

The Temporal Aspect of Team Cognition: Proposing the Construct of Team Temporal Cognitions

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This study proposes a new construct of team temporal cognitions to signify the temporal dimension of team cognition. The new construct consists of two sub-dimensions that incorporate both the shared understanding and the shared admiration of temporal requirements of tasks. It is argued that team members adjust their task actions based on their perceptions of designated schedules and deadlines; such perceptions inevitably affect the execution of team tasks, and ultimately affect team performance. A research framework is developed to theorize the sources and effects of team temporal cognitions, and to guide future research in the area.

INTRODUCTION

In the literature, team cognition has been suggested as one primary mechanism for facilitating knowledge activities in work teams (Kraut and Streeter, 1995; Faraj and Sproull, 2000; Levesque, et.al., 2001; He, et.al., 2007). Especially for knowledge-intensive projects such as information systems development that require knowledge and expertise from many domains (Curtis, et.al., 1988), the mere presence of individuals with diverse knowledge is an insufficient condition for a team to achieve quality performance (Faraj and Sproull, 2000). Team cognition plays an important role in that it “allow(s) team members to draw on their own well-structured knowledge as a basis for selecting actions that are consistent and coordinated with those of their teammates” (Mathieu, et.al., 2000; p. 274).

In general, team cognition refers to the mental models that are collectively held by team members enabling them work together in a coordinated fashion (He, et.al., 2007). Team cognition is complex and multi-dimensional in nature. Empirical research of team cognition has placed much emphasis on the shared understanding of team-specific and task-specific knowledge and expertise (e.g., Faraj and Sproull, 2000; Mathieu, et.al., 2000; Levesque, et.al., 2001; He, et.al., 2007). Other aspects of team cognitive have not received much attention. One of the understudied aspects of team cognition is the collective mental model that guides team members’ behaviors to meet with the schedules and deadlines designated for team tasks. Given the importance of meeting schedules/deadlines to team performance, understanding the temporal aspect of team cognition is critical to the successful management of team projects.

This study proposes a new construct of team temporal cognitions in order to enhance our understanding of the special dimension of team cognition for coping with schedules and deadlines. The paper is organized as follows. First, the literature of team cognition is reviewed. Previous work of the temporal aspect of team cognition is discussed. Then, a research framework is developed to theorize the sources and effects of team temporal cognitions in the context of project management. The paper ends

with a summary of the propositions and a discussion of the implications for future research, team practice and team leadership.

THEORETICAL BACKGROUND

Team Cognition: An Intervening Mechanism for Teams to Achieve Quality Performance

Teams are “group(s) of two or more individuals who must interact cooperatively and adaptively in pursuit of shared valued objectives” (Cannon-Bowers, et.al., 1993, p. 223). For the group of people to leverage knowledge and skills possessed by each individual member, a set of collective mental models emerge to guide them through team processes as a coordinated unit. The set of mental models, often referred to as team cognition, functions as mental templates which are imposed on information environments to give them form and meaning, providing a cognitive foundation for action (Walsh, 1995).

The concept of team cognition was first proposed as an explanatory mechanism for understanding interactions in effective teams (Cannon, et.al., 1993; Klimoski and Mohammed, 1994; Cooke, et.al., 2000). Team researchers soon embrace the concept as a powerful intervening mechanism that determines the effectiveness of work teams (Cannon-Bowers and Salas, 2000; Mohammed and Dumville, 2001; He, et.al., 2007). Team cognition enables members to formulate accurate teamwork and taskwork predictions (Cannon-Bowers, et.al., 1993; Katz and Tushman, 1979), adapt their activities and behaviors in a collaborative way, and thereby increase overall team effectiveness (Cannon-Bowers and Salas, 2001; Lewis, 2004; Salas and Cannon-Bowers, 2001). Without well-formed team cognition, team members will not be able to efficiently share knowledge and information, coordinate each other’s activities, resolve conflicts, or negotiate agreed-upon solutions (Walsh, 1995; Cannon-Bowers and Salas, 2001; Hollingshead, 2001). For knowledge-intensive projects in special, team cognition is found to help teams effectively manage their members’ knowledge, expertise, and skills as integrated assets (Walz, et.al., 1993), assign tasks to people with the most capability (Faraj and Sproull, 2000), and coordinate their actions and adapt their behavior to the demands of the project and the expectations of other members (Cannon-Bowers, et.al., 1993, Levesque, et.al., 2001). Therefore, the performance of a team can be effectively predicted by the maturity of team cognition in the team (He, et.al., 2007).

As a set of collective mental models, team cognition is complex and multi-dimensional in nature. Conceptually, team cognition covers a broad range of mental models among team members regarding the shared understanding of task-specific knowledge, task-related knowledge, knowledge of teammates, and attitudes/beliefs (Cannon-Bowers and Salas, 2001). For a project team in particular, various mental models such as equipment model, task model, interaction model, and team model may co-exist to direct members’ behavior (e.g., Cannon-Bowers, et.al., 1993). In addition, team cognition is contingent on tasks and the surrounding environment (Cooke, et.al., 2001). For example, the team cognition of a clinic operating team (e.g., including a surgeon and a nurse) could be very different from that of a software development team, in that the former requires that portions of members’ knowledge bases be shared or identical, while in the latter instance, compatible, but different, knowledge and skills are assumed to be beneficial to team effectiveness (He, et.al., 2007). However, empirical studies have been largely centered on the mental models that leverage task-related knowledge and process-related knowledge (Mathieu, et.al., 2000; He, et.al., 2007), including the understanding of concrete tasks (Levesque, et.al., 2001) and the understanding of the distribution of members’ expertise (Faraj and Sproull, 2000). Other dimensions of team cognition have not received much research attention.

One understudied dimension is the temporal aspect of team cognition (Gevers, et.al., 2006) that guide members’ time pacing behavior of working on assigned tasks. People prefer different pacing styles when working on a task: some prefer to act early and finish early; some prefer to wait till the “last minute”; while others prefer to act steadily within a given timeline. Individual pacing styles reflect personal preference and are not necessarily related to job performance. However, for a team whose performance is shaped by members’ collective actions, the team-level time pacing style will inevitably affect team performance by reflecting the behavior pattern among team members. An early action pacing style will greatly help the team to achieve team success in that it suggests the propensity of team members to jointly

work on tasks once they are assigned, therefore assures enough time for task execution and ultimately a timely completion of the tasks. In contrast, a late action pacing style indicates the reluctance among team members to work on tasks before the approaching of deadlines. The resulted last minute rush on tasks will likely lead to the failure of meeting schedules (Gevers, et.al., 2006). Thus, it has great relevance to team research to study the special mental model that guides team members' task pacing behaviors.

Team Temporal Cognitions

Team researchers have long recognized the significance of schedule and deadlines in the progress of teamwork. For example, Gersick (1988; 1989) found that the progress of work teams is likely triggered by team members' awareness of time and deadlines than by the completion of certain tasks in a special development stage. McGrath and O'Connor (1996) posited that schedules and deadlines serve as an important mechanism for synchronizing group activities by specifying who is supposed to do what, when tasks should be completed, and how the combination of individual efforts should ultimately produce the desired end-product. However, meeting schedules and deadlines will unlikely be achieved if team members (1) are not aware of the schedules and deadlines, and/or (2) do not feel responsible for meeting with the schedules and deadlines. The team-level understanding and admiration of the temporal requirements of team tasks should be considered as an important dimension of team cognition in that it induces members to deliberate their task pacing behaviors, such as whether to speed up the execution of a task, in order to meet the designated schedules and deadlines and ultimately to achieve team success.

So far, the temporal aspect of team cognition has not been well studied in the literature. Of the rare attempts, Gevers and colleagues proposed shared temporal cognitions as "the extent to which group members have congruent mental representations of the temporal aspects of a specific group task" (Gevers, et.al., 2006; p. 54). They conducted an experimental study to examine antecedents and effects of shared temporal cognitions. The results suggest that the similarities of individual time pacing styles help the formation of shared temporal cognitions during an early stage; later pacing-related activities such as temporal reminders (reminding teammates of schedules and approaching deadlines) further develop and reshape the shared temporal cognitions in the team. However, Gevers and colleagues have failed to find evidence to support their proposition that shared temporal cognitions exert direct effects on team performance.

Gevers and colleagues (2006) discussed shared temporal cognitions as the temporal aspect of team cognition. However, the last finding of their experimental study – the irrelevance of shared temporal cognitions to team performance – is in conflict with the team cognition theory. Team cognition theory posits team cognition as the cognitive foundation for teams to leverage members' knowledge and coordinating one another's activities in order to achieve quality performance (Cannon-Bowers and Salas, 2001). Thus, cognitions that have little influence to team performance should not be considered as part of team cognition.

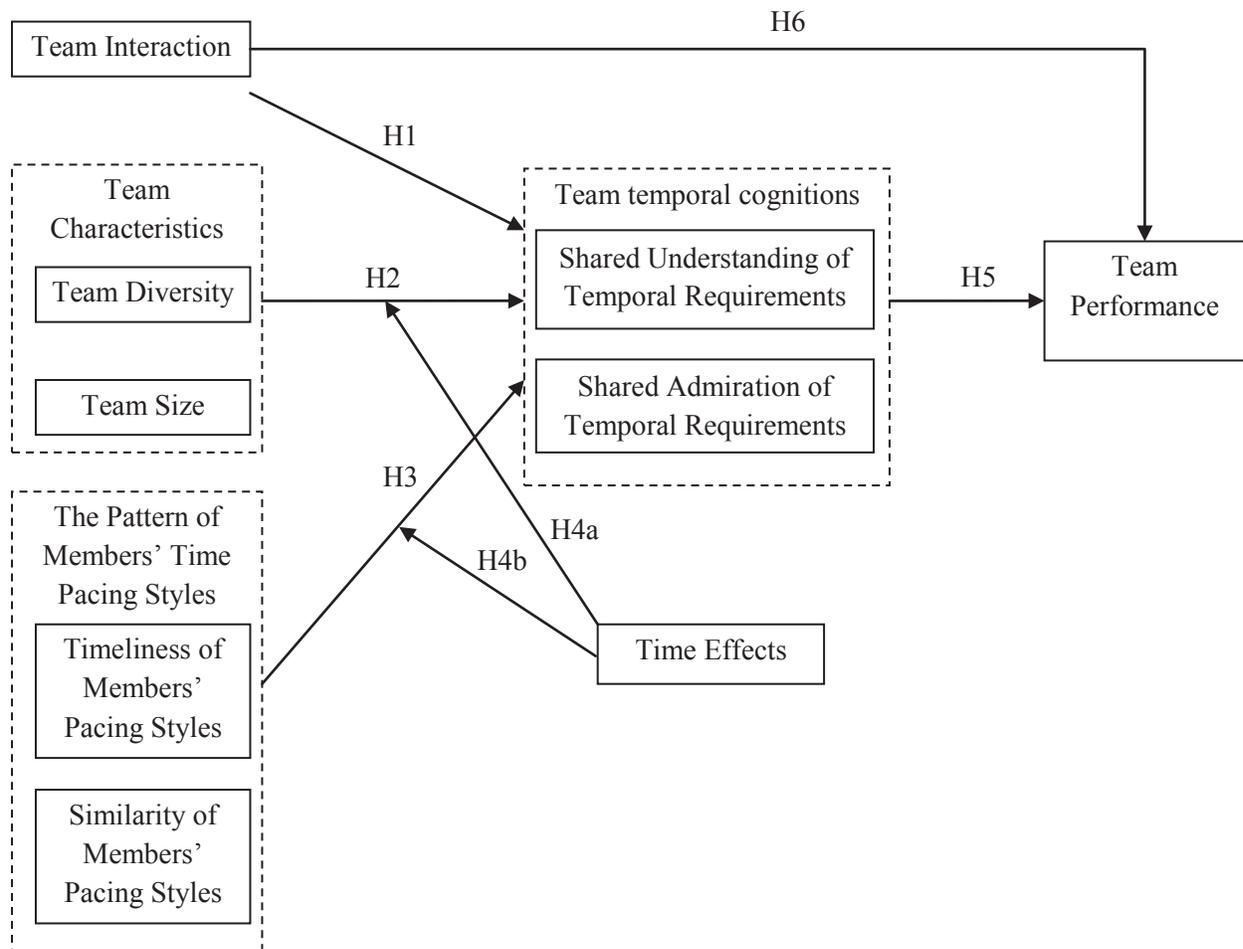
A close examination of the instrument that Gevers and colleagues have used for measuring shared temporal cognitions suggests that the construct has ignored the instrumental functions of team cognition in work teams. The instrument measured the shared understanding within a team in terms of schedules and the time allocated for each task. There is no assessment on the extent to which members believe that meeting the schedules is important to the team.

Team cognition is the underlying cognitive templates that direct team members to perform toward favorable team outcomes; while shared temporal models is a shared perception of team schedules and deadlines without further implications for behaviors. For an effective team, it is not sufficient for members to acknowledge team schedules and deadlines. Team members should develop a shared respect to the schedules and deadlines. Such a respect will lead to appropriate pacing behaviors, such as to start working on tasks early and complete tasks in a timely fashion, in order to achieve satisfactory team outcomes. Thus, I suggest a new construct of team temporal cognitions by integrating both the shared understanding and the shared admiration of temporal requirements (i.e., schedules and deadlines) of tasks in the team. The two sub-dimensions of team temporal cognitions will jointly suggest the extent to which a team is willing to work ahead of schedules to assure on-time delivery of products.

RESEARCH FRAMEWORK

In the study, a new construct of team temporal cognitions is proposed as the temporal dimension of team cognition. To test the validity of the new construct, a research framework (presented in Figure 1) is developed based on the literature of team cognition.

FIGURE 1
RESEARCH FRAMEWORK FOR STUDYING TEAM TEMPORAL COGNITIONS



Hypothesis 1, 2, and 3 theorize three sources from which team temporal cognitions will emerge and develop: team interactions, team characteristics, and the pattern of members' personal pacing styles.

Hypothesis 1 examines the determining effects of team interactions, which refers to the interactive activities and behaviors that members perform to carry out team tasks and facilitate team performance. These activities and behaviors help team members to exchange and process information and knowledge, develop the metaknowledge of others, and form perception of the focal task, leading to the formation and development of team cognition (He, et.al., 2007). For the focal construct of team temporal cognitions, intensive team interactions (e.g., frequent communications among team members) will help members develop both a shared understanding and a shared admiration of the temporal requirements of team tasks.

Hypothesis 2 proposes that team characteristics, including team diversity and team size, will affect the development of team temporal cognitions. Team diversity comprises both observable and non-observable

attributes (Milliken and Martins, 1996; Schippers, et.al., 2003). Attributes such as race, age, and gender are observable; In contrast, subtle attributes such as education, technical abilities, functional background, organizational tenure, personality characteristics, or values are non-observable. Team diversity research has concluded that in general it is easier for a team with little diversity to develop high levels of team cognition than for a team with large diversity. A team's gender pattern is one of the few exceptions: empirical research has found that mixed-gender teams are likely to develop higher levels of team cognition than that of single-gender teams (He, et.al., 2007).

Team size refers to the number of members in a team. Normally, team size exerts a negative effect on the development of team cognition in that the larger a team's size, the less manageable will be the team process and team interactions (Riopelle, et.al., 2003). Following the reasoning, it is expected that larger teams will have more difficulty to share perceptions of tasks' temporal requirements among members than that in smaller teams; thus, team size will negatively affect the development of team temporal cognitions.

Hypothesis 3 argues for the determining effects of the pattern of members' personal time pacing styles in a team. The pattern should examine the similarity among members' pacing styles, as well as the timeliness (referring to the tendency of conducting early actions) of these pacing styles. Team temporal cognitions are expected to develop faster in a team in which members share similar early action pacing styles than in other teams.

Hypothesis 4 proposes time effects on the development of team temporal cognitions. He and colleagues (2007) find that the influence of team characteristics on the development of team cognition is strong at the formation of a team, and fades away over time; they argue that as a team progresses, team cognition is shaped consistently by team interactions and less and less by pre-existing contextual factors. Following the same reasoning, two sub-hypotheses are developed: H4a: the effects of the three team characteristics on team temporal cognitions will decrease over time; and H4b: the effect of the pattern of members' personal pacing styles on team temporal cognitions will decrease over time.

Hypothesis 6 addresses the effects of team temporal cognitions on team performance. In consistent with other dimensions of team cognition, teams with high levels of team temporal cognitions are expected to achieve better performance than that of other teams (H6). Team temporal cognitions is developed based on the positions that a thorough understanding of, accompanied with due respect to, the temporal requirements of team tasks will lead to the time execution of tasks.

The research framework suggests that team interactions exert a direct effect on team performance (H7) after controlling the effects of team temporal cognitions. In other words, team temporal cognitions partially mediate the effects of team interaction on team performance. Such a proposition is based on the team research that highlights the importance of team interaction as a primary mechanism for team members to exchange knowledge and information and to achieve quality performance (Robey, et.al., 1993; Poole, 1999).

SUMMARY AND DISCUSSION

The current study proposes team temporal cognitions as a temporal dimension of team cognition. Unlike previous research that focuses on the shared understanding of schedules and deadlines, the proposed construct of team temporal cognitions consists of two sub-dimensions that incorporate both the shared understanding and the shared admiration of temporal requirements of tasks. A research framework is developed to theorize the sources as well as the effects of team temporal cognitions.

The study intends to enrich our understanding of the temporal aspect of team cognition. Future research, especially empirical studies, is needed to test and verify the construct of team temporal cognitions with the proposed framework in various contexts of work teams. Given the importance of meeting schedules/deadlines to work teams, the study of the temporal aspect of team cognition will be a promising area for team research.

According to the proposed structure of team temporal cognitions, a team will be viewed as of high levels of team temporal cognitions only if the team presents significant development of mental models on

both sub-dimensions. Figure 2 further elaborates how the two sub-dimensions interwoven with each other to jointly determine the levels of team temporal cognitions.

FIGURE 2
SUB-DIMENSIONS OF TEAM TEMPORAL COGNITIONS

		Shared Understanding of Temporal Requirements	
		High Levels	Low Levels
Shared Admission of Temporal Requirements	High Levels	High	Intermediate
	Low Levels	Intermediate	Low

A team that is high on both sub-dimensions will be viewed as of high levels of team temporal cognitions; a team that is low on both sub-dimensions will be viewed as the opposite. In addition, a team that is high only on one sub-dimension, either the shared understanding of temporal requirements or the shared admiration of temporal requirements, will be viewed as intermediate towards high levels of team temporal cognitions. The implication is that both the understanding and the admiration of temporal requirements are important for directing members to perform within appropriate timelines. A lack of development on either sub-dimension will be insufficient for a team to develop high levels of team temporal cognitions to facilitate the execution of team tasks within appropriate timelines.

The proposition of team temporal cognitions has strong implications to team practitioners, especially to team leaders. For a team to achieve favorable outcomes, significant emphasis on schedules/deadlines is required. Team leaders should consistently monitor and facilitate the development of team temporal cognitions through team process. In addition, knowing schedules/deadlines does not necessarily mean that members will adjust their behaviors to comply with the schedules/deadlines. Special emphasis should be placed on educating team members regarding the importance of the designated schedules and deadlines. Only with a sufficient understanding of and the due respect to the temporal requirements of team tasks, will team members be inherently motivated to adjust their activities and behaviors and execute tasks within appropriate timelines.

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