanisms to handle temporal ambiguity, conflict of temporal interests, and

scarcity of temporal resources (McGrath, 1991). Although temporal leadership, as a top-down construct, has been identified as one such organizing mechanism (Mohammed & Nadkarni, 2011), what is not known is whether team cognition, as a bottom-up construct, could serve a similar role for the effects of polychronicity diversity on team performance.

Temporal Team Cognition

Team cognition is an overarching concept that broadly reflects how knowledge is collectively held and represented within the team (e.g., Cannon-Bowers & Salas, 2001). Because team cognition is not a unitary concept, it reflects both overlapping and differentiated knowledge (Cannon-Bowers & Salas, 2001) and comprises many specific exemplars, including team mental models (e.g., Mohammed et al., 2010) and TMS (e.g., Ren & Argote, 2011). Over the past decade, there has been a proliferation of team cognition research across multiple disciplines (e.g., Cannon-Bowers & Salas, 2001; Fiore & Salas, 2006; Undre, Sevdalis, Healey, Darzi, & Vincent, 2006), and a recent meta-analysis of 65 studies concluded that team cognition positively predicts team processes, motivational states, and performance (DeChurch & Mesmer-Magnus, 2010). We examine two distinct and established forms of team cognition: perceived shared cognition (e.g., DeChurch & Mesmer-Magnus, 2010) and TMS (e.g., Lewis,

Temporal dynamics have been largely downplayed in the team cognition literature (Mohammed et al., 2012), a gap that is notable because the TIP theory has long advocated that temporality represents a distinct and key content area of tasks (McGrath, 1991). Following the TIP theory, recent research has underscored the need to place time at the forefront of team cognition by explicitly incorporating temporal referents in specific facets of team cognition (e.g., Mohammed et al., 2012; Standifer & Bluedorn, 2006). Paying heed to these calls, Gevers, Rutte, and van Eerde (2004) introduced STC. Although time has not been explicitly considered as part of the content of TMS, we integrate literature on TMS with emerging temporal research to create a *temporal TMS*.

Differences in the Nature of Knowledge Sharing: STC and Temporal TMS

Although both emerge in a bottom-up fashion from individual cognition, a noteworthy distinction is that shared cognition reflects knowledge that is held in common by team members, whereas TMS also reflects knowledge that is distributed across team members (e.g., DeChurch & Mesmer-Magnus, 2010; Ren & Argote, 2011). Whereas STC enables team members to be on the same temporal page regarding task information (e.g., deadlines and schedules), a key point of distinction for TMS is the differentiated knowledge structures that members possess. With STC, the focus is on the congruence between teammates' beliefs about the key aspects of tasks. With temporal TMS, the emphasis is on the complementary patterning of individual knowledge, which is then combined with an awareness of who knows what and when that unique knowledge is needed in the team. Because of their respective emphasis on overlapping and differentiated knowledge, the process by which STC and temporal TMS emerges to become a collective phenomenon is structurally dissimilar (Morgeson &

Hofmann, 1999). However, the two moderators are functionally similar in that they are expected to positively impact team performance.

We propose that STC and temporal TMS may each operate as a distinct type of "temporal organizing mechanism" (Ancona, Goodman, Lawrence, & Tushman, 2001; McGrath, 1991) in enhancing the benefits and/or reducing the costs of polychronicity diversity. Given the differences underlying overlapping and differentiated knowledge, STC should serve as a homogenizing function to facilitate a common understanding of the time-related aspects of completing team tasks, whereas a temporal TMS should serve a distributed function to facilitate specialized areas of expertise along with a shared awareness of whom, what, and when. Below, we expand upon the conceptualization of each moderator and develop each hypothesis.

Hypotheses

Polychronicity Diversity and STC

Employees organize their time at work based on both temporal characteristics (relatively stable individual differences) and perceptions of the organization's temporal agenda (task and situational factors) (Bartel & Milliken, 2004; Blount & Janicik, 2002). Combining both elements, Gevers et al. (2004, p. 68) proposed the construct of STC to answer the question "How do project teams given the diversity in how members may perceive and value time—manage to achieve the coordinated action required for meeting deadlines?" STC (also referred to as temporal consensus) reflects "the extent to which team members have congruent mental representations of the temporal aspects of their collective task, such as the importance of meeting the deadline, (sub) task completion times, and the appropriate timing and pacing of task activities" (Gevers, Rutte, & van Eerde, 2006, p. 54). High levels of STC indicate that members concur on the temporal strategy for a project, including agreement on specific deadlines, how quickly the team should work to meet the deadline, and how the work should be scheduled over time. In contrast, low levels of STC signify that team members place unequal value on meeting deadlines and/or "have entirely different schedules in mind, disagreeing not only about when to start the work on the project as a whole, but potentially also about when to start and finish the work on specific subtasks" (Gevers, van Eerde, & Rutte, 2009, p. 298).

As an emergent construct deriving from individual-level cognition but manifesting as a collective phenomenon, STC develops through social interaction processes such as participation, communication, and negotiation (Bartel & Milliken, 2004; Gevers et al., 2004). Team members may initiate temporal discussions proactively at the beginning of task activity. Contrastingly, missing team deadlines or the reoccurrence of scheduling errors may serve as critical events in the life of the team that cause members to reactively discuss how to avoid the same mistakes in the future. Time-based group communication may be enhanced by explicit mechanisms such as goal setting (operationalizing how milestones are to be achieved), temporal planning (estimating the time to complete subtasks, determining the flow of work between members, anticipating time constraints), and temporal reflexivity (monitoring if tasks were completed as planned, evaluating and adjusting plans as needed; Gevers et al., 2004). Thus, each of these mechanisms is proposed to facilitate the process by which members come to agreement on the importance of meeting milestones, the appropriate pacing of subtasks, and time allocation (Gevers et al., 2004). High interdependence necessitating intense collaboration is a contextual factor determining the structure of STC (Bartel & Milliken, 2004; Standifer & Bluedorn, 2006). In terms of function, limited empirical research has found that STC positively influences coordinated action and meeting deadlines (Gevers & Peeters, 2009; Gevers, van Eerde, & Rutte, 2009). Although our focus is on its moderating influence, we expect STC to have a positive, direct relationship with team performance.

The process of reaching agreement on specific deadlines, scheduling, and pacing increases the likelihood that members will (a) become more cognizant of polychronicity differences in the team and (b) be more willing to accommodate each other's multitasking or monotasking preferences. First, the frequent social interaction that gives rise to STC "can expose similarities and differences in members' temporal perceptions either explicitly (through actual statements or assertions made by members themselves) or implicitly (through inferences members make about others)" (Bartel & Milliken, 2004, p. 103). Second, "shared cognitions on time will facilitate team members to structure their behavior to fit with external temporal demands and to adapt to each others' actions" (Gevers et al., 2004, p. 81). As such, establishing a "collective temporal reference point" (Gevers et al., 2004, p. 74) makes it more probable that members will adjust their behavior, at least in the short term, to meet team temporal goals, although their underlying multitasking preferences would remain stable. For example, monochronics may temporarily agree to answer e-mails and phone calls to assist team members who need timely responses, despite their preference for devoting undivided attention to the task at hand. Also fostered by achieving greater consensus on temporal issues, a longer term solution may involve better understanding and anticipating each others' actions (Gevers et al., 2004). To illustrate, team members may work together to minimize interruptions for monochronics during periods of task concentration and build more lead time into schedules to accommodate polychronics' struggles with punctuality. Thus, "a common temporal understanding fosters an "awareness, acceptance, and intentional blending of each member's temporal perspective" (Standifer & Bluedorn, 2006, p. 918).

We therefore propose that STC leverages the benefits of polychronicity diversity and/or minimizes process losses on team performance. Agreeing on deadlines, schedules, and pacing helps to harmonize individual work cycles, thereby increasing the opportunity for monochronic and polychronic member strengths to complement (rather than conflict with) each other. With the homogenizing influence of shared temporal cognition, the benefits of focus and task execution (monochronicity) can be optimally combined with the benefits of flexibility and task juggling (polychronicity) to meet the multifaceted performance criteria (e.g., quantity, quality) of modern day teams. Alternatively, STC may act as a mitigating influence to help quell the potential tensions that may naturally arise between polychronic and monochronic members. In the absence of a common understanding regarding temporal milestones and scheduling, the mixture of sequential and simultaneous working styles is likely to exacerbate dissatisfaction, conflict, and coordination difficulties. Consequently, polychronicity diversity, coupled with different estimations of the time needed to complete

various tasks (low shared temporal cognition), could undermine task accomplishment.

Hypothesis 1: STC moderates the relationship between polychronicity diversity and team performance such that polychronicity diversity will be more positively related to team performance when STC is higher and/or more negatively related to team performance when STC is lower.

Polychronicity Diversity and Temporal TMSs

A TMS integrates the unique knowledge held by specific members with a collective awareness of who knows what in a team (Lewis & Herndon, 2011; Wegner, 1987). Studies have demonstrated that TMS is a higher order construct subsuming three correlated facets: specialization (knowledge differentiation within the team), credibility (trust in the reliability of one another's knowledge), and coordination (ability of members to work together efficiently; e.g., Lewis, 2003, 2004). Stressing the importance of examining content-specific cognition in teams, Austin (2003) advocated that "groups can have multiple transactive memory systems dealing with separate knowledge domains" (p. 868). Paying heed to calls for examining content-specific TMS as well as for placing time at the forefront of team cognition (e.g., Mohammed et al., 2012; Standifer & Bluedorn, 2006), we incorporate temporal referents in TMS.

On the basis of the original conceptualization and dimensionality of TMS (Lewis, 2003), we define a temporal TMS as the set of unique knowledge domains held by specific members combined with a shared understanding of who knows what and when that expertise is needed in team. Thus, a temporal TMS integrates "when" into "who knows what" and "who will do what," with specialization characterizing the differentiated knowledge within the team and when that knowledge is required in the task cycle, credibility describing the degree to which members depend on others' knowledge regarding deadlines and schedules, and coordination capturing the ability of team members to synchronize the timing of knowledge processing to work together effectively. This conceptualization of a temporal TMS extends the original construct by adding a time-based component. Because "considered separately, the specialization, credibility, and coordination variables do not imply that at TMS exists" (Lewis & Herndon, 2011, p. 1257), we combine all three dimensions into one temporal TMS construct.

A temporal TMS is an emergent collective construct that begins when members acquire information about others' expertise and when that knowledge is needed in the team. Because tasks have to be complex enough for members to require differentiated expertise from others, cognitive interdependence has been identified as an essential prerequisite to the development of a TMS (Brandon & Hollingshead, 2004). Inferences about expertise may be gleaned implicitly (from stereotypes, familiarity, and monitoring actions) or explicitly (from self-disclosures, written communication, assigned roles, and/or interpersonal inquiries; e.g., Ren & Argote, 2011). Through frequent communication, members build a temporal TMS by learning about others' expertise (Lewis, 2004) and when that expertise can be fully advantaged in the task cycle as well as the extent to which others' temporal knowledge is credible. Indeed, the capability to timely access knowledge has been iden-

tified as a key factor affecting the likelihood that group members will seek information from others (Borgatti & Cross, 2003).

Communication is the key mechanism through which the temporal TMS is refined and updated (Lewis, 2004) by members working together to accurately retrieve and integrate differentiated knowledge as well as to utilize each other's abilities at appropriate times. Because information that is relevant but not timely may fall through the cracks, social interaction and shared experiences help teammates learn when knowledge should be brought to bear in team interactions and how to synchronize knowledge from different members. In mature temporal TMS, members form convergent and accurate member-expertise associations that are linked to temporal referents. As teams with more developed TMS have benefited from higher performance (e.g., DeChurch & Mesmer-Magnus, 2010), we similarly anticipated that temporal TMS will positively influence team performance.

We expect that by promoting a shared understanding of whom, what, and when, a temporal TMS may provide a team-level organizing template to harness the strengths of monochronic and polychronic members to improve performance. According to the TIP theory, a "temporally efficient flow of work in groups requires complex matching of bundles of activities to particular periods of time [emphasis added]" (McGrath, 1991, p.163). As such, both project quality and quantity can be maximized when team tasks are properly sequenced across the project life cycle, so that monochronic members can concentrate fully on a single assignment until task closure and polychronic members can maintain project momentum by working on multiple and competing activities simultaneously. Thus, what is critical for performance is not just a collective awareness of unique domain-related knowledge possessed by each member but a shared sense of when that expertise is needed through time-based specialization. Lacking a temporal TMS, polychronic members will have difficulty identifying the unique expertise of monochronic members (and vice versa) as well as predicting which members will contribute to what part of the task and when those contributions are needed. Devoid of an organizing mechanism by which members coordinate when differentiated knowledge will be brought to bear during the project timeline, the probability is high that the strengths of monochronics and polychronics in the team will be squandered because of the failure to match monochronics and polychronics to the appropriate task at the appropriate time in the task cycle. According to the TIP theory, allocation of temporal resources to tasks and synchronization of activities are the recommended responses to the problems of conflicting temporal interests and scarcity of temporal resources (McGrath, 1991).

In addition to enhancing the benefits, a temporal TMS may mitigate the conflicts and tensions between monochronics and polychronics in a team. Because of improved task coordination and the ability to work efficiently, "there should be less confusion, fewer misunderstandings, and greater cooperation in groups with stronger transactive memory systems" (Moreland, 1999, p. 10). Similarly, higher task credibility improves trust levels of one another's knowledge among group members (Lewis, 2003). Therefore, stronger TMS groups should "make fewer public claims of expertise, be more open to one another's suggestions, and criticize one another's work less often" (Moreland, 1999, p. 10).

Building on these arguments, we expect that the coordination, credibility, and specialization promoted by a temporal TMS may

reduce the tension, dissatisfaction, and conflict arising from the inconsistent work priorities and pacing behaviors of monochronics and polychronics working interdependently. In teams with a strong temporal TMS, members not only may experience less discomfort in working with members whose polychronic orientations are markedly different from their own but may also cooperatively divide tasks to avoid conflicts. Such coordination can ensure a smooth and uninterrupted workflow, improving both quality and quantity of team outputs (Lewis & Herndon, 2011; Rico et al., 2008). Conversely, teams with weak temporal TMSs may not even be aware of polychronicity differences but still be plagued by intense conflicts because of this latent and unaddressed form of temporal diversity operating in the team. Fragmentation and lack of bridging mechanisms between monochronics and polychronics are likely to create significant workflow disruptions as well as dissatisfaction among team members, inhibiting team performance (Bartel & Milliken, 2004; Blount & Janicik, 2002). Thus, the following is hypothesized:

Hypothesis 2: Temporal TMS moderates the relationship between polychronicity diversity and team performance such that polychronicity diversity will be more positively related to team performance when temporal TMS is higher and/or more negatively related to team performance when temporal TMS is lower.

Method

Company Context

The data utilized in this article were part of a larger survey data collection, and a previous publication (Mohammed & Nadkarni, 2011) reported results from this dataset. Supplemental analyses reported in the Results section demonstrate that the moderator (team temporal leadership) from the published article did not explain the relationship between polychronicity diversity and team performance. Therefore, the two articles are substantively and empirically distinct.

We tested our model using teams from an Indian business process outsourcing (BPO) provider company. This company specialized in managing the front-end (e.g., customer interaction services such as telesales, customer support, and feedback) as well as the back-end (e.g., mortgage and credit card processing) functions of multinational banks. Client projects were managed by cross-functional teams consisting of functional experts (e.g., finance, marketing), technical specialists (e.g., information technology, management and information systems), and client coordinators who served as liaisons between the teams and client company. Each team reported directly to top management.

Teams in our sampled company had to closely adjust their internal activities to operations in the client organization, imposing a high level of reciprocal task interdependence (e.g., Thompson, 1967). Such a complex, multitask, multidomain, and interdependent environment strengthens the influences of temporal diversity (e.g., Horwitz, 2005; Mohammed & Angell, 2003). Moreover, the critical need and challenges of coordination in BPO teams also increased the importance of organizing mechanisms such as STC and temporal TMS. Polychronicity was also likely to be trait relevant (Tett & Burnett, 2003) in this context because members

had to simultaneously juggle different aspects of the project (e.g., technical and functional requirements), changing client demands, and tight temporal milestones.

Sample

The sample comprised 299 Indian employees, most of whom were full-time (81.3%), with an average firm tenure of 2.10 years (range of .5 to 5 years). A majority of the participants were male (59.5%), with a mean age of 26.18 (ranging from18 to 37). The sampled employees were members of 71 teams with three to eight employees per team (mean of 4.21 members). Each team served a single client and performed sales or information technology functions.

Data Collection Procedure

Surveys were administered at three different times. The first survey, measuring polychronicity and basic demographic data, was distributed to team members at the beginning of the monthly project cycle. Surveys, coded to ensure confidentiality, were sent to the human resource manager, who distributed them to the employees. Seventy-one out of 112 teams in the organization responded to the first survey for a response rate of 63.34%.

As incomplete member data create distortion for within-team diversity (Allen, Stanley, Williams, & Ross, 2007) as well as other team-level variables (Timmerman, 2005), it was imperative that we obtain high intrateam rates of response. Sixty-three out of 71 teams had a 100% response rate for the first survey (one member failed to respond in six teams, and two members in two teams).

About two weeks after the first survey, in the middle of the monthly project cycle, team members completed the STC and temporal TMS scales. For the second survey, 66 out of 71 teams had a 100% response rate (one member failed to respond in three teams and two members in two teams). At the end of the monthly project cycle, after the project was submitted to the client organization (minimum of two weeks after administering the second survey), client representatives rated the performance of each team (100% response rate). As the chief liaisons between team members and the client organization, client coordinators received extensive feedback from clients about their satisfaction with the quantity and quality of team performance.

Measures

Polychronicity was assessed with seven items from the widely used measure developed by Bluedorn et al. (1999) and two additional items developed by Hecht and Allen (2005) to better represent the middle of the polychronicity continuum. The nine items were combined into a single Likert scale ($\alpha = .86$). Sample items included "I like to juggle several activities at the same time" and "When I have several things to do, I prefer to spend a little bit of time on each—moving back and forth from one thing to the other."

Polychronicity diversity was measured via the within-group standard deviation because of its appropriateness for the measurement of separation diversity (Harrison & Klein, 2007), use with interval-level data (Harrison & Sin, 2006), and the prediction of interaction effects regarding dispersion (Roberson, Sturman, & Simons, 2007).

STC was assessed by a four-item scale developed by Gevers and colleagues (Gevers et al., 2006, 2009). This 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) captures the extent to which members have similar thoughts about meeting deadlines, the best way to use time, how to allocate the time available, and the time it takes to perform certain tasks. Sample items included "In our team, we have the same opinions about meeting deadlines" and "In our team, we agree on how to allocate the time available." The alpha for this scale was .81 at the individual level and .88 at the team level. As an emergent state, it was necessary to justify that data aggregation from individuals to create a team-level score was appropriate (e.g., Kozlowski & Klein, 2000). An ICC (1) value of .40 with a significant (p < .001) analysis of variance (ANOVA), an ICC (2) value of .74, and a median $r_{\rm wg}$ of .73 supported using average scores as team measures (LeBreton & Senter, 2008).

Temporal TMS was assessed by adding a temporal referent (e.g., Mohammed et al., 2012) to the Lewis (2003) scale containing 15 items measuring specialization, credibility, and coordination (5 items per dimension). Items were rated on a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). The full scale is included in Appendix A, and a validation study of our temporal TMS measure is reported in Appendix B.

We averaged the individual member ratings of temporal TMS into a composite team-level score. Because each dimension represents an indicator of the underlying latent construct, researchers advocate that subscales be combined into a composite score (Lewis, 2003). The alpha for this scale was .76 at the individual level and .83 at the team level. An ICC (1) of .61 with a significant (p < .001) ANOVA, an ICC (2) of .87, and a median $r_{\rm wg}$ of .91 supported aggregation to the team level (LeBreton & Senter, 2008).

A team-level confirmatory factor analysis (CFA) supported that STC, temporal TMS, and team performance were distinct factors ($\chi^2=47.67,\ df=41;$ comparative fit index [CFI] = .99, goodness-of-fit index [GFI] = .90, root-mean-square error of approximation [RMSEA] = .027). To create a more favorable ratio of indicators to sample size, we used three parcels for temporal TMS (one each for specialization, credibility, and coordination), one parcel for STC, and one parcel for team performance (e.g., Williams & O'Boyle, 2008). The fit of the three-factor model was superior to that of a one-factor model ($\chi^2=167.03,\ df=44;\ CFI=.81,\ GFI=.70,\ RMSEA=.20),$ as confirmed by a chi-square difference test ($\Delta\chi^2$ (df=3) = 119.36, p<.01).

Team performance was measured by four items adapted from Stewart and Barrick (2000), representing teams' effort levels, planning and scheduling, the quantity of work accomplished, and the quality of work. Client representatives utilized a 5-point scale anchored by 1 (poor), 3 (mediocre), and 5 (exceptional). The full scale is included in Appendix A. Cronbach's alpha was .87.

Control variables. Seven control variables were included in statistical analyses. First, because larger teams have the potential to be more diverse, team size (number of persons on a team) was included as a control variable to reduce the probability of attributing size-related phenomena to the effects of diversity (e.g., Somech, 2006). In addition, we controlled for whether teams specialized in information technology or sales functions, because task requirements can influence team functioning and outcomes (e.g., Jehn, 1995; Stewart & Barrick, 2000). Third, mean organi-

zational tenure (number of years in the company) was controlled for because members who have been with the company longer may better understand how to be successful within the firm's context, and a recent meta-analysis found a strong positive relationship between mean organizational tenure and team performance (Bell, Villado, Lukasik, Belau, & Briggs, 2011). Fourth, the group mean for polychronicity was also included as a control, because average scores on measures can be confounded with within-group standard deviations (e.g., Harrison & Klein, 2007).

Fifth, to evaluate the contribution of polychronicity diversity above and beyond surface-level and other types of job-related diversity, we controlled for gender, age, and organizational tenure diversity, as prior research has noted their effects on team process and outcomes (e.g., Harrison, Price, Gavin, & Florey, 2002; Nishii & Mayer, 2009; Shin & Zhou, 2007; Somech, 2006). Following the recommendations of Williams and Mean (2004), gender diversity was measured as the proportion of females in the group (linear and curvilinear effects) in order to capture both directional and diversity effects. As the correlation between the linear and curvilinear effects was .95 (p < .001), only the linear effect is reported, but effects did not substantively change when adding curvilinear effects. Age and organizational tenure diversity were calculated via the standard deviation.

Results

Data Analysis

Hypotheses were tested with moderated multiple regression using a four-step procedure. In Step 1, we controlled for team size, team task type, mean organizational tenure, polychronicity mean, and various types of diversity (gender, age, and organizational tenure). In Step 2, we entered the standard deviation of polychronicity. Mean STC and temporal TMS were added in Step 3, and interactions between polychronicity diversity and the two forms of temporal team cognition were added in Step 4. Interaction terms were mean centered to enhance interpretability (Aiken & West, 1991).

Descriptive Statistics

In order to provide an adequate test for diversity hypotheses, "a researcher's sample must evidence substantial between-unit variability in within-unit separation" (Harrison & Klein, 2007, p. 1218). Meeting this requirement, the range of within-group standard deviations across sampled teams was .06 to 1.66 for polychronicity. Table 1 provides the means, standard deviations, and correlations for all study variables at the group level of analysis. Demonstrating that they are distinct constructs empirically, STC and temporal TMS were not significantly correlated (r = .16, p > .05). Mean polychronicity was positively correlated with STC (r = .44, p < .01), temporal TMS (r = .34, p < .01), and team performance (r = .26, p < .05). As expected, higher STC (r = .51, p < .01) and temporal TMS (r = .24, p < .01) were associated with higher team performance.

Tests of Hypotheses

As shown in Model 3 of the moderated regression analyses presented in Table 2, the control variables, polychronicity diver-

sity, shared temporal cognition, and temporal TMS explained 37% of the variance in team performance. The interaction between polychronicity diversity and STC ($\beta=.21, p<.05$) was significant, and the interaction between polychronicity diversity and temporal TMS was marginally significant ($\beta=-.22, p=.051$), accounting for an additional 8% of the variance in team performance ($F_{2,58}=4.26, p<.05$) beyond controls and main effects. Figures 1 and 2 illustrate the interaction plots for high and low temporal team cognition (one standard deviation above and below the mean, respectively; Aiken & West, 1991).

Consistent with Hypothesis 1, a simple slope analysis for Figure 1 showed that when teams were low in shared temporal cognition, the relationship between polychronicity diversity and team performance was significant and negative (slope = -1.20, t = -2.33, p < .05). When teams were high in shared temporal cognition, the relationship between polychronicity diversity and team performance showed a positive trend but was not significant (slope = .51, t = .89, p > .05). Therefore, as compared with low polychronicity diversity, high polychronicity diversity was associated with lower team performance when STC was low.

However, counter to Hypothesis 2, the relationship between polychronicity diversity and team performance was significant and negative in teams with high temporal TMS (slope = -.97, t = -1.98, p < .05). There was no significant difference in team performance between high and low polychronicity diversity for teams low in temporal TMS (slope = .29, t = .68, p > .05). Thus, as compared with low polychronicity diversity, high polychronicity diversity was related to lower team performance when temporal TMS was high.³

As shown in Figures 1 and 2, polychronicity diversity interacted differently with STC and temporal TMS to influence team performance. The influence of STC was more salient under high poly-

² In addition to conducting the simultaneous test of the two interactions, we tested each interaction effect separately with the same controls as in Table 2. Run separately, the polychronicity diversity × STC interaction was marginally significant and positive (b = .90, $\beta = .179$, p < .10), and the polychronicity diversity × temporal TMS interaction was significant and negative (b = -1.61, $\beta = -.30$, p < .05). Therefore, in terms of significance levels, results were opposite those of the simultaneous regression but were consistent in terms of the direction and magnitude of the b weights. Although temporal TMS and STC were not significantly correlated (r = .16, p > .05) and variance inflation factor (all variables lower than 3.7, with most lower than 1.8) and tolerance (all variables higher than .28, with most above .6) diagnostics indicated that multicollinearity among variables in the equation was not a significant concern, multicollinearity is being driven by the same predictor (polychronicity diversity) in multiple cross-product terms. Given that a stated purpose and contribution of the study was to respond to repeated calls for research to combine overlapping and differentiated team cognition and to examine their differential effects (e.g., DeChurch & Mesmer-Magnus, 2010; Salas & Wildman, 2009), we believe that the simultaneous test of the two interactions is most consistent with our theoretical framework. However, we acknowledge that the simultaneous results suggest a slight case of suppression and/or multicollinear-

ity. 3 Given this pattern of findings, we ran a post hoc regression analysis testing a three-way interaction among mean polychronicity, polychronicity diversity, and temporal TMS, along with three two-way interactions and all of the same controls in Table 2. With the exception of the hypothesized two-way interaction between temporal TMS and polychronicity diversity ($\beta = -.339$, p < .05), none of the other two-way interactions nor the three-way interaction ($\beta = .063$, p > .05) was significant ($R^2 = .36$; $F_{16, 54} = 1.91$, p < .05).

Table 1
Means, Standard Deviations, and Correlations Between All Group-Level Variables

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11
1. Team size	4.21	0.86	_										
2. Team type	1.73	0.45	07	_									
3. Mean organizational tenure	2.11	0.40	02	16	_								
4. Mean polychronicity	2.92	0.71	.09	.11	.09	_							
5. Gender diversity	0.41	0.20	04	.06	04	16	_						
6. Age diversity	4.31	1.21	09	.08	21	13	03	_					
7. Organizational tenure diversity	1.15	0.38	12	14	.68**	18	13	.26*	_				
8. Polychronicity diversity	0.55	0.47	06	.04	16	17	11	.06	09	_			
Shared temporal cognition	2.76	0.81	.16	.11	.05	.44**	10	05	07	06	_		
10. Temporal transactive memory	2.92	0.54	.19	.07	03	.34**	13	14	.01	08	.16		
11. Team performance	4.11	1.59	.11	.11	.06	.26*	12	.15	.17	16	.51**	.24*	

Note. N = 71. * p < .05. ** p < .01.

chronicity variability, but the influence of temporal TMS was more salient under low polychronicity variability. Regardless of the level of polychronicity diversity, teams had similar levels of team performance when they were low in temporal TMS but high on STC. There was a significant negative relationship between polychronicity diversity and team performance for teams low in STC but high in temporal TMS. Thus, STC helped to prevent the negative effects of polychronicity diversity on performance, whereas temporal TMS worked to amplify the negative effects of polychronicity diversity on performance. Although our focus was on their moderating influences, it is worth noting that there was a strong positive main effect for STC ($\beta = .47, \, p < .01$).

Supplemental Analyses

Bartel and Milliken (2004) "encourage researchers to tease apart the differential effects that diversity in different temporal perceptions might have on work group functioning" (p. 106). Following this recommendation, we assessed the unique empirical contribution of this study relative to prior work, as shown in three tables in Appendix C. Table C1 reports the correlations between variables from both the current study and Mohammed and Nadkarni (2011). Next, we tested whether team temporal leadership, the moderator featured in Mohammed and Nadkarni (2011), would interact with polychronicity diversity (see Table C2). Similarly, we also explored whether the moderators from the current study would interact with the temporal diversity dimensions examined in Mohammed and Nadkarni (2011; time urgency, future time perspective, and pacing style diversity) in Table C3. As shown in Table C2, team temporal leadership did not significantly moderate the effect of polychronicity diversity and team performance. Similarly, temporal TMS did not moderate the relationships between time urgency, pacing style, and future time perspective diversity with team performance (see Table C3). One exception is that STC was found to moderate the relationship between time urgency (but not pacing style or future time perspective) and team performance. Graphing the interaction showed a similar form to Figure 1 for polychronicity diversity. Given the pattern of only one significant interaction among the seven tested, different moderators are uniquely affecting different temporal diversity variables.

Discussion

Two major findings resulted from our study. First, temporal team cognition moderated the relationship between polychronicity diversity and team performance. Second, STC and temporal TMSs exhibited distinct interactive effects with polychronicity diversity in affecting team performance. These study results augment our knowledge of team diversity, polychronicity, and team cognition in significant ways. Below, we discuss the theoretical implications, limitations, and future directions of our study.

Theoretical Implications

Polychronicity diversity. Researchers investigating team-level polychronicity have assumed that individuals possess comparable temporal preferences and collectively agree on how to structure their work (e.g., Kaplan, 2009; Mohammed et al., 2008). For example, Souitaris and Maestro (2010, p. 654) recently stated that "members will exhibit similarity in their preferences and behavioral tendencies" in conceptualizing polychronicity at the team level. We challenge this isomorphic assumption by addressing what happens when team members exhibit a diverse mix of

⁴ Although specialization, credibility, and coordination must be combined to constitute a TMS (Lewis & Herndon, 2011), a recent review of the TMS literature advocated that "future studies report not only TMS as a construct, but also the value of different dimensions" (Ren & Argote, 2011). Following this recommendation as well as that of an anonymous reviewer, we ran a hierarchical regression with the same control variables as in Table 2: polychronicity diversity, mean levels of each of the three TMS dimensions, and three interactions between polychronicity diversity and specialization, credibility, and coordination. Results revealed a significant interaction between specialization and polychronicity diversity $(\beta = -.35, p < .01)$, accounting for an additional 14% of the variance in team performance ($F_{3, 56} = 4.28, p < .01$) beyond controls and main effects. The graph of the interaction showed a similar pattern to that of Figure 2 for the whole temporal TMS scale. As indicated by simple slope analyses, the relationship between polychronicity diversity and team performance was significant and negative in teams with high temporal TMS (slope = -1.76, t = -2.56, p < .05). There was no significant difference in team performance between high and low polychronicity diversity for teams low in temporal TMS (slope = .91, t = 1.61, p > .05). As no significant effects emerged for credibility or coordination, specialization (emphasizing uniquely held or differentiated knowledge) is the dimension of TMS that is driving the effects exhibited in Table 2 and Figure 2.

Table 2
Hierarchical Regression Analyses Testing the Moderating Effects of STC and Temporal TMS on the Relationship Between Polychronicity Diversity and Team Performance

Predictor	Step 1 1.89 [†] .17			Step 2 1.75 .18 .01				Step 3		Step 4		
$F \\ R^2 \\ \Delta R^2$								3.49** .37 .18**		3.93** .45 .08*		
Variable	b	SE	β	b	SE	β	b	SE	β	b	SE	β
Step 1: Controls												
Team size	.24	.22	.13	.23	.22	.13	.08	.20	.04	.10	.20	.06
Team task type	.37	.42	.11	.39	.39	.42	.24	.38	.07	.36	.36	.10
Mean organizational tenure	71	.79	18	72	.79	18	49	.74	12	40	.71	10
Mean polychronicity	.73	.29	.33*	.68	.29	.30*	.12	.31	.05	.03	.29	.01
Gender diversity	18	.95	02	32	.96	04	20	.86	03	.17	.83	.02
Age diversity	.09	.19	.07	.10	.19	.07	.14	.18	.11	.16	.17	.12
Organizational tenure diversity	1.52	.87	.36†	1.45	.88	.34	1.12	.83	.26	1.05	.79	.25
Step 2: Temporal diversity												
Polychronicity diversity				36	.40	11	38	.36	11	37	.35	11
Step 3: Moderators												
STC							.92	.23	.47**	.91	.22	.47**
Temporal TMS							.37	.35	.13	.74	.35	.25*
Step 4: Interactions												
Polychronicity Diversity × STC										1.07	.53	.21*
Polychronicity Diversity × Temporal TMS										-1.16	.58	22^{\dagger}

Note. N=71. STC = shared temporal cognition; TMS = transactive memory systems. $^{\dagger}p<.10.$ $^*p<.05.$ $^{**}p<.01.$

monochronic and polychronic tendencies. As the first to empirically examine intrateam polychronicity diversity, our study expands the types of temporal heterogeneity investigated in previous studies (e.g., Gevers, Claessens, et al., 2009; Mohammed & Angell, 2004; Mohammed & Nadkarni, 2011) and establishes polychronicity as an important form of deep-level task-related diversity.

Low Poly Diversity

Low STC

Low STC

Low STC

Low STC

High STC

High STC

Figure 1. Interaction between polychronicity diversity and shared temporal cognition on team performance. STC = shared temporal cognition; Poly = polychronicity.

Our results support the contention that polychronicity diversity may be a disruptive force in teams, and managing this diversity is important for team performance. Therefore, an important implication of our results is the need to broaden the conceptualization of team-level polychronicity beyond mean-level effects to include diversity. Considering both forms of team composition clearly provides a more complete understanding of how polychronicity impacts team outcomes. As group studies of mean-level polychronicity have tended to examine outcomes other than team

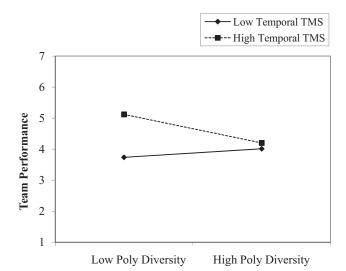


Figure 2. Interaction between polychronicity diversity and temporal transactive memory systems (TMS) on team performance. Poly = polychronicity.

performance (e.g., Mohammed et al., 2008; Waller et al., 1999), demonstrating the influence of polychronicity diversity on project quality and quantity enhances the prescriptive value of this construct in team settings.

Temporal team cognition. Confirming that polychronicity diversity is indeed a double-edged sword for team performance, our findings help to resolve the opposing conceptual mechanisms in the team and temporal diversity literatures by specifying the conditions under which the polychronicity diversity—team performance relationship is strengthened or weakened. In particular, we expanded emerging research on temporal diversity by introducing a new and unexplored moderator: temporal team cognition.

Through establishing that different moderators have distinctive effects on different team diversity variables, the supplemental analyses demonstrate the unique empirical contribution of this study relative to prior work. Whereas a formal team leader helped to leverage pacing style diversity in a top-down manner (Mohammed & Nadkarni, 2011), the bottom-up nature of temporal team cognition fulfilled a similar purpose for polychronicity diversity on team performance. Perhaps whether members prefer to work sequentially or simultaneously is most evident to teammates but less visible to leaders and therefore more affected by emergent states. In addition, effective management of polychronicity diversity may require the awareness and involvement of multiple members as opposed to an intervention by a single person. Interestingly, as team processes (Mohammed & Angell, 2004), team temporal leadership (Mohammed & Nadkarni, 2011), and STC have all moderated the time urgency-team outcome linkage, this form of temporal diversity demonstrates the greatest receptivity to a variety of influences. In comparison to polychronicity and pacing style, which have been more specifically focused on work activity, the more general orientation of time urgency in being more broadly applied to a variety of human behaviors (Mohammed & Harrison, 2013) may play a role in interpreting these findings. Further research is clearly needed to explore the mechanisms underlying the differential effects of diverse forms of temporal diversity.

As team cognition research has been criticized for being temporally deficient, we responded to recommendations to integrate temporal referents into team cognition research (e.g., Gevers et al., 2004; Mohammed et al., 2012) and are the first to extend the TMS construct to include time. Our results suggest that there is value in continuing to examine temporal team cognition in future research. In addition, few studies have holistically examined the impact of both overlapping and differentiated forms of team cognition on team outcomes (exceptions are Ellis, 2006 and Pearsall, Ellis, & Bell, 2010), despite numerous calls to examine the two forms of team cognition in the same study (e.g., DeChurch & Mesmer-Magnus, 2010; Salas & Wildman, 2009). Finding that STC and temporal TMSs contrastingly shaped the effects of polychronicity diversity on team performance illustrates the fruitfulness of simultaneously examining both forms of team cognition.

Contrasting moderating effects of STC and temporal TMS. As predicted, the combination of low and high polychronicity team members was particularly detrimental to team performance in the absence of consensus surrounding time-related aspects of task execution. Thus, agreement on deadlines, schedules, and pacing helped to compensate for the disadvantageous aspects of mixing members with sequential and simultaneous working styles. As

STC helped to reduce the negative effects but not amplify the positive effects of polychronicity diversity, additional organizing mechanisms such as behavioral integration (Hambrick, 1994) may be needed to leverage the performance benefits of combining members whose strengths are focus and task execution with those whose strengths are flexibility and task juggling.

An interesting, yet unexpected outcome was that high polychronicity diversity combined with *high* temporal TMS decreased performance. Therefore, whereas high STC had a mitigating effect, high temporal TMS had an exacerbating effect on the negative relationship between polychronicity diversity on team performance. In contrast to STC serving a homogenizing function to facilitate a common understanding regarding schedules and deadlines, temporal TMS served a differentiating function through combining specialized member expertise with a shared understanding of who knows what and when that knowledge was needed in the team. This differentiating function was confirmed empirically, as post hoc analyses found that specialization, the distributed aspect of TMS, is the dimension of temporal TMS that is driving the effects exhibited in Figure 2.

Upon close inspection, the interactions between the two sources of temporal homogeneity/differentiation in teams-temporal composition (polychronicity) and temporal organizing mechanisms (STC and temporal TMS)—reveal a similar pattern of effects. The combination of high temporal diversity and high temporal differentiation (temporal TMS) as well as the combination of low temporal diversity and high temporal homogeneity (STC) proved detrimental to team performance. Rather, team performance was higher when high temporal diversity was balanced with team organizing mechanisms emphasizing homogeneity. To illustrate, high variability on polychronicity when combined with low STC in Figure 1 or high temporal TMS in Figure 2 decreased performance. In contrast, high polychronicity diversity and high STC in Figure 1 and low polychronicity diversity and high temporal TMS in Figure 2 increased performance. With the benefit of hindsight, optimal distinctiveness theory (Brewer, 1991) provides a framework for understanding the benefits of including both unifying and diversifying elements in teams. According to Brewer (1991), team members actively endeavor to obtain an optimal balance of assimilation and differentiation within teams and will take corrective action to avoid being too similar (through reasserting distinctiveness) or too unique (through reasserting inclusion; Pickett & Brewer, 2001).

Eisenhardt (2004) argued, consistent with optimal distinctiveness theory, that team outcomes will be more favorable when temporal diversity is matched with process homogeneity. Because temporal composition is a given for members, adjustments to process issues such as scheduling may be key to achieving an optimum temporal balance in teams. Teams with high temporal diversity could instill homogenizing temporal mechanisms (high STC and low temporal TMS), whereas teams with low temporal diversity could emphasize differentiation mechanisms (low STC and high temporal TMS) to attain temporal optimality and increase performance. Although this possibility is consistent with the pattern of moderating effects we found in our study, we acknowledge that future research is needed to provide a direct test the tenets of optimal distinctiveness theory for polychronicity diversity and temporal team cognition.

As a high temporal TMS was necessary for low polychronicity diversity groups to perform well, the underlying reasons for this finding might differ, depending on whether teams consist of mostly monochronic or polychronic members. In the case of the former, because most individuals would fully concentrate on their own particular task, important responsibilities could fall through the cracks. A temporal TMS would help prevent gaps and blind spots in the collective workflow by allocating specific tasks to the right person at the right point in time. In the case of mostly polychronic members, the likelihood of duplication of effort and wasted resources is high when multiple individuals are working on multiple tasks simultaneously. Consequently, a temporal TMS would coordinate when expertise is needed in the project cycle to streamline task progress and avoid redundancy.

Whereas there is a growing body of research showing that TMS positively affects team performance (DeChurch & Mesmer-Magnus, 2010), scholars have recognized that rigidity in members' knowledge and the loss of information through incorrect assignment or lack of member recall may result in adverse TMS effects (Hollingshead, Gupta, Yoon, & Brandon, 2012; Lewis & Herndon, 2011). Indeed, Hollingshead (1998) noted that "information may be transferred or explicitly delegated to the 'wrong' individual in the system, e.g., one who does not have responsibility for that type of information or is unlikely to remember it due to a lack of expertise" (p. 427). Pearsall, Ellis, and Bell (2008) illustrated the existence of errors in TMS and their unfavorable effects on team performance due to lack of adequate communication among team members. Our results complement this nascent research by suggesting that the adverse effects of temporal TMS occur when team polychronicity diversity is higher rather than when it is lower. The tendency of diverse members to avoid those who manage their time differently may interfere with intrateam communication, resulting in misrepresentations of when member expertise is needed and errors in temporal TMS that hamper performance. In contrast, homogeneity in polychronicity may facilitate effective communication and allow members to accurately estimate member expertise and effectively coordinate activities, resulting in superior team performance. The critical need and challenges of coordination in BPO teams (e.g., Beulen, Ribbers, & Roos, 2010), in combination with high polychronicity diversity, may have rendered a temporal mechanism based on differentiation insufficient for overcoming the negative consequences of time-based individual differences. Future studies should explicitly test the effects of temporal TMS in multiple contexts to test our post hoc theorizing.

Limitations and Directions for Future Research

According to a recent review by Lewis and Herndon (2011), scale-based measures of TMSs are appropriate "if one is interested in predicting the existence of a TMS or predicting the effects of a TMS" (pp. 1257–1258), which were the goals of the current study in relation to temporal TMS. Admittedly, however, our measure of a temporal TMS was limited to knowledge representation and excluded the process mechanisms by which group members encode, store, and retrieve information (e.g., Wegner, 1987). In addition, there is some inevitable overlap between the general and temporal TMS measures, and further research beyond this study is needed to differentiate the two constructs. Also, although the mechanism is implied in our theorization of the positive and

negative effects of polychronicity diversity on team performance, we did not explicitly test the possible mediators in the diversity–performance link. Future studies should explicitly test the mechanisms under which STC maximizes beneficial aspects (e.g., coordinated action, Gevers, van Eerde, & Rutte, 2009) or minimizes adverse effects (e.g., conflict resolution, Mohammed & Angell, 2004) of polychronicity diversity in teams.

At this stage of the nascent work on polychronicity in teams, we chose to focus solely on the bottom-up or emergent aspects of how individual-level polychronicity affects team performance. However, we acknowledge that polychronicity was first proposed as a cultural-level construct (Hall, 1983) and that the larger cultural environment can exert top-down influences (Kozlowski & Klein, 2000).

Although we collected data at three points in time, our design does not permit causal conclusions. A promising area for future research includes examining the formation and development of temporal team cognition at different stages of team development and task progress. For example, is STC developed earlier in a team's cycle more beneficial than that developed later? Do groups make adjustments to their temporal team cognition at the midpoint of task progress (Gersick, 1988)? Given that polychronicity diversity (as well as temporal team cognition) would change as members leave and join the team, future research should also track team composition longitudinally.

Practical Implications

Our study informs managers about a new a form of diversity operating in teams as well as ways to effectively manage polychronicity diversity in multiproject and client-driven environments. By showing that polychronicity diversity matters for team performance, our study alerts managers to consider differences in employees' preferences to work simultaneously or sequentially in forming teams and in monitoring team progress. Although polychronicity diversity can be a disruptive influence in teams, results revealed that shared temporal cognition mitigated the negative effects of polychronicity diversity on performance. Thus, an important implication is to encourage team members to reach agreement about temporal milestones and scheduling. Explicitly discussing expectations regarding deadlines and pacing as part of the development of a team charter (e.g., Mathieu & Rapp, 2009) would help to formalize and structure this dialogue.

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Appendix A

Study Measures

Temporal Transactive Memory (Adapted From Lewis, 2003)

Specialization

- Different team members are responsible for expertise in different areas needed at different points in the project.
- The specialized knowledge of several different team members is needed to complete the project deliverables in a timely manner.
- I know which team members have expertise in specific areas needed at different points of time in the project.
- Each member has specialized knowledge of some aspect of our project.
- 5. I have knowledge about an aspect of the project that no other team member has.

Credibility

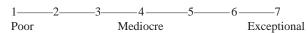
- I am comfortable accepting procedural suggestions about meeting deadlines from other team members.
- I trust that other members' knowledge about the project deadlines is credible.
- 8. I am confident relying on the information about meeting deadlines that other team members bring to the discussion.
- 9. When other members give information about meeting project deadlines, I want to double-check it for myself.
- 10. I do not have much faith in other members' ability in meeting deadlines.

Coordination

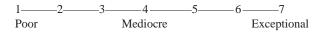
- Our team works together in a well-coordinated fashion in developing the project timeline.
- Our team has few misunderstandings about what to do and when to do it.
- 13. Our team needs to backtrack and start over in defining the project timelines.
- We accomplish tasks smoothly and efficiently in a timely manner.
- There is much confusion about how and when we will accomplish tasks.

Team Performance Scale

 The effort level displayed by team members in working on this project was:



The team's planning and scheduling of project tasks was:



The team's amount of work accomplished for this project was:



4. The team's quality of work on this project was:



(Appendices continue)

Appendix B

Validation of Temporal Transactive Memory Systems (TMS) Scale

We validated the temporal TMS scale in a separate study of 189 working managers from an executive education program at a major eastern university. The participants were assigned to 56 teams in a strategic management course. Each team was required to write a business plan. As expected, the overlap between the temporal TMS scale and the original TMS scale was high but not high enough to suggest redundancy (r = .54 at the individual level and r = .57 at the team level).

To create a more favorable ratio of indicators to sample size, we used three parcels for temporal TMS and three parcels for original TMS (one each for specialization, credibility, and coordination; Williams & O'Boyle, 2008) in confirmatory factor analyses (CFA, LISREL; Jöreskog & Sörbom, 2004). The two-factor model for temporal TMS and original TMS fit the data well ($\chi^2=187.19$, df=8; CFI = .94, GFI = .92, nonnormed fit index [NNFI] = .92; RMSEA = .047). Furthermore, the fit of the two-factor model was superior to that of a one-factor model ($\chi^2=275.87$, df=9; CFI = .78, GFI = .65, NNFI = .71; RMSEA = .31), as confirmed by a chi-square difference test ($\Delta\chi^2$ (df=1) = 88.68, p<.01). Interfactor correlations between the temporal TMS and original TMS scales were .51 (p<0.001) at the individual level and .48 (p<0.001) at the team level.

We examined the convergent and discriminant validity of the temporal TMS scale by linking it to four team correlates: temporal coordination (three items, Janicik & Bartel, 2003), deadline adherence (two items, Gevers, van Eerde, & Rutte, 2009), workload sharing (three items, Campion, Medsker, & Higgs, 1993), and familiarity (one item for each team member, adapted from Hinds, Carley, Krackhardt, & Wholey, 2000). Conceptually, both temporal coordination and deadline adherence capture explicitly time-based phenomena in teams (e.g., Janicik & Bartel, 2003), whereas workload sharing and familiarity have been found to relate posi-

tively to TMS in prior studies (e.g., Akgün, Byrne, Keskin, Lynn, & Imamoglu, 2005; Littlepage, Hollingshead, Drake, & Littlepage, 2008).

Therefore, we expected and found that temporal TMS would have a stronger positive relationship with temporal coordination (individual level: r = 0.37, p < 0.001, team level: r = 0.45, p <0.001) than would the original TMS scale (individual level: r =0.19, p < 0.05; team level: r = 0.18, p < 0.05). The correlations were significantly different for both individual-level analyses (Z = 2.69, p < .01) and team-level analyses (Z = 2.27, p < .05; Steiger, 1980). Similarly, temporal TMS had a stronger positive relationship with deadline adherence (individual level: r = 0.41, p < 0.001; team level: r = 0.43, p < 0.001) than did the original TMS scale (individual level: r = 0.19, p < 0.10; team level: r =0.14, p < 0.10) at the individual level (Z = 3.32, p < .01) and team level (Z = 2.40, p < .05). In contrast, as expected, the original TMS scale (r = 0.39, p < 0.001) related more strongly with familiarity than did the temporal TMS scale (r = 0.14, p <0.10) at the individual level (Z = 3.72, p < .01). Parallel findings were obtained for the team level of analysis (r = 0.44, p < 0.001; r = 0.12, n.s., respectively; Z = 2.65, p < .05). Likewise, the original TMS scale (individual level: r = 0.40, p < 0.001; team level: r = 0.40, p < 0.001) was more strongly correlated with workload sharing than was temporal TMS (individual level: r =0.14, p < 0.10; team level: r = 0.11, n.s.) at the individual level (Z = 3.88, p < .01) and team level (Z = 2.37, p < .05). Finally, temporal TMS explained 17% additional unique variance (β = 0.29, p < 0.01; $\Delta R^2 = 0.17$, p < 0.01) in team performance beyond that explained by the original TMS scale and team size $(\beta = 0.30 \text{ and } \beta = 0.22, p < 0.05, \text{ respectively}; R^2 = 0.23, p < 0.05)$ 0.01).

(Appendices continue)

Appendix C Unique Empirical Contribution of the Current Study With a Previously Published Study

Table C1 Correlations Between Substantive Variables From the Current Study and the Published Study

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Mean time urgency (P)	_											
2. Mean pacing style (P)	11	_										
3. Mean future time perspective (P)	.05	.05										
4. Mean polychronicity (C)	32**	.14	10	_								
5. Time urgency diversity (P)	10	.12	35**	.05	_							
6. Pacing style diversity (P)	.01	.46**	.14	.23	04	_						
7. Future time perspective diversity (P)	04	.11	.01	12	.00	05	_					
8. Polychronicity diversity (C)	03	.06	.07	17	.07	04	14	_				
9. Team temporal leadership (P)	02	.03	13	.34**	.16	13	.04	.16	_			
10. Shared temporal cognition (C)	09	.12	43**	.44**	.04	.15	10	06	.42**	_		
11. Temporal transactive memory (C)	.45**	16	.15	.34**	12	.12	08	08	.40**	.16	_	
12. Team performance (P)	.01	01	28*	.21	.08	04	04	.08	.59**	.59**	.26**	_
13. Team performance (C) ^a	.03	.04	23	.26*	.11	.02	.04	16	.52**	.51**	.24*	.62**

Note. N = 71. P = published study; <math>C = current study.

Table C2 Hierarchical Regression Analyses Testing the Moderating Effects of Team Temporal Leadership on the Relationship Between Polychronicity Diversity and Team Performance

Predictor	1.87 .13				Step 2			Step 3		Step 4			
$F R^2 \Delta R^2$				1.80 .15 .02				5.53** .38 .24**		4.83** .38 .00			
Variable	b	SE	β	b	SE	β	b	SE	β	b	SE	β	
Step 1: Controls													
Team size	.34	.21	.19	.36	.21	.20	.21	.19	.12	.21	.19	.12	
Part-time/full-time status	.97	1.18	.11	1.25	1.20	.14	1.46	1.03	.17	1.53	1.04	.18	
Gender diversity	-2.68	1.47	22	-2.71	1.46	22	-1.47	1.28	12	-1.57	1.30	13	
Age diversity	.21	.17	.17	.22	.17	.18	.12	.15	.10	.14	.15	.11	
Mean polychronicity	.49	.26	.23	.55	.26	.25*	.08	.24	.04	.12	.25	.05	
Step 2: Temporal diversity													
Polychronicity diversity				.46	.39	.14	.08	.34	.03	.05	.34	.02	
Step 3: Moderators													
Team temporal leadership							.88	.18	.56**	.89	.18	.56**	
Step 4: Interactions													
Polychronicity Diversity × Team													
Temporal Leadership										.23	.39	.06	

(Appendices continue)

^a Given the nascent state of the literature on temporal diversity, the team performance measure utilized in the published study emphasized timeliness. The current article broadens the measurement of team performance to nontemporal domains by examining effort level, planning and scheduling, work quality, and work quantity.

^{*} p < .05. ** p < .01.

Note. N = 71. * p < .05. ** p < .01.

Table C3
Hierarchical Regression Analyses Testing the Moderating Effects of Shared Temporal Cognition and Temporal TMS on the
Relationship Between Time Urgency Diversity, Future Time Perspective Diversity, and Pacing Style Diversity and Team Performance

Predictor		Step 1			Step 2			Step 3			Step 4		
$F \\ R^2 \\ \Delta R^2$	1.34 .17			1.02 .17 .01			2.54** .39 .22**			2.20* .47 .08			
Variable	В	SE	β	b	SE	β	b	SE	β	b	SE	β	
Step 1: Controls													
Team size	.16	.23	.09	.16	.27	.09	.08	.24	.05	03	.25	02	
Team task type	.67	.44	.19	.76	.46	.21	.42	.42	.12	.26	.45	.07	
Mean organizational tenure	40	.88	10	43	.90	11	53	.79	13	59	.79	15	
Mean urgency	.09	.25	.05	.10	.25	.06	.00	.25	.00	.23	.28	.12	
Mean future time perspective	64	.27	30*	61	.29	28*	13	.31	06	56	.37	26	
Mean pacing style	.10	.26	.05	.09	.31	.04	.03	.28	.01	.23	.31	.11	
Gender diversity	-1.04	.95	13	-1.13	.99	14	46	.88	06	72	.93	09	
Age diversity	.07	.20	.05	.06	.22	.04	.08	.19	.06	.07	.19	.05	
Organizational tenure diversity	1.16	.91	.28	1.20	.94	.29	1.26	.82	.30	1.53	.83	.37	
Step 2: Temporal diversity													
Time urgency diversity				.29	.64	.06	.57	.56	.12	.63	.68	.13	
Future time perspective diversity				.39	.64	.08	.56	.56	.11	.99	.63	.19	
Pacing style diversity				05	.52	02	27	.46	08	50	.47	16	
Step 3: Moderators													
Shared temporal cognition							.93	.26	.47**	.83	.28	.42**	
Temporal TMS							.54	.39	.18	.58	.42	.20	
Step 4: Interactions													
Time Urgency Diversity × Shared Temporal Cognition										1.93	.82	.33*	
Future Time Perspective × Shared Temporal Cognition										.23	.68	.04	
Pacing Style Diversity × Shared Temporal Cognition										33	.68	08	
Time Urgency Diversity × Temporal TMS										.15	.96	.02	
Future Time Perspective × Temporal TMS										2.30	1.65	.19	
Pacing Style Diversity × Temporal TMS										45	.85	07	

Note. N = 71. TMS = transactive memory systems. * p < .05. *** p < .01.

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