Chapter 10
Reaching for the Moon: Expanding Transactive Memory's Reach with Wikis and Tagging

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ABSTRACT

Transactive memory systems (TMS) support knowledge sharing and coordination in groups. TMS are enabled by the encoding, storage, retrieval, and communication of knowledge by domain experts—knowing who knows what. The NASA Ames Intelligent Robotics Group provides an example of how TMS theoretical boundaries are stretched in actual use. This group is characterized as being highly innovative as they routinely engage in field studies that are inherently difficult due to time and technology resource constraints. We provide an expanded view of TMS that includes the technology support system available to this group, and possible further extensions to NASA's or other such dynamic groups' practice.

INTRODUCTION

The United States National Aeronautics and Space Administration (NASA) is pushing to return astronauts to the Moon by 2020, and then on to Mars (Lawler, 2007). Robots will play a crucial role in this vision by performing time consuming, repetitive tasks that have little to gain from high-level human reasoning. The Intelligent Robotics Group (IRG) at NASA Ames Research Center develops software enabling space exploration robots of the future to carry out their tasks in unstructured environments without requiring human guidance at every step.

The dynamics of innovative, research-oriented groups such as IRG present a considerable challenge to capturing and reusing knowledge. In their discussion of knowledge management in research

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and development, Armbrecht et al. (2001) note that managing knowledge is not literally possible in R&D environments, and that facilitating knowledge flows is a more productive approach. Support for the development, maintenance, and augmentation of cognitive Transactive Memory Systems is one way to facilitate these knowledge flows.

Transactive Memory System (TMS) theory provides a framework based on group-level cognition describing how individuals in a group can cooperatively learn, store, use, and coordinate their knowledge to increase the group's effectiveness (Brandon & Hollingshead, 2004; Lewis, Belliveau, Herndon, & Keller, 2007; Moreland, Argote, & Krishnan, 1998; Wegner, 1987). TMS are the cognitive memory systems through which teams know who knows what, who needs what knowledge, and how to coordinate given the distribution of this knowledge. Much of the research on TMS has focused on small, stable groups. However, simulation models suggest that TMS may be of even more value to larger groups, groups in a dynamic task environment, and groups that deal with volatile knowledge environments (Ren, Carley, & Argote, 2006). At the same time, more dynamic and emergent environments present difficulties around the boundaries of TMS mechanisms (Majchrzak, Jarvenpaa, & Hollingshead, 2007; Nevo & Wand, 2005).

Just as returning to the Moon and sending humans to Mars push our technical capabilities, the demands of the required tight time horizons, technical integration, and fluid teams push our understanding of team dynamics and support as well. In the sections of this article, we extend the concept and application of TMS to focus on fluid teams that interact with technology. We review the TMS literature with a specific focus of highlighting areas where knowledge management systems and practices can augment the TMS. We see knowledge management as intertwined technical systems and organizational practices supporting knowledge coordination, transfer, and reuse (e.g., Sambamurthy & Subramani, 2005).

Whereas most TMS research focuses on TMS development through teams working face to face on the task, we focus on how to extend TMS development in settings where computer mediated communication is prevalent and technology augmentation is part of the general task environment. We use IRG as an exhibit for this discussion, and conclude with further design ideas to generalize from this setting to organizational settings more broadly.

TRANSACTIVE MEMORY: A FOUNDATION FOR SUCCESSFUL TEAM WORK

Organizational knowledge is useful to the extent that knowledge is high quality, transfers across users, and is used in a coordinated fashion—for example, when team process knowledge supports the link between task knowledge and performance outcomes (Griffith & Sawyer, 2007; Griffith, Sawyer, & Neale, 2003; Haas & Hansen, 2007; Reagans, Argote, & Brooks, 2005). In this context, task knowledge is knowledge about the task at hand while process knowledge is about how to apply that task knowledge toward performance. Transactive memory, a type of process knowledge, is a team's way of knowing who knows what and how to coordinate as a result (Wegner, 1987). Transactive memory is a powerful force in team performance and provides our focus here (Kanawattanachai & Yoo, 2007; Lewis, 2004).

More specifically, a TMS describes how individuals in a group learn, store, use, and coordinate their knowledge to increase the group's effectiveness (Wegner, 1987). One of the main advantages of the TMS is that it provides individuals with more extensive and higher quality knowledge than they have access to in their individual memories (Moreland & Myaskovsky, 2000). TMS theory builds upon what is known about individual memory