

Informant Discrepancies in Transactive Memory System scoring

by

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Abstract

A transactive memory system (TMS) refers to a psychological phenomenon in which two or more people share, encode, and retrieve knowledge (Wegner, 1987). To develop, this system requires communication between those within the dyad or group. Through communication, individuals within dyads and groups can share their knowledge and encode new retrieved knowledge from others. The importance of a TMS lies in the fact that it reduces the labor for learning new tasks and materials by allowing each individual within a group to only memorize certain information; Hollingshead (1998a) describes it as a cooperative division of labor for joint tasks. Research has shown that a more effective TMS results in better performance in joint tasks (Choi, Lee, & Yoo, 2010; Lewis, 2004; Wegner, Erber, & Raymond, 1991). Transactive memory systems have many practical implications for the development of specific group training and information directory (a system organizing sources of various information) development (Huang, Barbour, Su, & Contractorv, 2013). TMS theory also applies to many different types of groups, including emergent groups, like those who worked to help rebuild after Hurricane Katrina (Majchrzak, 2007) and geographically dispersed groups, such as specific project teams in international businesses (Espinosa, 2007; Yuan, Fulk, & Monge, 2007).

To score dyads in TMS studies, current researchers have each individual rate TMS using a self-report scale and then aggregate the scores of the individuals within the dyad. The main purpose of this study was to explore the scoring methods currently used in TMS research by examining TMS rating discrepancies between members of a dyad, also referred to as informant discrepancies in the literature (De Los Reyes, Henry, Tolan,

& Wakschlag, 2009). More specifically, we examined whether discrepancies between group members, in their individual TMS scores, predicted performance over and above the aggregate group TMS score. This study also examined how constructs related to TMS development, such as communication and conflict, consensus about expertise, and relationship length, are associated with discrepancies in perceptions of TMS within a dyad. Transactive memory systems are a relatively new construct. Incorporating informant discrepancies into our understanding of TMS may provide additional information about the formation and maintenance of TMS within a dyad and a providing a more comprehensive view of dyadic and group functioning generally.

Introduction

Transactive memory (TM) is a group-think theory developed by Daniel Wegner in the 1980s. The original purpose of TM theory was to better understand how couples divide labor for informational problems, such as life organization and household responsibilities. TM is a socially organized type of memory that cannot be individualized (Wegner, 1987). A transactive memory system (TMS) requires two or more individuals to share, encode, and retrieve information through active communication (Wegner, 1987). For example, even in simple tasks that require two or more people to participate (e.g. preparing and organizing meals, organizing schedules for two or more people), the task is easier to complete with clear communication. For a more concrete example, imagine two individuals assigned to a grant-writing task. One individual is particularly skilled at persuasive writing, while the other is skilled at planning and researching sources. TMS and quality communication would allow these two individuals to effectively complete their task. Past research on communication has shown the importance of TMS to team cohesiveness, performance, and coordination (Hsu, Shih, Chiang, & Liu, 2012; Wegner et al, 1991).

Wegner (1987) describes TMS as a two-part construct composed of an internal and external memory. The internal memory refers to the memory of the individual and the external memory refers to the individual's awareness of another individual's knowledge (1987). Moreland and Myaskovsky (2000) likewise describe TMS as a collective system that exists due to the schema in the mind of each individual. This schema involves the knowledge of each individual's own expertise (internal memory) and their knowledge of the expertise of other individuals within their team or group

(external memory). Current research in the field focuses on the external memory factor of TMS rather than both internal and external factors.

Factors Impacting TMS

The formation and the effectiveness of the TMS that develops within a dyad depends upon many factors, including communication, differentiated knowledge, expertise consensus, and relationship length.

Communication

Communication between individuals within dyads is the backbone of TMS. According to Pinto & Pinto (1990), communication refers to the face to face or removed exchange (e.g. non-face to face communication) of information between two or more individuals. Communication is essential because it allows individuals to continually update, share, and retrieve knowledge from one another to encode to their own schema, and in turn update their own knowledge of new information about their team members (Wegner et al., 1991). For example, Wegner et al. (1991) state that it is important for others in a group or dyad to know what the other knows in order to be able to ask for and retrieve their knowledge; this knowledge of others' knowledge is described as meta-memory. Thus, communication in the form of the exchange of information is the factor that updates and reinforces meta-memory. Meta-memory, in turn, contributes to the TMS system by allowing individuals to appropriately access the information encoded by others. Indeed, researchers have been able to find a strong positive correlation between the quality of communication, TMS, and task performance (Hsu et al., 2012).

Although important to the formation of TMS, more research on how communication affects TMS in its different developmental stages is needed. For example,

not all communication is equally effective for TMS formation and maintenance. Only meaningful communication that allows group members to grow their meta-memory of each other's knowledge promotes the formation of TMS (Hollingshead 1998b, Lewis et al., 2004). In contrast, sharing redundant information may hinder TMS development (Gruenfeld, Mannix, Williams, & Neale, 1996; Hsu et al., 2012; Lewis et al., 2004). Specifically, if both members of a dyad hold the same skills and knowledge, they have no additional information to share with each other, hindering further TMS development. Additionally, ineffective communication exchanges do not promote TMS development. Hsu et al. (2012) state that communication difficulties can arise with mentally diverse teams, however, an increase of information exchanges, both formally and informally, increases understanding among team members and decreases levels of uncertainty. Communicating in different settings allows individuals to have a more comprehensive knowledge of their teammates.

Differentiated Knowledge and Expertise Consensus

A second aspect of TMS development is the differentiation of knowledge and shared awareness and agreement about such differentiated expertise (Peltokorpi, 2008). Differentiated knowledge within a dyad refers to the differences in expertise and skills between individuals; in other words, the different information team members can provide based on their existing knowledge. Differentiated knowledge between individuals within groups is also crucial to the development of TMS (Hollingshead, 2000). Hollingshead (2000) analyzed 22 work dyads and found that individuals learned more when they believed that their knowledge was differentiated. Specialization in different knowledge domains allows those within the group to see one another as useful and credible sources

of information (Hollingshead, 2000). In addition, more differentiated knowledge allows for less redundant information to hinder effective communication (Gruenfeld, Mannix, Williams, & Neale, 1996; Hsu et al., 2012; Muller and Turner, 2005).

Although not extensive, current research on TMS focuses more on perceived expertise than actual expertise. Participants' belief of expertise distribution within their dyads is important to TMS development. For example, when learning new information, group members who have the perception of differentiated expertise focus more on learning information only in their area of specialization, trusting that their partner will do the same (Hollingshead, 2000). Given a well-operating TMS, such division of labor then increases both individuals' pools of knowledge without any increased individual burden (Hollingshead, 2000). Austin (2003) indirectly reviewed actual expertise by examining TMS accuracy. Austin (2003) described TMS accuracy as the extent to which an individual within a dyad or team actually possesses the knowledge expected by the others in the team. Accuracy was measured by comparing reports of expertise of an individual by others, with their own expertise reports. The results revealed a strong positive relationship between TMS accuracy and performance (2003).

Related to expertise accuracy is agreement about expertise. This is referred to as expertise consensus and is described as the ability of individuals within a dyad or team to agree on who holds what knowledge (Austin, 2003). Austin (2003) measured this type of consensus as a component of TMS and found a significant positive relationship between a team's consensus and their performance. Austin (2003) connected consensus to the specialization factor of TMS, arguing that greater expertise consensus enables individuals

within a group to better coordinate their specialized knowledge, resulting in overall higher TMS scores.

Length of Relationship

Finally, because the formation of TMS is based on a shared history of communication and experience with others' knowledge and expertise (Wegner, 1991), strong transactive memory systems require time to develop. Time and shared activities during that time are important to TMS formation because they allow individuals within dyads to understand how information and knowledge is distributed among team members (Hsu et al., 2012). Additionally, time and shared activities allow individuals within groups to develop interpersonal relationships with one another. This increased familiarity, in turn, promotes greater TMS by decreasing "coordination losses." In other words, it increases the team's or dyad's ability to use their own and their teammates' knowledge and skills effectively for a given task (Zheng, 2012, p.578).

Indeed, more familiar dyads or groups generally have better functioning TMS (Goodman & Garber, 1988; Goodman & Leyden, 1991; Zheng, 2012). For instance, Wegner (1991) explored the performance of familiar couples and impromptu dyads in a categorical word memory task, where some participants in each condition (familiar and impromptu) were told specifically which category of words to memorize. The results revealed that natural couples with no expertise assignment performed better than all other conditions, but natural couples who were assigned categories of words to memorize performed worse than the impromptu dyads. Wegner (1991) interpreted these findings as indicating that the natural TMS expertise perception and assignment of familiar couples

had been interrupted, thus suggesting that over time individuals within a couple or dyad develop their own network of shared information. Time together promotes TMS development among randomly grouped individuals as well. Strangers trained together on the task perform better on categorical trivial pursuit tasks than strangers who were not trained (Hollingshead, 1998). These findings suggest that time spent together has a positive effect on TMS development. For example, imagine two individuals who have just started to work together. They must communicate enough between each other to understand where their skills lie, and how to best work together to accomplish tasks.

Measuring TMS

TMS is typically assessed through observed performance on group tasks, interviews, or through self-report scales.

Observational Method

During the early stages of research, TMS was frequently measured by observing participants engaging in a group task, such as radio assembly and word memory tasks. Researchers would record participants performing the task and code the video for conceptual indicators of TMS. For example, Moreland (1999) examined group interactions for indicators of specialization, coordination, and credibility (differentiated knowledge within dyad or team, communication quality during information exchanges, and trust of team-members' knowledge, respectively). Specifically, Moreland (1999) defined specialization as team members' ability to remember and unify their memory/knowledge of different factors of their task. He operationalized coordination as the extent to which groups interacted with few misunderstandings and more cooperation. Credibility was coded in terms of fewer public announcements of expertise in areas

pertaining to the task (having a strong TMS would negate the need for this kind of communication), more openness towards one another's suggestions, and less criticism of each other's input. Likewise, Mell, Knippenberg, and Ginkel (2014) observationally measured the retrieval factor of transactive memory by coding information-seeking types of communication (e.g., "are there any legal issues with this?") (p.1163).

Although these group tasks provided a controlled environment in which to assess TMS behaviors, laboratory measures of TMS do not fully capture the complexities of actual work-teams (Lewis, 2003). In particular, these observational methods are very task-specific. The observations are made based on knowledge about specific tasks and these tasks often do not match the complexity of tasks that real work groups experience, and therefore do not always translate well into the field (Lewis, 2003). They also fail to fully assess components of TMS that involve individuals' mental models of team knowledge.

Interviews

Interviews can be used when measuring TMS in work groups and organizations to ascertain tasks relevant to daily performance. In contrast to observational studies of TMS, research using interview methods has focused primarily on assessing mental models of TMS rather than its instantiation in behavior. For instance, Austin (2003) used interview methods to examine four dimensions of TMS centering on individuals' understanding of their group's knowledge: stock of knowledge, consensus about knowledge sources, specialization of expertise, and accuracy. Stock of knowledge referred to the total knowledge available to the group when all individual knowledge was combined. Accuracy referred to the extent that those perceived to have specialized

knowledge actually possessed that knowledge. Specialization of expertise was the extent to which a team identified distinct team members as possessing specific knowledge. Consensus about knowledge sources was defined as a mental model of knowledge distribution within a team, or more broadly, agreement about “who knows what” (Austin, 2003, p. 867).

This study used a semi-structured interview asking participants about recent work issues and relevant skills and relationships usually required for their general duties. Their responses were then used to create tasks involving specific problem-solving scenarios (based on identified work issues) relevant to each work group. Specialization of expertise was coded by asking participants to identify who in their group held each skill. Consensus about knowledge sources was assessed by determining the consistency with which participants within a group all identified the same member for a given skill. Accuracy was indicated by high problem solving scores on the scenarios relevant to each participant’s identified skills. Performance was measured using three methods (goal attainment, internal evaluation, and external evaluation). Goal attainment was measured by examining whether the groups attained the goals set by the company the year before. Next, internal evaluation was measured by having groups rate their own performance on those goals. Lastly, external evaluation was measured by having the strategic managerial team rate each group on their performance. Results were consistent with previous research; consensus, accuracy, and specialization aspects of TMS predicted performance on at least one measure of performance. This method of assessing TMS has the advantage of being more ecologically valid than tasks unrelated to typical group work. However,

generalizability of results and replicability could be a potential issue, as the measures were tailored to the specific groups and tasks used in that study.

Self-Report

Due to the difficulty of generalizing observational and interview-based methods in TMS field studies, Lewis (2003) developed a more generalizable, less task-focused self-report measure of TMS that bridges perceptions of TMS with TMS-related behaviors. The Lewis (2003) TMS scale consists of 15 items, with 5 items dedicated to each of 3 TMS indicators: specialization, credibility, and coordination. It is the most widely-used scale in current TMS research and has been successfully utilized in field and laboratories settings among groups of various sizes (Dai, Du, Byun, & Zhu, 2017; Lewis, Lange, & Gillis, 2005; Michinov, Michinov, & Huguet, 2009; Zheng, 2012). For example, Peltokorpi & Hasu (2016) used the Lewis (2003) TMS scale to study the productivity of 124 multi-technological research teams. After removing 5 poor fitting items, they found that TMS partially mediated the relationship between task orientation and team innovation. Specifically, per Peltokorpi & Hasu (2016), task orientation enhanced TMS processes (specialization, shared expertise awareness), which in turn predicted more team innovation.

The majority of research using Lewis's (2003) TMS scale has been conducted with professional teams. However, Wegner (1987) originally developed the concept of TMS for the shared cognition of partners in an intimate relationship. Accordingly, Hewitt and Robert (2015) recently modified Lewis's (2003) TMS scale for use with dyads and romantic couples, rather than work groups, modifying the wording to be more oriented to

couples. For example, “team members” was changed to “my partner” or “my partner and myself.” In their validation study, Hewitt & Robert (2015) found the modified TMS scale to be reasonably reliable and valid among adult romantic couples, with the expected three-factor structure (specialization, credibility, coordination). No known research has yet used the Hewitt & Robert (2015) scale among friendship dyads.

Informant Discrepancies

To date, researchers assessing TMS using self-report scales typically aggregate participants’ scores within the dyad or group. Although TMS scores of individuals in a group are often strongly correlated (e.g., Lewis, 2003; Marques-Quinteiro et al., 2013), correlations represent *rank* similarity in scores within a group. This is an indication that there may still be significant differences in absolute levels of TMS scores among group members as well as significant variability between groups in the extent of these differences. However, researchers do not address discrepancies between these scores in the TMS literature. Nevertheless, there is mounting evidence from clinical and developmental psychology studies that the discrepancies between informants in their perceptions of a phenomenon is important to consider.

Informant discrepancies refer to differences in ratings provided by individuals reporting on the same phenomenon (e.g., parent versus teacher reports of child behavior problems, parent versus child reports of family conflict). Such discrepancies are ubiquitous in research on child adjustment (Achenbach, 2006) and family dynamics (Ohannessian & De Los Reyes, 2014; Ohannessian, Lerner, Lerner, & von Eye, 1995). For instance, De Los Reyes et al. (2009) measured child disruptive behaviors among 327 participants, using reports from parents, teachers, and observational methods. Of the 124

participants who were reported to have disruptive behavior symptoms, only 24 (9%) were reported by both parents and teachers, while the disruptive symptoms of the remaining 100 children were reported by either a teacher or parent, but not both (De Los Reyes et al., 2009).

Such discrepancies have long been considered merely measurement error (De Los Reyes & Kazdin, 2005). However, recent research has shown that informant discrepancies are a source of meaningful information unto themselves (De Los Reyes, 2011). For example, in a review of informant discrepancies research, De Los Reyes (2011) suggests that informant discrepancies in domains such as relationship quality and child adjustment problems predict poorer youth outcomes, such as risky driving and delinquency, over and above individual reports. Likewise, individual adjustment and group level dynamics predict increased informant discrepancies. Ehrlich et al. (2015) showed that family members' depressive symptoms and poor family communication, both independently, predicted discrepancies in parent-teen reports of family conflict.

Measuring Informant Discrepancies

There are multiple ways to measure informant discrepancies. Three primary methods involve calculating the difference between raw scores, the difference between standardized scores, and the residual of one score controlling for the other. Finding the difference between raw scores involves subtracting one informant's raw-reported score from another. Determining the difference between standardized scores involves standardizing each informant's score and then subtracting their standardized scores. The residual difference scoring method involves running a regression with one informant as a predictor and one as the outcome. Then, the residualized informant's score (difference

between the predicted rating and the actual rating of the informant) is used as a measure of informant discrepancy.

De Los Reyes & Kazdin (2004) argues that researchers should not use these methods interchangeably and caution that the use of different methods can lead researchers to different conclusions. De Los Reyes & Kazdin (2004) explore these differences by examining discrepancies between child and parent reports on externalizing symptoms from the research diagnostic interview (RDI; assesses presence, intensity, and duration of symptoms of diseases such as oppositional defiant disorder and attention deficiency disorders) and their associations with individual informant's reports and demographic and family characteristics. The different methods of computing informant discrepancies produced strikingly different results. Residual scores were almost perfectly correlated ($r=.99$) with the scores of whichever informant was used as the outcome variable in the regression equation. However, residual scores were not at all related to the informant's scores used as the predictor in that equation. This means that variance accounted for by the "predictor" informant is not present in the residualized discrepancy score. Consequently, associations between residualized difference scores and family characteristics were indistinguishable from associations between the "outcome" informants' scores and family characteristics. Likewise, raw difference scores were relatively susceptible to differing variance in informants' reports, where the informant with more variance in his or her score accounted for a disproportionate amount of the explanatory power in the resulting raw discrepancy score (De Los Reyes & Kazdin, 2004). In turn, associations between raw difference scores and family characteristics were somewhat inconsistent. Standardized difference scores produced the most equitable

results across informants and were most consistently linked with family characteristics. Therefore, De Los Reyes & Kazdin (2004) argue that standardized difference scores should be the preferred method of measuring informant discrepancies when a single “discrepancy” variable must be utilized.

Laird & De Los Reyes (2013) also argue against using raw difference scores, instead suggesting the use of interactions to represent discrepancies between informants. They note that raw difference scores will not significantly predict another variable if both informants’ scores have equal variances and correlations with an outcome variable (2013). Furthermore, they argue that a difference score mathematically constrains the coefficients of the two informants’ reports to be equal in size but opposite in direction, thus essentially testing the hypothesis that one informant’s reports are positively correlated with the outcome while the other informant’s reports are negatively correlated with the outcome. They present evidence that interaction terms do not suffer from this problem. Interactions function well as measures of informant discrepancies when the discrepancies are predictors, but less optimally when they are outcome measures, however. They also do not allow researchers to predict outcomes from discrepancies without first controlling for the informants’ individual reports (due to the need to control for “main effects” before an interaction) and are less intuitive measures of difference.

Factors impacting ID as it relates to TMS

Communication

Many of the same factors associated with TMS may also impact the degree of discrepancy in individuals’ perceptions of it. For instance, interaction quality is related to informant discrepancies. Ehrlich, Richards, & Cassidy (2015) argue that individual

differences between raters, and factors relating to the quality of those raters' relationships, such as communication, conflict, and consensus, can contribute to the discrepancies in multiple reports. Specifically, Ehrlich et al. (2015) found that conflicted, or sparse communication patterns, as observed during mother-adolescent interactions, predicted greater absolute informant discrepancies of relationship conflict, while more open communication had the opposite effect. Furthermore, poor communication may lead to greater discrepancies due to a lack of shared knowledge of a specific domain. Ehrlich et al.'s (2015) finding suggests that relationship factors like interaction quality may affect partner agreement on TMS scales (i.e., informant discrepancies), particularly due to potential disagreements about expertise in a given domain. Therefore, dyads with better communication and less conflict would be expected to exhibit greater TMS and smaller TMS discrepancies.

Length of Relationship

Length of relationship has yet to be directly examined with informant discrepancies. The length of relationship between individuals is a factor in determining their familiarity. Research that examines familiarity, performance, and decision making suggests that familiarity is beneficial to group development. Individuals in familiar groups have more, and more accurate, information about each team member's knowledge (GruenFeld, Mannix, Williams, & Neale, 1996). This increased understanding of team members' knowledge should therefore increase overall TMS within the dyad (ability to utilize differentiated knowledge) and decrease discrepancies in perceived TMS (differences in TMS scale scores) between dyad members.

Expertise Consensus

Expertise consensus has not been explored specifically in relation to informant discrepancies. However, expertise consensus (or lack thereof) is itself a form of discrepancy and there is evidence that dyads with greater discrepancies in one area of dyadic behavior tend to have greater discrepancies in others (De Los Reyes & Kazdin, 2006; Rote & Smetana, 2016). This similarity in discrepancy level appears to be particularly true when considering discrepancies about constructs that involve dyadic information or behaviors (such as level of conflict and maternal knowledge about teen behaviors; Rote & Smetana, 2016). TMS and expertise comparisons both occur within a shared context between dyad members. Therefore, discrepancies in members' perceptions are likely to be correlated, resulting in greater expertise consensus being associated with smaller informant discrepancies about TMS.

Current Study

The purpose of the current study was to examine whether informant discrepancies in TMS scores offer helpful information about dyad dynamics and group performance over and above information provided by aggregate TMS scores. This study also examined how factors previously associated with aggregate TMS scores, such as interaction quality, expertise consensus, and length of acquaintances are related to the extent of discrepancy between dyadic partners TMS scores. Given these goals, and information gained from prior literature, the following was hypothesized:

Hypothesis 1: Dyads with a higher combined TMS score will perform better on a dyadic Trivial Pursuit task.

Hypothesis 2: Greater discrepancies between TMS scores will predict lower scores on the dyadic Trivial Pursuit task.

Hypothesis 3: TMS score discrepancies will predict additional variance in task performance over and above the combined TMS score.

Hypothesis 4: Dyads who have known each other longer will have higher combined TMS scores and smaller informant discrepancies in TMS scores.

Hypothesis 5: Dyads with better interaction quality (e.g. better communication and lower conflict) will have higher combined TMS scores and smaller discrepancies between partners in their perceived TMS.

Hypothesis 6: Dyads with more expertise consensus will show higher aggregate TMS scores and smaller TMS discrepancies.

Methodology

Participants and Recruitment

A total of 40 dyads participated in this study. Examinations of outliers, identified by a Mahalanobis distance with a significant Chi-square distribution of $p < .001$ (as suggested by Tabachnick & Fidell, 2007), resulted in the removal of four dyads. The final sample therefore consisted of 36 dyads, comprised of 72 adults from the Tampa Bay area (Male: $N=31$, Female: $N=39$). Participants were recruited through the use of flyers on both USF Tampa and USF St. Petersburg campuses, postings on various Facebook groups (e.g. USF Tampa and USF St. Petersburg groups), and the University of South Florida St. Petersburg (USFSP) research participation system (SONA), through which students can choose research studies to participate in. Sessions for participants recruited through SONA were held in smaller 2 to 4 participant groupings on the USFSP campus. Sessions for participants recruited through flyers and Facebook postings were held in larger 6 to 12 participant groups at the USFSP and USF Tampa campuses. The latter sessions were open to all in the Tampa Bay area, including university staff. Because at least two individuals were required for each study session, participants were encouraged to bring another individual to the sessions. At all sessions, participants either brought a familiar person, or came alone and were placed in an impromptu dyad. Approximately 97% of participants were students from the USF Tampa and USF St. Petersburg campuses. The remaining 3% of participants were university staff members. Participants in large sessions were compensated with food and refreshments; participants who registered through the school research participation system, SONA, were awarded extra credit for their participation consistent with department policy. To encourage attention

and effort on the tasks, participants were rewarded with a Starbucks gift card if they earned a perfect score on the dyadic Trivial Pursuit task. Participants were predominantly white (63.5%) with an average age of 22.26 years (SD=3.64). See Table 1 for more information about the demographic characteristics for the 72 participants retained in the sample. *Table 1: Demographic Characteristics*

Characteristics	N	%
Gender		
Female	39	54.2
Male	31	43.1
Non-binary/other	2	2.7
Ethnicity		
American Indian/Alaskan	3	4.2
Asian	9	12.5
Black	14	19.4
White	47	65.3
Hispanic	13	18.1

Note. N = 72, some participants selected more than one ethnic background but all percentages are out of 72.

Task

Based on the methods of Hollingshead (1998a), participants' main task in this study was to answer 20 Trivial Pursuit questions, adapted from the Trivial Pursuit Genius 2013 edition by Hasbro company. There were 4 questions from each of 5 different categories: science, entertainment, sports, American history, and literature. Questions in

each category ranged from easy to hard (e.g. easy: what is the only metal liquid at room temperature? and hard: what happens in a hydrogen bomb?). A complete list of questions is listed in Appendix A. Participants completed the same 20 questions at two points for each session, once individually for 8 minutes and once with a partner for 15 minutes. Consistent with Hollingshead (1998a), scores from the joint Trivial Pursuit task were used as an indication of joint task performance.

Measures

Demographics

Participants completed a short demographic questionnaire assessing their gender, age, ethnicity, and student level in college. Participants who were not currently students could note as much. Demographic questions are listed in Appendix B.

Transactive Memory System

TMS was measured using a 15-item self-report dyadic TMS scale validated for use in adult populations (Hewitt & Roberts, 2015). Hewitt & Robert's (2015) scale is based upon the original TMS scale by Lewis (2003) for larger teams but with wording adapted for dyads. This scale measures three dimensions of TMS with five questions assigned to each dimension: specialization, credibility, and coordination. For example, an item for the credibility dimension is, "I trust that my partner's knowledge is credible." All questions are assessed on a five-point response scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The full TMS scale is available in Appendix C.

Dyadic Functioning:

Similar to Lewis (2004), dyadic functioning in the task was assessed using single questions measured on Likert scales. Length of relationship, communication, conflict, and expertise consensus were all assessed. Length of relationship was examined by asking participants “How long have you known your partner?” and was assessed with a 5-point Likert scale, ranging from 1 (We just met) to 5 (One year or more). Communication and conflict were assessed by asking participants “How well were you and your partner able to communicate during this task?” and “How well do you and your partner get along?”, respectively. Participants rated each of these questions on a 5-point Likert scale ranging from 1 (not well at all) to 5 (very well). Scores on the conflict variable were reverse scored prior to analyses such that higher scores represented more conflict. These questions are listed in Appendix D.

Expertise Consensus

Expertise consensus was assessed by asking participants to individually indicate who was more knowledgeable about each of the five content areas assessed in the Trivial Pursuit task (“me,” “my partner,” or “equally knowledgeable”) and then combining these scores within the dyad. Individual answers of “me” were scored 1, “my partner” were scored -1, and “equally knowledgeable” were scored 0. Expertise consensus was then calculated by summing the partners’ scores within each content area, taking the absolute value of each sum score, and adding them. This initially resulted in a scale ranging from 0 to 10, with greater values indicating *less* expertise consensus, but the variable was later reverse-scored for ease of interpretation, such that greater scores on the 0-10 scale meant *more* expertise consensus.

For instance, if a dyad agreed that Partner 1 was more knowledgeable about every content area, Partner 1 would have scores of 1 (me) on all five items and Partner 2 would have scores of -1 (my partner) on all items. For each item, the sum score would be 0 (agreement) and the resulting scale sum would initially be 0. When reverse scored, this dyad would have an expertise consensus score of 10. Alternatively, if a dyad disagreed on all items such that each partner thought he or she was more knowledgeable, each partner would have scores of 1 on every item, the dyadic sum score for each item would be 2, and the overall scale score would initially be 10. After reverse scoring, this dyad would have a score of 0 on the expertise consensus variable.

Procedures

Upon arrival, participants were briefed about the study, the tasks they would be asked to perform, and were asked to provide informed consent. Participants first completed the above described 8-minute Trivial Pursuit task individually. They were then divided into either impromptu (if they came alone to the session) or natural familiar pairs (if they brought a partner to the session) and completed the same 20 questions with their partners for 15 minutes. Additional time was provided to encourage participants to discuss their answers and reach consensus during the dyadic Trivial Pursuit task. A pilot practice was used to determine the allotted times for both the individual and dyadic task. All participants were able to complete the tasks within the allotted time frames. After finishing these two tasks, participants completed all self-report measures individually in paper and pencil format (e.g. TMS, demographics, and dyadic functioning).

Analytic Method

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) 24 and the SPSS add-on PROCESS by Hayes (2013) for interaction analyses. Four research assistants entered data from the paper surveys and Trivial Pursuit tasks into two identical datasets. Discrepancies in data entry were checked by visually comparing values across the dual entries and errors were corrected by referencing and entering the correct values from the original paper forms. Less than 1% of data was missing, and was missing completely at random according to Little's (1988) MCAR procedure $\chi^2(146) = 132.45, p=0.782$ for a N of 72. Based on Widaman's (2006) recommendations for data sets with little missing information, a single imputation method was used to replace the missing data. Cronbach's alpha for the original 15-item TMS scale was acceptable for both partners ($r = 0.82, 0.72$ for Partner A and Partner B, respectively); however, certain items had unexpected negative or low loadings. Examination of item-total correlations for the scale as a whole, and for the individual subscales, indicated that three questions (4, 9, and 12) were problematic, and therefore were removed. The remaining scale consisted of 12 items and demonstrated acceptable internal consistency reliability for both individuals in the dyad ($\alpha = 0.87, 0.77$ for Partner A and Partner B, respectively).

Trivial Pursuit scores were measured by checking the participants' answers against an answer key and summing up the number of correct answers. Additionally, individual transactive memory system scores were computed by summing the ratings on the 12 remaining items comprising the TMS scale. Consistent with typical practice (Michinov & Michinov, 2009), dyadic TMS scores were calculated by then averaging

individual scores on the TMS scale across dyad members. In accordance with the recommendations of De Los Reyes (2004) and Laird and De Los Reyes (2013), informant discrepancies were analyzed in two ways: standardized difference scores and interaction terms. Standardized difference scores were computed by first converting individual raw TMS scores into Z-scores, subtracting the TMS scores within dyads, and then taking and recording the absolute value of the difference. Interaction terms were computed by centering and multiplying the individual TMS scores within a dyad.

Prior to testing the individual hypotheses, it was evident that individual Trivial Pursuit scores predicted later Dyadic Trivial Pursuit scores. Thus, to ensure that TMS scores did not appear to predict higher Trivial Pursuit scores only because people with higher aggregate TMS scores started out with higher individual knowledge; aggregate TMS scores were correlated with individual Trivial Pursuit scores. Individual scores on the Trivial Pursuit tasks were not significantly correlated with aggregate TMS scores. Therefore, any significant associations between aggregate TMS scores and dyadic Trivial Pursuit scores can be viewed as indicative of the role of TMS on improved dyadic coordination.

Linear regressions were used to analyze all hypotheses. To test Hypothesis 1, which predicted that the dyadic transactive memory system would predict dyadic scores on the Trivial Pursuit task, dyadic Trivial Pursuit scores were regressed upon aggregate TMS scores. Hypotheses 2 and 3 examined whether informant discrepancies predicted collaborative performance on the Trivial Pursuit task alone (Hypothesis 2) and above and beyond the variance accounted for by aggregate TMS scores (Hypothesis 3). To determine this, aggregate Trivial Pursuit scores were regressed upon the TMS

standardized difference score alone (Hypothesis 2) or upon the TMS aggregate scores in step one and then the TMS standardized difference score in step two of a hierarchical regression (Hypothesis 3). Hypothesis 3 was alternatively tested using an interaction term to represent TMS discrepancies; dyadic Trivial Pursuit scores were regressed upon both partners' individual TMS scores in step one and then a product term representing the interaction of the partners' individual TMS scores in step two of a hierarchical regression. Hypotheses 4 through 6 examined associations between relationship variables and TMS scores (aggregate and discrepancies). For all three hypotheses, aggregate TMS scores and TMS standardized difference scores were separately regressed upon relationship length (Hypothesis 4), communication and conflict (Hypothesis 5) and expertise consensus (Hypothesis 6).

Results

Data Cleaning

Prior to hypotheses testing, relevant assumptions were analyzed. All analyses involved the use of simple or hierarchical linear regression analyses; therefore, multivariate normality, linear relationship, homoscedasticity, autocorrelation, and multicollinearity were examined. As previously stated in the analytical plan, four multivariate outliers, indicated by a mahalanobis distance with a significant Chi-square distribution of $p < .001$ (as suggested by Tabachnick & Fidell, 2007) were removed. Independent t-tests indicated that outlying participants differed from retained participants only by student level. They did not differ in other demographics. Specifically, removed participants were earlier in their college career than retained participants, $M=2.00$, $SD=2.45$ for removed cases and $M=2.53$, $SD=1.42$ for retained cases, $t(38) = -2.71$, $p = 0.01$. Kolmogorov-Smirnov statistics were non-significant for all variables when predicting collaborative performance and aggregate TMS (individual transactive memory system) with p -values ranging from 0.06 to 0.20, suggesting a normal distribution. However, relationship length seemed to load more on three points of the scale (e.g. “just met,” and “6-12 months,” and “one year or more”). Scatter plots that examined the relationship between dependent (collaborative performance, aggregate TMS) and independent variables (aggregate TMS, communication, conflict, relationship length, etc.) of interest in the study suggest linear relationships. Moreover, analysis of residual P-P plots to examine the relationship between collaborative performance and its predictors (e.g. relationship length, aggregate TMS, communication etc.), and the relationship between aggregate TMS and its predictors, demonstrate no large deviations from

normality, suggesting homoscedasticity for most variables (Hair, Black, Babin, Anderson & Tatham, 1998). Lastly, multicollinearity was not excessive in the sample: Variance inflation factor (VIF) for all analyses was within normal ranges, (VIF: 1.00- 2.49) (Hair et al., 1998).

Utilization of a Subsample

No analyses reached significance in the full sample of 36 dyads. See Table 2 for descriptive statistics and correlations for variables in the full sample. This is at odds with previously established associations between aggregate TMS and task performance in the general literature, which tend to be moderately large and positive (Austin, 2003; Michinov & Michinov, 2009). For example, in Michinov & Michinov (2009) found an association as large as $r = 0.40$ between aspects of TMS and performance. However, association was non-significant in this sample and somewhat weaker than might be expected ($r = .31, p = .069$). Therefore, potential sources of differences between the current sample and prior research were considered. One such difference that emerged was the inclusion of impromptu dyads in the research design. Research on TMS has examined differences between established and impromptu dyads and found that TMS is operative in both groups after a short training period (although it is stronger in established dyads; Kozlowski & Ilgen, 2006; Prichard & Ashleigh, 2007). However, all such studies used indirect and observational methods of assessing TMS (Hollingshead 1998a, 1998b; Wegner 1991). To date, TMS self-report scales have, for the most part, been utilized among individuals who have prior experience working together (Lewis, 2004; Liao, O'Brien, Jimmieson & Restubog, 2015; Zheng, 2012). It is possible that self-reported

TMS may be inaccurate for impromptu dyads who are basing their reports on a single 15-minute joint task, leading to the observed inconsistencies.

This supposition was examined through a moderation analysis of relationship length on the association between TMS and performance. Using Process by Hayes (2013), the interaction of aggregate TMS and relationship length on dyadic Trivial Pursuit task performance was significant, $B = 0.12$, $t(32) = 2.34$, $p = 0.02$. The overall model was significant, $F(3,32) = 3.23$, $p = 0.035$, $R^2 = 0.23$, with a moderately large effect size $f^2 = 0.299$. Additionally, simple slope analyses were conducted to determine associations between aggregate TMS and task performance at different values of relationship length. Aggregate TMS scores were not significantly associated with dyadic task performance for individuals one standard deviation below the mean on familiarity ($M = 0.11$ -“0 to 1 month”), $B = -0.08$, $t(32) = -0.59$, $p = 0.559$, 95% CI [-0.35, 0.19], or with average familiarity for the sample ($M = 1.81$ -“2 to 6 months”), $B = 0.13$, $t(32) = 1.46$, $p = 0.155$, 95% CI [-0.05, 0.30]. However, aggregate TMS scores positively predicted dyadic task performance for dyads one standard deviation above the mean on relationship length ($M = 3.51$ - “one year or more”), $B = 0.33$, $t(32) = 3.06$, $p = 0.004$, 95% CI [0.11, 0.55]. Figure 1 depicts this interaction. Therefore, the hypotheses were reanalyzed among the subsample of 23 dyads with members reporting that they had known each other for at least some time prior to the current study (excluding those that indicated that they had just met). All participants with any familiarity were included in these analyses in order to maximize sample size and power, while maintaining a sample of individuals with at minimum a positive (if not always significant) association between TMS and task performance. These results are presented below in Table 2.

Table 2: *Dyadic Reports of performance, informant discrepancies, and dyadic relationships: Correlations and Descriptive Statistics for the Full Sample (N = 36)*

Variables	1	2	3	4	5	6	7
1. Transactive memory system	-						
2. TMS discrepancies	-0.09	-					
3. Dyadic Trivial Pursuit	0.31 [†]	0.04	-				
4. Relationship length	0.15	-0.22	-0.04	-			
5. Communication	0.47**	0.12	-0.03	0.27	-		
6. Conflict	-0.47*	0.26	0.19	-0.07	-0.62**	-	
7. Expertise consensus	0.16	0.21	0.33 [†]	-0.01	0.01	-0.05	-
Variables	1	2	3	4	5	6	7
Means	49.11	0.90	10.00	1.81	3.64	2.23	7.41
SD	4.46	0.61	2.39	1.69	0.47	0.43	1.92

[†] $p < .10$, * $p < .05$, ** $p < .01$.

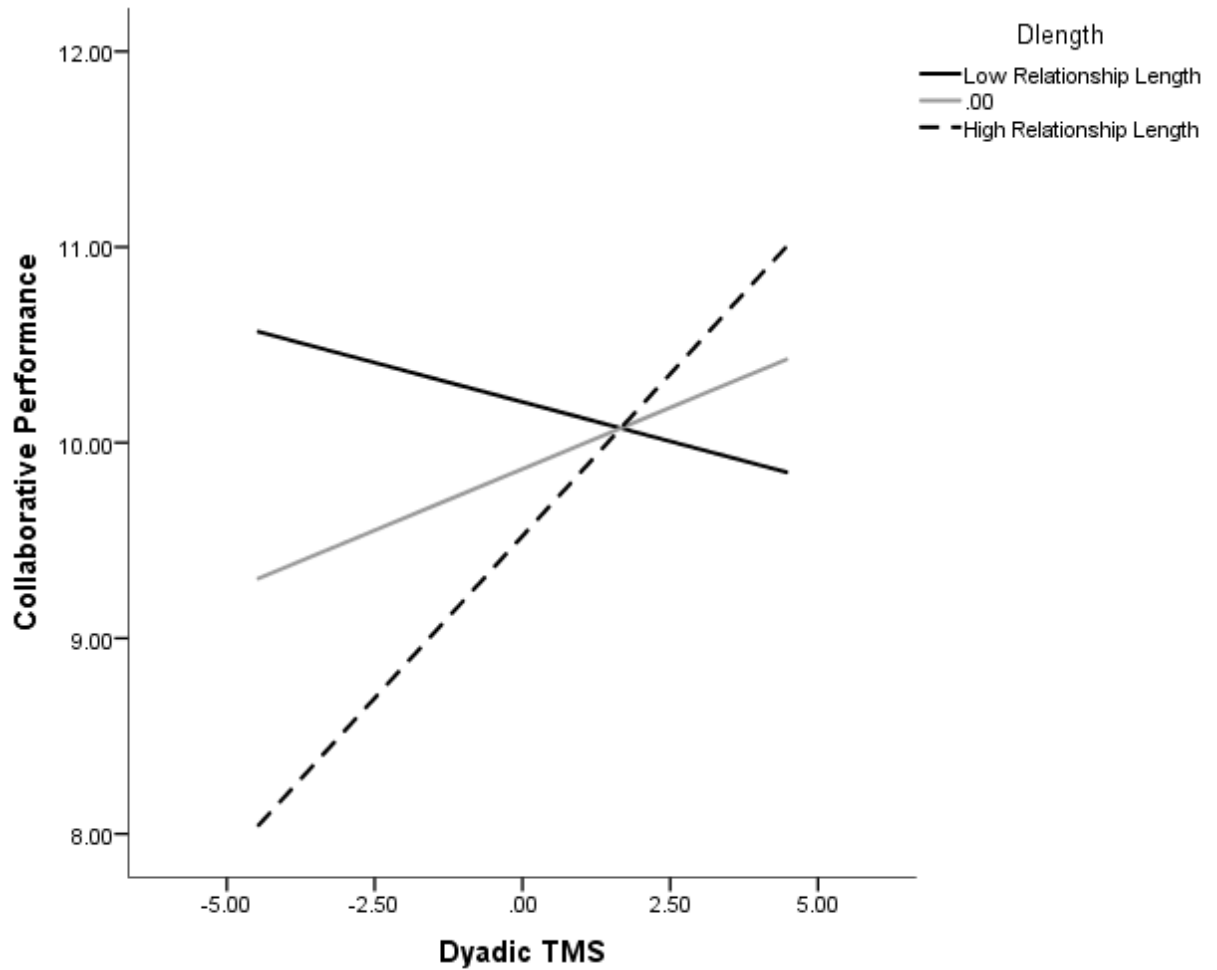


Figure 1: Moderation of relationship Length on the relationship between TMS and collaborative performance.

Descriptive Statistics

The descriptive statistics and correlations for the subsample used for the subsequent analyses are all reported in Table 3. Participants in the familiar subsample had moderate familiarity with one another; they reported an average relationship length of 2.82 (between two to six months and six months to a year) with a standard deviation of 1.26. There was a wide amount of variability among dyads in their familiarity, however. Dyads ranged from only one partner admitting prior knowledge of the other (min = 0.50) to dyads that had known each other for over a year (max = 4.00). Communication ease

was high in the sample ($M=3.70$, $SD=0.42$), with good variability, with answers ranging from “fairly well” ($\min=2.50$) to “very well” ($\max=4.00$). Conflict was moderate in the sample ($M=2.20$, $SD=0.41$) with a small range ($\min=2.00$, $\max=3.00$). Moreover, transactive memory systems’ strength was high in the sample ($M=49.46$, $SD=4.92$) with a minimum score of 40 and maximum of 57.50 out of a possible minimum of 12 and a maximum of 60. The standardized TMS score discrepancies were moderate ($M= 0.78$, $SD=0.62$), with a minimum score of 0.08 and a maximum score of 2.35. Additionally, collaborative task performance (e.g. dyadic Trivial Pursuit scores) was moderate in the sample ($M=9.65$, $SD=2.17$) with a wide range of scores ($\min=5$, $\max=14$). Lastly, descriptive statistics were evaluated for expertise consensus ($M=7.29$, $SD=2.23$) and it had acceptable ranges of variability ($\min=2.00$ $\max=10.00$). Table 4 provides these descriptive statistics.

Table 3: *Dyadic Reports of performance, informant discrepancies, and dyadic relationships: Correlations and Descriptive Statistics for Familiar Dyads (N = 23)*

Variables	1	2	3	4	5	6	7
1. Transactive memory	-						
2. TMS discrepancies	-0.03	-					
3. Dyadic Trivial Pursuit	0.60**	-0.04	-				
4. Relationship length	0.13	0.02	0.29	-			
5. Communication	0.37†	0.25	0.18	0.33	-		
6. Conflict	-0.50*	0.18	-0.11	0.06	-0.55*	-	
7. Expertise consensus	0.23	0.25	0.64**	0.09	-0.19	0.18	-

Variables	1	2	3	4	5	6	7
Means	49.46	0.78	9.65	2.83	3.69	2.20	7.29
SD	4.92	0.62	2.17	1.26	0.42	0.41	2.23

† $p < .10$..* $p < .05$. ** $p < .01$.

Table 4: *Basic Descriptive Statistics for subsample, N=23.*

Variable	<i>M</i>	<i>SD</i>	min	max
1. Transactive memory system	49.46	4.92	40.00	57.50
2. TMS discrepancies standardized	0.78	0.62	0.08	2.35
3. Dyadic Trivial Pursuit	9.65	2.17	5.00	14.00
4. Relationship length	2.83	1.26	0.50	4.00
5. Communication	3.69	0.42	2.50	4.00
6. Conflict (R)	2.20	0.41	2.00	3.00
7. Expertise consensus	7.29	2.23	2.00	10.00

Predicting Task Performance from TMS

Hypothesis 1: Dyads with a higher combined TMS score will perform better on a dyadic Trivial Pursuit task.

A linear regression was examined to predict collaborative performance of dyads in the Trivial Pursuit task from their combined TMS scores. Consistent with hypotheses, dyads with higher aggregate TMS demonstrated greater collaborative performance on the Trivial Pursuit task, $\beta=0.60$, $F(1, 21)=11.91$, $p =0.002$, $R^2 = .362$, with a large effect size, $f^2=0.56$.

Hypothesis 2: Greater discrepancies between TMS scores will predict lower scores on the dyadic Trivial Pursuit task.

A linear regression was conducted to analyze whether informant discrepancies significantly predicted collaborative performance. Dyadic Trivial Pursuit scores were regressed upon TMS standardized difference scores. Results revealed a non-significant and slightly negative relationship between informant discrepancies and performance, $\beta = -.04$, $F(1, 21) = 0.034$, $p = 0.85$, $R^2 = 0.002$, with a very low effect size, $f^2 = 0.002$.

Hypothesis 3: TMS score discrepancies will predict additional variance in task performance over and above the combined TMS score.

The hypothesis that informant discrepancies in TMS perceptions predict collaborative performance over and above aggregate TMS levels was tested in two ways: using standardized difference scores and interaction terms. For the model utilizing TMS standardized difference scores, dyadic Trivial Pursuit scores were regressed upon aggregate TMS scores in Step 1 of the model (results reported in Hypothesis 1 above) and then the standardized difference score in Step 2. This model was significant, $F(2, 20) = 5.68$, $p = .011$, $R^2 = 0.362$, with a large effect size, $f^2 = 0.56$. However, TMS standardized difference scores did not predict dyadic task performance over and above aggregate TMS scores, $\beta = -0.05$, $F(2, 20) = 0.02$, $\Delta R^2 = .000$, $p = .902$. In the model using an interaction to test informant discrepancies, individual-centered TMS scores were entered into the model as a set first, and the product of these scores was entered next. The results revealed that the set of individual TMS scores had a marginally significant association with dyadic task performance, $F(2, 20) = 2.90$, $p = .079$, $R^2 = 0.225$, with a moderately large effect size $f^2 = 0.29$. However, the interaction did not

account for significant additional variance in Trivial Pursuit scores, $F(3, 19) = 0.27$, $\Delta R^2 = .011$, $p = .612$, $\beta = 0.23$. The overall model, including both the main effects of individual's TMS scores and their interaction, was non-significant, $F(3, 19) = 1.95$, $p = .156$, $R^2 = 0.235$, with a moderate effect size, $f^2 = 0.31$.

Predicting TMS from Relationship Features

Hypothesis 4: Dyads with better interaction quality (better communication and low conflict) will have higher combined transactive memory scores and smaller discrepancies between partners in their perceived TMS.

To test whether interaction quality predicts TMS scores, aggregate TMS scores were regressed on mean communication and conflict as a set. Interaction quality marginally significantly predicted TMS scores, $R^2 = 0.261$, $F(2, 17) = 3.02$, $p = .076$, with a large effect size $f^2 = 0.35$. Examination of the unique associations of each component of interaction quality with TMS indicated that communication was not significantly associated with dyad TMS, controlling for conflict, $\beta = 0.11$, $F(2, 17) = 0.20$, $p = 0.66$, and the following partial correlation, $pr = 0.09$. However, conflict marginally predicted less TMS, controlling for communication, $\beta = -0.44$, $F(2, 17) = 3.11$, $p = .09$, $pr = -0.50$. To test whether interaction quality predicted informant discrepancies in TMS, standardized TMS informant discrepancies were regressed on communication and conflict simultaneously. Interaction quality did not significantly predict standardized TMS discrepancy scores, $R^2 = 0.18$, $F(2, 17) = 1.85$, $p = 0.19$, although the size of this effect was moderately large, $f^2 = 0.22$.

Hypothesis 5: Participants who have known each other longer will have higher combined TMS scores and smaller informant discrepancies in TMS scores.

To test whether relationship length predicted aggregate TMS scores, TMS scores were regressed upon relationship length. Relationship length did not significantly predict TMS scores, $\beta = 0.13$, $F(1, 21) = 0.355$, $p = 0.557$, $R^2 = 0.017$, and had a small effect size, $f^2 = 0.017$. Next, to test whether relationship length predicted discrepancy in TMS, standardized TMS informant discrepancy was regressed on relationship length. Relationship length did not predict discrepancies in TMS, $\beta = 0.02$, $F(1, 21) = 0.006$, $p = 0.937$, $R^2 = 0.0003$, with a very low effect size, $f^2 = 0.0003$.

Hypothesis 6: Dyads with more expertise consensus will show higher aggregate TMS scores and smaller TMS discrepancies.

In order to examine associations between expertise consensus and TMS, aggregate TMS and standardized discrepancies in TMS were separately regressed upon expertise consensus. Expertise consensus was not associated with more aggregate TMS, $\beta = 0.23$, $F(1, 15) = 0.81$, $p = 0.384$, $R^2 = 0.05$, with a small effect size $f^2 = 0.05$. Expertise consensus was also not associated with standardized discrepancies in TMS scores, $\beta = 0.25$, $F(1, 15) = 0.960$, $p = 0.343$, $R^2 = 0.06$, with a small effect size, $f^2 = 0.06$.

Discussion

This study had two primary goals. The first was to determine whether informant discrepancies in TMS between individuals within a dyad would predict performance on a collaborative task, and whether it could predict collaborative performance over and above aggregate values of a dyad's transactive memory system. The second goal was to examine associations between discrepancies in TMS and interpersonal features of dyadic relationships previously associated with aggregate TMS, such as interaction quality, expertise consensus, and relationship length. Broadly, hypotheses concerning informant discrepancies were not confirmed, both in terms of predicting task performance and in associations with established correlates of aggregate TMS. Associations with aggregate TMS itself were as expected, although sometimes did not reach full significance due to low power in the smaller subsample utilized. Additionally, a novel and important finding concerning the validity of using the TMS self-report scale in impromptu dyads emerged. These points are discussed in more detail below.

Predicting Task Performance from TMS

Interaction of Relationship Length and TMS

To establish that TMS processes operated similarly in this sample as in prior research, collaborative task performance was first associated with aggregate TMS within a dyad. This association was only marginally significant in the full sample (N=36). Moderation analyses showed that TMS was only significantly predictive of performance for those with an extended relationship length (12 months or greater). Familiar dyads with a shorter relationship showed positive, but non-significant links between TMS and task performance, and impromptu dyads showed a slightly negative, non-significant

association. As these findings shed doubt on the validity of the self-report TMS scale in impromptu dyads, only those dyads with prior familiarity were retained for subsequent analyses. When associations between aggregate TMS and joint task performance were examined in the familiar subsample, these links were positive and strongly significant, as is consistent with the TMS literature (Hollingshead, 1998a; Wegner, 1991).

The interaction of relationship length and aggregate TMS on task performance is consistent with, but extends prior research and theorizing that perceived TMS in impromptu dyads is not well developed. Hollingshead (1998a) suggests that even strangers have a TMS; however, its development and mechanics are unknown. Using observational methods, TMS appears lower in impromptu dyads than in familiar dyads but is still predictive of task performance (Hollingshead, 1998a; Wegner, 1991). Indeed, Hollingshead (1998a) observed different information retrieval and communication patterns between impromptu and familiar dyads in face-to-face interactions. In contrast, relationship length was not associated with self-reported TMS in this study for the full sample, nor was TMS significantly lower for impromptu than familiar dyads ($t(34) = -0.61$). This suggests that recently formed dyads may not be able to accurately conceptualize or report upon their TMS, whereas observational methods may be better able to discern subtle TMS differences in early stages of development before participants are conscious of their level of functioning.

Additionally, it may be that impromptu dyads do not yet have a shared awareness of their TMS, and are therefore either underestimating or overestimating their TMS through the scales. At the early stages of TMS formation, communication is paramount for members to encode, retrieve, and update their directories, and meta-memory (Wegner,

1987, 1991) and is additionally beneficial for TMS developments and performance in joint tasks (Hsu et al., 2012). Impromptu dyads may need more than a 15-minute task to engage in the communication necessary to form a shared awareness of knowledge. This may be particularly true in terms of the self-report TMS scale, as it is purposefully task-neutral and meant to draw upon broad representations of TMS within a group or dyad representations that may be incorrect when based upon only a single, short task. Although Hewitt & Roberts (2015), and Michinov, Michinov & Huguet (2009) have modified the original scale for dyadic couples, the TMS scale is fairly new and used mainly with work/organizational samples. The TMS scale needs further verification in other settings and dyads, thus increased understanding of the scale's uses and limitations, such as those found in this study, are critical.

Role of Informant Discrepancies

Counter to the proposed hypotheses, informant discrepancies in TMS reports were not associated with poor joint task performance, either alone, or above and beyond aggregate TMS scores. Research on informant discrepancies stems from the clinical and developmental literatures (De Los Reyes et al., 2011). As such, studies have mainly focused on discrepancies between family members in regard to family constructs (e.g., Ehrlich et al., 2015; Ohannessian & De Los Reyes, 2014) or child adjustment (e.g., Achenbach, 2006; De Los Reyes, Youngstrom, Pabon, Youngstrom, Feeny, & Findling, 2011). The current study attempted to bridge this research with work from an industrial organizational perspective, focusing on transactive memory systems and predictors of task performance. Although it seems reasonable that a lack of consensus on transactive

memory between members of a team would predict poor collaborative performance in the same way that a lack of consensus between mothers and children on child behavior problems predicts greater family conflict (De los Reyes & Kazdin, 2006), this appears not to be the case. There are a couple of potential reasons for these null findings.

First, it may be that participants felt that they should rate their TMS positively, due to social desirability bias. More specifically, participants may have felt they should rate their friends favorably. This may be especially true for the familiar sub-sample used, therefore washing out differences in their TMS perceptions. Additionally, perhaps the task and relaxed data collection setting was not conducive to extracting potential discrepancies between individuals' perceptions of their TMS. More specifically, the larger data collection sessions mirrored other social university events than a more traditional laboratory study would (i.e. participants received refreshments, had the option to bring a friend). Additionally, some of the participants verbally stated how much they enjoyed participating in the task. These factors suggest perhaps that participants were not properly motivated for the task; therefore, the setting and the task of the study needs consideration for future studies.

Second, informant discrepancies on TMS may not reflect the same types of differences observed and found to underlie informant discrepancies in reports of family interactions. Informant discrepancies are theorized to have links with struggling parent-child relationships and adjustment because they reflect a lack of understanding or awareness of relationship dynamics (Goodman, De Los Reyes, & Bradshaw, 2010). Informant discrepancies on TMS did not appear to relate to interaction quality. As informant discrepancies in TMS were not associated with interaction quality, it stands to

reason that they would not predict task performance. This lack of finding may, again, be a function of the task used. While the Trivial Pursuit task did require participants to discuss and come to a consensus on the task, most dyads finished quickly and well before the 15 minutes allotted or the 30 minutes provided in prior work using this method (Hollingshead, 1998a). Thus, the task may have been too easy or not motivating enough for the participants, and participants may have in turn more universally-rated their interactions positively. Moreover, perhaps in this sample, due to a lack of strong motivation, it is not bothersome if one person seeks a lot of advice (and trusts the other and thinks they're an expert) and the other does not.

It is also possible that the type of task and the specificity of the TMS scale used in this study explains the lack of findings. Here we focused on an indirect measure of TMS that drew upon performance on a specific Trivial Pursuit task rather than focusing on the interpersonal factors important to the development of TMS. However, most informant discrepancies research is based on reflections about a history of behavior/shared interactions rather than a specific laboratory task. Perhaps there is a lack of external validity of the laboratory task to the greater complexities of relationship dynamics. Lewis (2003) made this argument when comparing TMS measurements in laboratories to real work groups. Perhaps the impact of discrepancies is more relevant for individual and long-term functioning than for performance in a confined and momentary task.

Finally, informant discrepancies may still be relevant to the formation of TMS, even if it not associated with task performance itself. Specifically, TMS requires all individuals to have a shared awareness of knowledge distribution within their system. Therefore, discrepancies in the perception of that system may be problematic to further

development (Austin, 2003) even if they are not problematic for more temporally-related task performance.

Predicting TMS from Relationship Features

Another goal of the study was to examine some of the relationship features associated with TMS and discrepancies in its perception. It was hypothesized that length of relationship would have a positive relationship on perceived TMS within a dyad. This is because a well-developed TMS needs ample time to develop within teams and previous TMS research suggests that familiarity has a positive effect on TMS (Hsu et al., 2012; Zheng, 2012). However, relationship length did not predict TMS scores in this sample either at the aggregate level or in terms of discrepancies. The lack of associations may be due to the way in which familiarity was measured in this study. The current study conceptualized familiarity solely in terms of relationship length, but including additional measures of the quality of this familiarity might have changed the results. Specifically, adding in the number or type of shared activities and average time spent together could provide a more nuanced picture of familiarity that might relate more fully to the extent that participants have time and opportunity to communicate and exchange knowledge that contributes to TMS formation.

Associations between interaction quality and aggregate TMS were found generally to be expected, but an interesting finding regarding task specificity of the interaction quality emerged. Interaction quality (comprised of conflict and communication) marginally predicted aggregate TMS scores. Furthermore, as expected, aggregate TMS showed a marginally significant positive bivariate correlation with

communication quality and a significant negative bivariate correlation with conflict. However, when controlling for one another (the correlation between the two was $r=0.55$), only the association with conflict remained at all significant, and only marginally so. (In a larger sample, this result may have reached significance.) These results may indicate that conflict is more predictive of TMS than communication quality. However, the conflict question (reverse scored “How well do you and your partner get along”) was also much less task-specific than the communication question (“How well were you and your partner able to communicate during this task?”). Therefore, it is equally feasible that TMS is more related to general dyadic interaction quality than task-specific interaction quality, even though the TMS is itself somewhat task-specific.

Lastly, consensus on the distribution of knowledge is important to TMS, thus it was hypothesized that expertise consensus would positively predict TMS scores, but be negatively related to informant discrepancies in TMS. Neither was significant in the sample; however, expertise consensus was positively associated with TMS, with a moderate effect size. Expertise consensus may have not predicted aggregate TMS in this sample due to neither participant in the dyad feeling confident in the five available categories causing inconsistent results. Other researchers (Michinov et al., 2009) suggest that it may be best to measure TMS while relevant tasks are being performed, suggesting the use of an indirect measure of TMS is also a limitation, and may be the reason for the results.

Limitations

Some limitations of this study include the limited and reduced sample size, and low observed power. Specifically, results were generally expected for most non-significant findings. That is, greater discrepancies were associated with poorer joint task performance on the Trivial Pursuit task. Likewise, relationship length was positively associated with TMS, but negatively associated with discrepancies in TMS. Interaction quality was marginally significant associated with TMS, but was in the correct direction (e.g. negatively related to conflict, and positively related to communication). Lastly, expertise consensus also showed similar patterns in its association with TMS, but was unexpectedly related positively to discrepancies in TMS. Effect sizes, analyzed through f -squared with G-power showed relatively low to moderate effect sizes. More specifically, analyses with informant discrepancies had betas ranging from 0.002 to 0.21, and those without informant discrepancies ranged from 0.17 to 0.35. Therefore, given a larger sample, it is possible that many more of the expected associations would have been significant. Using G-power, it was determined that the observed power for these analyses ranged from 0.05 to 0.65. These values range from extremely low to moderate compared with an ideal power of .80. As previously discussed, a subsample including only those dyads with prior familiarity was used for most analyses because self-reported TMS did not appear to be a valid indicator of the actual operation of transactive memory in impromptu dyads. This resulted in a significant reduction in the overall sample size available for most analyses (reduced to 23 dyads from 36) and low observed power. A larger sample may provide more consistent results.

Further limitations to this study include the method of measurement of certain variables. For example, the utilization of one to two question measures may not capture the full range of information of those measures. For example, familiarity was measured by asking participants to rate their length of relationship, but extent and type of time spent together was not included. In the future, it may be best to use a scale that provides richer information on participants' familiarity. Additionally, gender may impact associations between TMS and performance (Michinov et al., 2009), but was not controlled in this study.

Future Directions

Perhaps in the future, when examining informant discrepancies and TMS, research could focus on discrepancies in interpersonal dynamics that are part of TMS (such as coordination, and communication, shared awareness). These would be less directly related to the task, and may yield different results because those relationship dynamics may be more aligned with previous informant discrepancy research. Additionally, a task that required more interpersonal interactions, and more time for the task may also aid when studying TMS in a sample with both impromptu and familiar dyads. Lastly, it would be interesting to see if feedback could help impromptu dyads be able to perceive a more comprehensive and accurate TMS.

List of References

- Achenbach, T. M. (2006). As Others See Us: Clinical and Research Implications of Cross-Informant Correlations for Psychopathology. *Current Directions in Psychological Science, 15*, 94-98.
- Austin, J. R. (2003). Transactive memory in organizational groups: the effects of content, consensus, specialization, and accuracy on group performance. *Journal of Applied Psychology, 88*(5), 866.
- Choi, S. Y., Lee, H., & Yoo, Y. (2010). The impact of information technology and transactive memory systems on knowledge sharing, application, and team performance: a field study. *MIS quarterly, 855-870*.
- Dai, Y., Du, K., Byun, G., & Zhu, X. (2017). Ambidextrous in new ventures: The impact of new product development alliances and transactive memory systems. *Journal of Business Research, 75*, 77-85.
- De Los Reyes, A. (2011). Introduction to the special section: More than measurement error: Discovering meaning behind informant discrepancies in clinical assessments of children and adolescents. *Journal of Clinical Child & Adolescent Psychology, 40*(1), 1-9.
- De Los Reyes, A. (2013). Strategic objectives for improving understanding of informant discrepancies in developmental psychopathology research. *Development and Psychopathology, 25*(03), 669-682.
- De Los Reyes, A., & Kazdin, A. E. (2004). Measuring informant discrepancies in clinical child research. *Psychological assessment, 16*(3), 330.
- De Los Reyes, A., & Kazdin, A. E. (2005). Informant discrepancies in the assessment of

childhood psychopathology: a critical review, theoretical framework, and recommendations for further study. *Psychological bulletin*, 131(4), 483.

De Los Reyes, A., & Kazdin, A. E. (2006). Informant Discrepancies in Assessing Child Dysfunction Relate to Dysfunction Within Mother-Child Interactions. *J Child Fam Stud*, 15, 643-661. doi:10.1007/s10826-006-9031-3.

De Los Reyes, A., Henry, D. B., Tolan, P. H., & Wakschlag, L. S. (2009). Linking informant discrepancies to observed variations in young children's disruptive behavior. *Journal of Abnormal Child Psychology*, 37(5), 637-652.

De Los Reyes, A., Youngstrom, E. A., Pabon, S. C., Youngstrom, J. K., Feeny, N. C., & Findling, R. L. (2011). Internal consistency and associated characteristics of informant discrepancies in clinic referred youths age 11 to 17 years. *Journal of Clinical Child and Adolescent Psychology*, 40, 36-53.

Ehrlich, K. B., Richards, J. M., Lejuez, C. W., & Cassidy, J. (2015). When parents and adolescents disagree about disagreeing: Observed parent-adolescent communication predicts informant discrepancies about conflict. *Journal of Research on Adolescence*.References

Espinosa, J. A., Slaughter, S. A., Kraut, R. E., & Herbsleb, J. D. (2007). Team knowledge and coordination in geographically distributed software development. *Journal of Management Information Systems*, 24(1), 135-169. doi: 10.2753/MIS0742-1222240104

Goodman, K. L., De Los Reyes, A., & Bradshaw, C. P. (2010). Understanding

- and Using Informants' Reporting Discrepancies of Youth Victimization: A Conceptual Model and Recommendations for Research. *Clinical Child and Family Psychology Review*, 13, 366-383. doi:10.1007/s10567-010-0076-x
- Goodman, P. S., & Garber, S. (1988). Absenteeism and accidents in a dangerous environment: Empirical analysis of underground coal mines. *Journal of Applied Psychology*, 73(1), 81.
- Goodman, P. S., & Leyden, D. P. (1991). Familiarity and group productivity. *Journal of Applied Psychology*, 76(4), 578.
- GruenFeld, D. H., Mannix, E. A., Williams, K. Y., & Neale, M. A. (1996). Group composition and decision making: How member familiarity and information distribution affect process and performance. *Organizational Behavior and Human Decision Processes*, 67(1), 1-15.
- Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (1998). Multivariate data analysis. Upper saddle River. *Multivariate Data Analysis (5th ed) Upper Saddle River*.
- Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford Press.
- Hewitt, L. Y., & Roberts, L. D. (2015). Transactive memory systems scale for couples: development and validation. *Frontiers in Psychology*, 6.
- Hollingshead, A. B. (1998a). Retrieval processes in transactive memory systems. *Journal of Personality and Social Psychology*, 74(3), 659-671. doi:10.1037/0022-3514.74.3.659
- Hollingshead, A. B. (1998b). Communication, learning, and retrieval in

- transactive memory systems. *Journal of Experimental Social Psychology*, 34(5), 423-442.
- Hollingshead, A. B. (2000). Perceptions of expertise and transactive memory in work relationships. *Group Processes & Intergroup Relations*, 3(3), 257-267.
- Hsu, J. S. C., Shih, S. P., Chiang, J. C., & Liu, J. Y. C. (2012). The impact of transactive memory systems on IS development teams' coordination, communication, and performance. *International Journal of Project Management*, 30(3), 329-340.
- Huang, M., Barbour, J., Su, C., & Contractor, N. (2013). Why do group members provide information to digital knowledge repositories? A multilevel application of transactive memory theory. *Journal of the American Society for Information Science and Technology*, 64(3), 540-557.
- Kozlowski, S. W., & Ilgen, D. R. (2006). Enhancing the effectiveness of work groups and teams. *Psychological science in the public interest*, 7(3), 77-124.
- Laird, R. D., & De Los Reyes, A. (2013). Testing informant discrepancies as predictors of early adolescent psychopathology: Why difference scores cannot tell you what you want to know and how polynomial regression may. *Journal of abnormal child psychology*, 41(1), 1-14.
- Liao, J., O'Brien, A. T., Jimmieson, N. L., & Restubog, S. L. D. (2015). Predicting transactive memory system in multidisciplinary teams: The interplay between team and professional identities. *Journal of Business Research*, 68(5), 965-977.
- Little, R. J. (1988). A test of missing completely at random for multivariate data

- with missing values. *Journal of the American Statistical Association*, 83(404), 1198-1202.
- Lewis, K. (2003). Measuring transactive memory systems in the field: scale development and validation. *Journal of Applied Psychology*, 88(4), 587.
- Lewis, K. (2004). Knowledge and performance in knowledge-worker teams: A longitudinal study of transactive memory systems. *Management Science*, 50(11), 1519-1533.
- Lewis, K., Lange, D., & Gillis, L. (2005). Transactive memory systems, learning, and learning transfer. *Organization Science*, 16(6), 581-598.
- Majchrzak, A., Jarvenpaa, S. L., & Hollingshead, A. B. (2007). Coordinating expertise among emergent groups responding to disasters. *Organization Science*, 18(1), 147-161. <http://dx.doi.org/10.1287/orsc.1060.0228>
- Marques-Quinteiro, P., Curral, L., Passos, A. M., & Lewis, K. (2013). And now what do we do? The role of transactive memory systems and task coordination in action teams. *Group Dynamics: Theory, Research, and Practice*, 17(3), 194.
- Mell, J. N., Van Knippenberg, D., & Van Ginkel, W. P. (2014). The catalyst effect: The impact of transactive memory system structure on team performance. *Academy of Management Journal*, 57(4), 1154-1173.
- Michinov, N., & Michinov, E. (2009). Investigating the relationship between transactive memory and performance in collaborative learning. *Learning and Instruction*, 19(1), 43-54.
- Michinov, E., Michinov, N., & Huguet, P. (2009). Effects of gender role and task content

- on performance in same-gender dyads: Transactive memory as a potential mediator. *European Journal of Psychology of Education*, 24(2), 155-168.
- Moreland, R. L. (1999). Transactive memory: Learning who knows what in work groups and organizations. In L. L. Thompson, J. M. Levine, D. M. Messick, L. L. Thompson, J. M. Levine, D. M. Messick (Eds.), *Shared cognition in organizations: The management of knowledge* (pp. 3-31). Mahwah, NJ, USA: Lawrence Erlbaum Associates Publishers.
- Moreland, R. L., & Myaskovsky, L. (2000). Exploring the performance benefits of group training: Transactive memory or improved communication? *Organizational behavior and human decision processes*, 82(1), 117-133.
- Müller, R., & Turner, J. R. (2005). The impact of principal–agent relationship and contract type on communication between project owner and manager. *International Journal of Project Management*, 23(5), 398-403.
- Ohannessian, C. M., Lerner, R. M., Lerner, J. V., & von Eye, A. (1995). Discrepancies in adolescents' and parents' perceptions of family functioning and adolescent emotional adjustment. *The Journal of Early Adolescence*, 15, 490-516.
- Ohannessian, C. M., & De Los Reyes, A. (2014). Discrepancies in Adolescents' and Their Mothers' Perceptions of the Family and Adolescent Anxiety Symptomatology. *Parenting*, 14, 1-18. doi:10.1080/15295192.2014.870009
- Peltokorpi, V. (2008). Transactive memory systems. *Review of General Psychology*, 12(4), 378.
- Peltokorpi, V., & Hasu, M. (2016). Transactive memory systems in research team

- innovation: A moderated mediation analysis. *Journal of Engineering and Technology Management*, 39, 1-12.
- Pinto, M. B., & Pinto, J. K. (1990). Project team communication and cross-functional cooperation in new program development. *Journal of product innovation management*, 7(3), 200-212.
- Prichard, J. S., & Ashleigh, M. J. (2007). The effects of team-skills training on transactive memory and performance. *Small group research*, 38(6), 696-726.
- Rote, W. M., & Smetana, J. G. (2016). Patterns and Predictors of Mother-Adolescent Discrepancies across Family Constructs. *Journal of youth and adolescence*, 45(10), 2064-2079.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston: Pearson Education.
- Society Annual Meeting* (Vol. 55, No. 1, pp. 311-315). SAGE Publications.
- Wegner, D. M., Erber, R., & Raymond, P. (1991). Transactive memory in close relationships. *Journal of Personality and Social Psychology*, 61(6), 923-929.
doi:10.1037/0022-3514.61.6.923
- Wegner, D. M. (1987). Transactive memory: A contemporary analysis of the group mind. In *Theories of group behavior* (pp. 185-208). Springer, New York.
- Widaman, K. F. (2006) Missing data: What to do with or without them. *Monographs of the society for research in child development: Vol. 71. Best practices in quantitative methods for developmentalists* (pp. 42-64).
- Yuan, Y. C., Fulk, J., & Monge, P. R. (2007). Access to information in connective and

communal transactive memory systems. *Communication Research*, 34(2), 131-155. DOI 10.1177/009365020629806.

Zheng, Y. (2012). Unlocking founding team prior shared experience: A transactive memory system perspective. *Journal of Business Venturing*, 27, 577-591.
doi:10.1016/j.jbusvent.2011.11.001

Appendix A

General knowledge

Instructions: Read the questions below and answer them to the best of your abilities. You will have 8 minutes for this task (During the dyadic task, participants had 15 minutes).

Science and Nature

1. What is the only metal that is liquid at room temperature?
2. What molecule did James Watson and Francis Crick discover in 1944?
3. What nuclear process takes place in a Hydrogen bomb?
4. What is the chemical symbol for Iron?

Entertainment

5. In what boy band did Justin Timberlake get his start?
6. Whose “anaconda don’t want none unless you got buns hun”?
7. What color is Mr. Spock’s blood?
8. Name four of Santa Claus’s eight reindeer from “’Twas the Night Before Christmas.”

Sports and Leisure

9. Who holds the NHL record for most career goals?
10. What number did Dan Marino wear as quarterback for the Miami Dolphins?
11. What former heavy-weight boxing champion was also the African American golfer to compete in a PGA-sanctioned event?
12. What vehicles are raced in the Tour de France?

American History

13. During which war was the U.S. National Anthem, the Star Spangled Banner, written by Francis Scott Key?
14. Who was Malcolm Little better known as?
15. Who was the first astronaut to walk on the moon on July 20, 1969?
16. How many U.S. presidents have been assassinated while in office?

Art and Literature

17. What is Shakespeare’s Shortest play?
18. What brew do Harry Potter and his friends quaff at the Leaky Cauldron?
19. What crime writer’s novels include: *Along Came a Spider*, *Roses are Red*, and *Cat and Mouse*?
20. In what Brothers Grimm tale does a talking mirror anger a wicked queen?

Appendix B

Demographic Questionnaire

Member _____

The following questions are about you and your life, and any and all answers will be kept confidential.

1. What is your age? _____
2. With which racial/ethnic categories do you most identify? Select all that apply.
 - a. American Indian/Alaska Native
 - b. Asian
 - c. Native Hawaiian or Other Pacific Islander
 - d. Black/African American
 - e. White
 - f. Hispanic or Latino
3. With which gender do you most identify?
 - a. Female
 - b. Male
 - c. Non-binary/other
4. What year in college are you?
 - a. Freshmen
 - b. Sophomore
 - c. Junior
 - d. Senior
 - e. Graduate student
 - f. Not a student

Appendix C

TMS Scale items (Hewitt & Roberts, 2015)

Specialization

1. My partner and I have specialized knowledge in specific domains.
2. I have knowledge about specific domains that my partner does not have.
3. My partner and I are responsible for expertise in different domains.
4. The specialized knowledge of both my partner and myself is needed to complete tasks.
5. I know whether it is my partner or myself who has expertise in specific areas.

Credibility

1. I am comfortable accepting suggestions from my partner.
2. I trust that my partner's knowledge is credible.
3. I am confident relying on information that my partner provides.
4. When my partner provides information, I want to double it for myself.
5. I have lost a lot of faith in my partner's expertise.

Coordination

1. My partner and I work together in a well-coordinated fashion.
2. My partner and I have very few misunderstandings when completing tasks.
3. My partner and I are able to complete tasks on the first attempt.
4. My partner and I can accomplish tasks smoothly and efficiently.
5. There is not much confusion when my partner and I set out to accomplish a task.

*The response scale for this measure: 1 (Strongly disagree), 2(Disagree), 3(Neutral), 4(Agree), 5 (Strongly agree)

Appendix D

Additional Questions

1. How long have you known your partner? _____

- a. We just met
- b. 0-1 month
- c. 2-6 months
- d. 6-12 months
- e. One year or more

2. How well were you and your partner able to communicate during this task?

<u>Not well at all</u>	<u>Slightly well</u>	<u>Somewhat well</u>	<u>Fairly Well</u>	<u>Very Well</u>
1	2	3	4	5

3. How well do you and your partner get along?

<u>Not well at all</u>	<u>Slightly well</u>	<u>Somewhat well</u>	<u>Fairly Well</u>	<u>Very Well</u>
1	2	3	4	5

Appendix E

TMS and ID Trivial Pursuit Answer Key

Science and Nature

1. Mercury
2. DNA
3. Fusion
4. Fe

Entertainment

5. NSYNC
6. Sir Mix-a-lot
7. Green
8. Dasher, Dancer, Prancer, Vixen, Comet, Cupid, Donner (Donder), Blitzen.

Sports and Leisure

9. Wayne Gretzky-894 goals in career
10. 13
11. Joe Louis
12. Bicycles

American History

13. War of 1812
14. Malcolm X
15. Neil Armstrong
16. 4 (Kennedy, McKinley, Lincoln, Garfield)

Art and Literature

17. Comedy of Errors
18. Butter Beer
19. James Patterson
20. Snow White