THE ROLE OF COMPUTER MEDIATED COMMUNICATION COMPETENCE ON UNIQUE INFORMATION POOLING AND DECISION QUALITY IN VIRTUAL TEAMS

By

Heng Chen Xie

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

Psychology—Master of Arts

2015

ABSTRACT

THE ROLE OF COMPUTER MEDIATED COMMUNICATION COMPETENCE ON UNIQUE INFORMATION POOLING AND DECISION QUALITY IN VIRTUAL TEAMS

By

Heng Chen Xie

Past studies and reviews on the role of Computer Mediated Communication (CMC) mediums on unique information pooling and decision quality in virtual teams has largely been inconsistent and, at times, contradictory. In this study I argue that the inconsistency in past findings is due to a flawed interpretation of CMCs as being equivalent forms of communication, when they should instead be viewed as distinct mediums varying in media richness. In this study I present a new model of decision-making whereby the media richness of the CMC being used and the team's level of CMC competence will predict decision quality through unique information pooling. Results indicated that there were significant differences in unique information pooled between high and low media richness conditions, with teams in the high media richness condition pooling significantly more unique information. However, team CMC competence was not found to predict unique information pooling, and unique information pooling was not found to predict decision quality.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

The organizational landscape has been rapidly evolving the past few decades. Globalization has increased both the reach and span of organizations, leading to a proliferation of multinational and transnational workforces that transcend the boundaries of time and geography (Martins, Gilson, & Maynard, 2004). The work team is increasingly becoming the focal point of work structures due to its agility in dealing with rapidly changing environments without having to await for orders from top management, and also because of its ability to leverage the skills and expertise of its members to interpret a diverse range of information to deal with complex decision-making tasks(Mesmer-Magnus & DeChurch, 2009). Advances in communication technology have allowed for the decentralization of teams, allowing for the creation of virtual teams that can access the expertise and skills of members located throughout the world, while lowering costs associated with relocating or importing personnel. With so many potential benefits, it's no surprise why more and more organizations are adopting the use of virtual teams (Copeland, 2006). However, it would be folly to see only the upsides without considering the potential downsides of having people work and communicate virtually rather than naturally in a face-to-face (FTF) context. An important consideration is that when teams use computer-mediated communication (CMC) mediums, or any type of communication medium that is facilitated through a computer-interface (e.g. instant messaging, e-mail, Skype), the manner in which they share and interpret information changes. In fact, there has been considerable research arguing that virtual collaboration using CMCs often lead to slower decision making, lower group effectiveness and lower satisfaction (Baltes, Dickson, Sherman, Bauer, & LaGanke, 2002; Kiesler, Siegel, & McGuire, 1984; Kiesler & Sproull, 1992). Furthermore, research findings have shown that information sharing, a central process of effective team sharing, may be hampered by

the limitations of the CMC in its capacity to transmit information, the degree to which it is similar to face to face interactions, and the virtuality of the team using the CMC (Daft & Lengel, 1984; Kock, 2004; Mesmer-Magnus, DeChurch, Jimenez-Rodriguez, Wildman, & Shuffler, 2011). As such, research aimed at understanding how the unique context of the virtual team changes the way in which people interact and collaborate is critical in maximizing the potential benefits of virtual teams, while minimizing the downsides. (Stahl, Maznevski, Voigt, & Jonsen, 2010).

Unfortunately, empirical findings regarding communication technology have been inconsistent at best and a recent meta-analysis by Lu, Yuan, and McLeod (2012) actually found no significant effects of communication medium (CMCs vs. Face-to-Face) on unique information pooling and decision quality. However, this conclusion has to be interpreted cautiously as they noted many of the studies they looked at were decades old and both the technology and user base has matured since then. Back in the 90's personal computers were still relatively new and likewise, the user base was also less familiar and inexperienced with using CMCs to communicate. However, technology and virtuality are now ingrained into our everyday lives (e.g., e-mail, texting, Facebook, Twitter, Skype) and it would not be difficult to argue that today's society is more technologically literate than ever before. Thus it would only make sense for us to re-examine the effects of CMC technology using a sample experienced with virtual communication and more representative of the modern workforce. As such, in this study I will be using a sample of undergraduate students who should be sufficiently familiar and adept with CMC technology.

Furthermore, there is an important deficiency in how information sharing and team performance is studied in virtual teams today. Researchers in the information sharing literature

have largely neglected the characteristics of the specific CMC being utilized; lumping together CMCs ranging from e-mail, to audio-conferencing, to group decision support systems to video conferencing into an all-encompassing CMC category for meta-analyses(Lu et al., 2012; Mesmer-Magnus et al., 2011). This questionable practice has led to predictably ambiguous and contradictory findings within the literature, as it should seem rather obvious that communicating with e-mail would be very different from communicating through a video conference call. It is time for researchers to clearly look at the distinct differences between types of CMCs, so that we can understand how these differences can influence information exchange and decision making. One important distinction between types of CMCs I will be discussing in this study is the CMC's media richness, or the medium's capacity for immediate feedback, the number of cues and channels utilized, personalization, and language variety (Daft & Wiginton, 1979). As a critical process of team decision-making is the ability to share information, it is expected that since virtual teams communicate exclusively through CMCs, the CMC's media richness will have a significant impact on how quickly information can be disseminated within the group and what type of information can be shared within the group.

Lastly, I introduce the concept of CMC competence, or an individual's belief in his or her ability to communicate effectively using CMCs, to show that not only is it the CMC being used that can affect information sharing and decision-making in virtual teams, but also how the CMC is being used and by whom. Many studies have shown that there are inter-individual differences in communication efficacy and personality (Joinson, 2004; Spitzberg, 2006; Tosun & Lajunen, 2010) that can affect how people communicate and build relationships virtually. As such, it is likely that a member's self-perceived competence in communicating virtually can have a significant impact on successful information sharing within the team. It is expected that, as a

result of different experiences and predilections, individuals are likely to vary in the degree to which they are competent in using CMCs. A team with competent users that are familiar with the CMC being utilized would very likely outperform a team with users that are technologically illiterate or wary of communicating virtually. As such, the role of CMC competence should be a critical component of effective information sharing in virtual teams.

Information Sharing and Decision-Making in Virtual Teams

Virtual teams are teams that rely on computer mediated communications (CMCs) and can cross boundaries of geography, time and organization (Martins, Gilson & Maynard, 2004). There are thought to be many perks associated with these types of teams such as allowing collaboration between members who are in different countries or in different organizations (can "hire" outside assistance or a specialist), or saving on the costs of relocating members (regular face to face teams require physical proximity). However, because virtual teams communicate and interact primarily using CMCs rather than through face-to-face interactions, virtual teams can encounter significant barriers to effective team performance such as difficulty in establishing trust between members, forming relationships, and may exchange/interpret information differently than face-to-face teams (Mesmer-Magnus & DeChurch, 2009; Mesmer-Magnus et al., 2011; Rosen, Furst, & Blackburn, 2007; Walther & Bunz, 2005).

As a critical process of effective decision-making in teams is the effective sharing of information, there has been extensive research on how information sharing is influenced by the context of the virtual team. One important avenue of research has focused on the effects of CMC on the hidden profile and the shared information bias (Stasser & Titus, 1985, 1987). Hidden profile research has shown that decision-making teams are more likely to make incorrect

decisions when members share common information that is biased towards an incorrect profile (Lu et al., 2012). This finding is attributed to the shared information bias where shared information is more likely to be mentioned, re-mentioned and supported, whereas unique information (information that is not known by all members) is often not discussed at all or unsupported by others and thus discounted. Studies on the shared information bias have shown that teams must not only possess the knowledge to make the correct decision, but also possess the ability to share that knowledge between members so that appropriate action can be taken. Thus, it is not surprising that unique information pooling has been found to be the strongest predictor of decision quality (Lu et al., 2012; Mesmer-Magnus & DeChurch, 2009) and we would expect that teams that are able to overcome the shared information bias will be more likely to reach the correct decision.

As previously mentioned, research looking at the effect of communication medium on unique information pooling and decision quality has been somewhat conflicted. While Lu et al. (2012) found no overall effect of communication medium on unique information pooling and team decision quality, there are some studies that do suggest a more positive note for CMC use. For example, Lam and Schaubroeck (2000) found that teams using group decision support systems (GDSS) were much more likely to share unique information than FTF teams, and that overall GDSS teams significantly outperformed FTF teams in hidden profile decision-making tasks. On the other hand, studies such as Kerr and Murthy (2009) found that teams utilizing a CMC chat tool were less successful in exchanging and processing information in a hidden profile task and thus less successful than FTF teams in correctly solving the hidden profile task. Yet Crede and Sniezek (2003) found no difference between video-conferencing groups and face-to-face groups in regards to decision accuracy, overconfidence or commitment to group decisions.

At face value it may seem that perhaps Li Lu and her colleagues were right, perhaps these contradictory findings mean that there is no consistent effect of CMC on either unique information pooling or decision quality. However, if one were to look carefully at the studies, it becomes clear that their findings are based on the assumption that all CMCs are equal. One important distinction is that in each of the three studies mentioned a different CMC (GDSS, chat tool, video conferencing) is being compared to face-to-face teams. However, it would be folly to consider all CMCs to be equivalent. For example, when using a video conferencing CMC you are able to hear and see the person you are communicating with, as compared to using a chat tool where you are unable to perceive visual and audio information. In fact, it could be argued that video conferencing is more similar to face to face communication than it is to a chat tool. Unfortunately, I have not been able to find any empirical studies comparing different types of CMC and their influence on team unique information pooling and/or decision quality and will seek to remedy that problem in this study.

One potential manner in which predictions can be made regarding how differences between CMCs may affect unique information pooling and decision quality comes from the cues filtered out perspective (Culnan & Markus, 1987). This perspective argues that because CMCs transmits less nonverbal, contextual and social cues compared to face to face communication, the way in which members perceive and interact with one another become markedly different from face-to-face communication. It was thought that due to the lack of contextual and social cues, communication between members in virtual teams may become less personal and/or result in a lack "social presence" (Short, Williams, and Christie, 1976). As a result, it would be expected that communication using CMCs that severely limit the amount of nonverbal, contextual and social cues (e.g. e-mail) may become more task-focused and less affectively laced whereas

CMCs that allow for the transmission of additional cues will be more similar to face-to-face communication (e.g. video conferencing). However, this increased focus on the task at hand and the blocking of extraneous information/background noise may in some cases actually facilitate better task performance.

One school of thought on how information sharing differs in a virtual context is that virtual teams benefit from its lack of social/contextual/visual cues through social/status equalization (Driskell, Radtke, & Salas, 2003; Siegel, Dubrovsky, Kiesler, & McGuire, 1986). Typically in small group discussion, there are strong group norms and pressures at play leading to inhibition to share information. Those viewed as having higher status and prestige will be afforded more opportunities to lead conversation, to be recognized and agreed with (Driskell & Mullen, 1990), whereas low status members may fear to speak out against those high status members for fear of censure or reprisal. Expectation states theory (Berger, Cohen, & Zelditch, 1972) suggests that people attribute expectations to status characteristics perceived to be salient in the situation (i.e. deference would be given to a doctor during a medical emergency). These attributions can create an informal hierarchy based on power and prestige within the group. However in some virtual teams these status characteristics are suppressed or made less salient because the CMC limits what type of information can be transmitted. For example, oftentimes seniority can be a powerful status characteristic (e.g. younger workers may defer to the veterans as they are thought to be more knowledgeable), but when visual cues are suppressed (such as when using e-mail as the CMC) this hierarchy may fail to appear and afford more opportunities to those who may traditionally be in a "lower" status. As such, we would expect the amount of contextual information conveyed through the communication medium to affect not only how information is shared and accepted/rejected, but also who is able to step up to the plate and share.

This suggests that teams using CMCs that limit the type of information shared to the bare minimum (i.e. only text information) will not only be more task-focused and unencumbered by extraneous information, but may also promote more equal contribution amongst team members, leading to more unique information pooled.

Some support for this conclusion comes from a meta-analysis conducted by Mesmer-Magnus et al. (2011) on the effect of team virtuality on information sharing and team performance. Similar to the argument presented in this study, they argued that it makes little sense to compare only face-to-face teams to virtual teams as there are degrees of virtuality within teams. Instead, they classified virtual teams as either high or low on virtuality, drawing from Kirkman and Mathieu (2005), which presented three dimensions of virtuality: the proportion of communication that was done exclusively through CMCs, the extent to which CMC transmits data that is valuable for team effectiveness, and the synchronicity of the CMC (real time vs. lagged response). High virtuality teams would be teams that communicate almost exclusively through CMCs that had a heavy delay and had severe limitations on what type of information could be transmitted (e.g. virtual teams communicating via e-mail). Low virtuality teams would be teams that communicate using both CMC and face-to-face, and/or use CMCs that are high in synchronicity and allow for many different types of information to be shared (e.g. co-located virtual team that occasionally video conferences meetings). Their findings revealed that teams high in virtuality were more successful in pooling unique information as compared to low virtuality teams and face-to-face teams which were more successful in openly sharing high volumes of information. However, one must keep in mind that while team virtuality is in part derived from media richness, they are still distinct concepts. Team virtuality is a characteristic of

a team and can be altered (e.g. meeting more frequently in person, changing the CMC being used), whereas media richness is an intrinsic property of the CMC.

Media Richness Theory

The Media Richness Theory (Daft & Lengel, 1984; Daft & Lengel, 1986) was initially developed to describe how different communication mediums differ in their capacity to exchange information and it is where concept of media richness was first coined. To understand their theory, one must first clarify what they contend are the three fundamental issues at play in situations requiring information exchange and also what differentiates one communication medium from another.

Information and richness: Firstly, they contend that information differs in richness**.** Richness of information is defined as its ability to change understanding within a time interval by overcoming different frames of reference or clarifying ambiguous issues. Within organizations and the workgroups, information needs to be shared, pooled and then processed before a decision can be made. Information's main purpose is twofold, to reduce uncertainty (i.e. absence of information) and limit equivocality (i.e. ambiguity or conflicting views regarding a situation). Situations that organizations and workgroups face can vary in the amount of uncertainty and equivocality present.

In situations of high uncertainty, there exists a gap between the group's information and the amount of information necessary for the group to make a quality decision. For example, a situation characterized by high uncertainty might be one where a promotion committee examining performance reviews is missing a few months' worth of performance data. Situations that are characterized instead by high equivocality are ones where there are conflicting views on

what is correct or most appropriate, where the problem space is poorly defined. This would be especially prominent in diverse groups where members hold differing values/view and interpret the information differently. For example, the Supreme Court of the United States must make decisions based on their interpretation of the Constitution. However, the manner in which the Justices of the Supreme Court interpret the Constitution can vary dramatically, and oftentimes there is no simple clear-cut correct answer because the Constitution was not meant to deal with many modern issues.

Information that is high in richness possesses the ability to quickly change/persuade one to accept an alternate view, or strengthen one's support of a view by reducing uncertainty/ambiguity. It needs to be noted here, however, that just because the information is rich does not necessarily mean it will be accepted. It simply means that rich information should be more effective in changing opinions than low richness information that is hard to understand or unconvincing. For example, let us say you are a jury member in a murder trial. Both the prosecutor and defense attorney present you with different pieces of evidence/testimony accompanied with explanations seeking to persuade your judgment. Some evidence or testimony may be more effective in helping you reach a decision, and some will be less effective. Strong, rich evidence (e.g. a written confession or a videotape of the crime in action) will help you to quickly come to a decision; whereas weaker, less rich evidence (e.g. witness testimony from someone that seems highly unreliable, blurry videotape) may be ineffective in helping you come to a conclusion.

Ability to convey rich information: Secondly, they contend that different types of communication media differ in their richness, or ability to convey rich information. Media richness is defined as the medium's capacity for immediate feedback, the number of cues and

channels utilized, personalization, and language variety (Daft & Wiginton, 1979). As this theory was first proposed prior to the digital age, their ordering of mediums was limited, with face to face being the highest in richness followed by the telephone, letters/memos, impersonal written memos, and numeric documents. Face to face was thought to the be richest medium because it happens in real-time, allowing for instant communication and feedback while also allowing for additional, supportive information such as nonverbal cues, tone and gestures to come into play as well. Documents were considered less rich because there was no instant feedback (they took time to be sent and read), and were less "persuasive" because they were not supplemented with nonverbal cues etc.

CMCs, like all other forms of communication mediums, also vary in their richness. Rich mediums such as video conferencing are nearly equal to face-to-face communication since they are able to transmit a significant amount of contextual, verbal and audio information and is nearly as synchronous as face to face communication. On the lower end of the media richness spectrum we would place instant messaging, as it is severely limited in its ability to convey visual/audio/contextual information. At its core the Media Richness Theory has five main tenets:

a. Situations vary in uncertainty and equivocality that must be addressed before a decision can be made.
b. Information varies in its richness, its ability to reduce uncertainty and resolve equivocality.
c. Communication mediums vary in their ability to transfer rich information. Media Richness is determined by the medium's capacity for immediate feedback, the number of cues and channels utilized, personalization and language variety.

d. Certain situations, such as those characterized by high equivocality and that require debate/rapid exchange to reach consensus, will benefit more from high richness mediums whereas other situations can be resolved with low richness mediums. Thus improperly matching the communication medium to the situation will lead to sub-optimal performance outcomes.
e. People will learn to match, and prefer communication mediums that meet the optimal level of richness. More richness, while always better, is not always necessary.

The Media Richness Theory has met with mixed empirical results. While there were a number of papers that found supporting evidence that people performed better and were more satisfied when the type of medium matched the situation (Daft & Lengel, 1986; Graetz, Boyle, Kimble, Thompson, & Garloch, 1998; Rice, 1993; Sproull & Kiesler, 1986), there were also those that found little differences in performance outcomes when using low richness mediums vs. high richness mediums (Crede & Sniezek, 2003; Dennis & Kinney, 1998; ElShinnawy & Markus, 1997; Hiltz, Johnson, & Turoff, 1986). Additionally, managers and workers commonly utilized and preferred e-mail on a variety of tasks and situations where it would be deemed as a sub-optimal match in terms of media richness (Markus, 1994). However, despite the mixed results of media richness on group performance outcomes, the FTF medium remained the preferred medium of choice for participants in most studies, especially when the task was more complex or required higher levels of coordination or discussion (Adrianson & Hjelmquist, 1991; Straus & McGrath, 1994). Additionally, even in situations where performance was the same, or when Media Richness Theory would argue a richer medium was not necessary, people consistently rated higher satisfaction when using mediums higher in richness. To address this particular phenomenon, and to provide an alternative explanation for why richer mediums are typically

preferred over lower richness mediums, the Media Naturalness Hypothesis and, subsequently, the Media Compensation Theory was developed (Hantula, Kock, D'Arcy, & DeRosa, 2011; Kock, 2004, 2005).

Media Naturalness Hypothesis

Kock's (Kock, 2004) basic argument was that people preferred face-to-face communication the most because it is the most natural way for humans to communicate. If we consider that the face-to-face communication has been facilitated by millions of years of evolution, such as the development of special facial muscles dedicated to facial expression or specialized brain circuits dedicated to deciphering facial and speech recognition, one can hardly be surprised why we feel most comfortable with our de facto mode of communication. We must also consider that FTF communication brings with it the ability to communicate in synchronicity, complemented by a vast array of facial expressions, body gestures, speech tones and inflections that even the most advanced video-conferencing software fails to completely capture. To that end, Kock created the term *media naturalness*, or the ability of communication media to support co-located and synchronous communication employing facial expressions, body language and speech. He defined seven elements of media naturalness, and CMCs possessing more would be considered more natural and those possessing less would be considered less natural. The seven elements are: a) individuals are co-located and can scan, see and hear one another, b) there is a high degree of synchronicity that allows individuals to quickly interact with each other, c) individuals have the ability to observe and convey facial expressions, d) individuals are able to observe and convey body language, e) individuals can convey and listen to oral speech, f) individuals are able to engage in mutual gaze; making and holding (or avoiding) eye contact and seeing where other people are located, and finally g) individuals are able to use and sense subtle

olfactory and tactile stimuli such as pheromones or a light touch. In a sense, when we remove certain aspects of our natural communication, such as synchronicity or facial expressions, we are essentially "crippling" the way we communicate.

He theorized that when naturalness was low it would lead to an increase in cognitive effort (increased neural activity in the brain), increased communication ambiguity (misinterpretation due to missing cues), and lower physiological arousal (lower task engagement). It was expected that these factors would mediate the relationship between media naturalness and performance outcomes and that the less natural the medium, the worse its impact on communication and thus performance. However, his theory has not been tested empirically.

At first glance, it would seem that Media Naturalness and Media Richness are highly similar, as after all, mediums that contain more elements of media naturalness would also be higher in media richness (e.g. video conferencing is both more natural and rich than e-mail). However, the distinction lies in that Media Richness Theory, at its core, argues that more richness is always better as it facilitates the rapid exchange of information and resolution of uncertainty and ambiguity, whereas the Media Naturalness Hypothesis would argue mediums that add too much information could be counter-productive and cause cognitive overload at a point (because they are not natural). An example of how a media richness continuum would look relative to media naturalness is shown in the following Figure 1 (Hantula et al., 2011) below. Media richness increases as the continuum moves from the left to the right, but media naturalness decreases as it moves from the center (center is always highest naturalness).

Figure 1. Media Richness/Naturalness Continuum

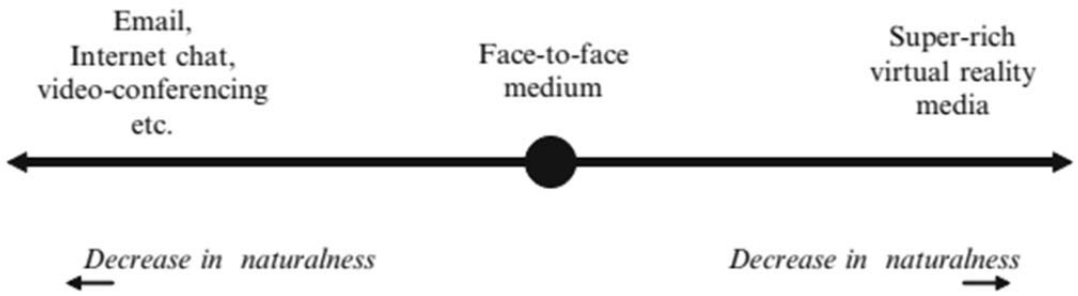


Fig. 1 The face-to-face medium is the most natural, located on a midpoint between lean and super-rich media

Media Compensation Theory

It is frequently found that virtual teams utilizing CMCs are able to communicate and collaborate effectively, and have been shown to be able to generate decisions with equal or better accuracy/quality as FTF teams (Crede & Sniezek, 2003; Lu et al., 2012). In fact, there is evidence that shows managerial preference for media lean mediums such as e-mail for a variety of tasks that both Media Richness Theory and the Media Naturalness Hypothesis would deem to be a poor fit (Rice & Shook, 1990). In order to address this seemingly paradoxical finding for why people would choose and efficiently utilize potentially poorly fitting and unnatural CMCs, the Media Compensation Theory (Hantula et al., 2011) was developed. This theory is an expansion of Kock's original Media Naturalness hypothesis and contains seven additional principles beyond the Media Naturalness principle and seeks to explain how humans communicate naturally, and how they adapt to non-natural CMCs. The eight principles are a) media naturalness, b) learned schema diversity, c) innate schema similarity, d) evolutionary task relevance, e) compensatory adaption, f) media humanness, g) cue removal, and h) speech imperative.

The media naturalness principle is basically a transplant of the media naturalness hypothesis by Kock, and has already been thoroughly discussed beforehand. At its core, it argues that CMCs that are more similar to face to face communication will be considered more natural, resulting in less effort to interpret messages, and increase physiological arousal.

The learned schema diversity principle argues that "Individuals learn and acquire communication schemas through interaction with the environment; individual differences are a result of learning." The idea of schemas was first introduced by Jean Piaget (Piaget & Cook, 1952) and defined as an organized pattern of thought and behavior that are organized categories of information and the relationships among them. Originally used for characterizing development in children, Piaget argued that as children develop by encountering new information and experiences, they will repeatedly acquire new schemas or modify existing ones to organize their understanding of the world. Similarly here, the Media Compensation Theory argues that the manner in which people communicate are also based off communication schemas that they have acquired through their development, and that there will be inter-individual differences in the amount of schemas acquired because individuals will have had different experiences. For example, the communication schemas that the average teenager possesses now might include communicating through tweets on Twitter, texting on phones, or posting comments on Facebook. These teens may possess substantial knowledge about commonly used abbreviations in CMCs such as "brb," "ttyl," or "lol." On the other hand, the average 80 year old will likely not have had much experience with these types of communication schemas and have difficulty communicating through Twitter or Facebook and/or fail to recognize what those abbreviations mean. Instead they might still remember the days when you sent regular mail or sent beeper messages rather than e-mail. Thus, individuals should differ in their ability to communicate via CMC depending

on how much exposure and experience they have had with different mediums in the past. However, it is important to understand that communication schemas are not necessarily tied down to one medium. For example, the use of emoticons or emojis to express feelings is a communication schema that can be applied to multiple types of CMCs including e-mail, Twitter, instant messaging, Facebook and so on. Another example would be starting letters/e-mails with a "Dear Mr." or "Hello," and ending with "Sincerely." As such, it would be expected that schemas attained through using one form of communication can sometimes be transferrable to other forms of communication. I will connect this principle later on with CMC competence to show that individuals will be more competent at certain CMCs due to their different experiences that have led to acquisition of different communication schemas.

The innate schema similarity principle argues that there are universally shared communication schemas that exist between all humans as all humans have evolved to communicate in a similar fashion. At its core, this principle argues that despite cultural, geographical, and linguistic differences between individuals nowadays, there still exist some communication commonalities that can be interpretable by all. Examples include facial expressions such as smiling or frowning. When applied to the virtual context, it implies that despite people using new communication schemas such as CMCs to communicate, we will still incorporate classic schemas that should be recognizable by all (e.g. smiling in a video call). This principle has limited applicability to my study beyond that participants will likely be able to recognize smiles and facial expressions of each other in the video conferencing condition.

The evolutionary task relevant principle argues that modern tasks that are functionally similar to ancient tasks (e.g. foraging, hunting) will require less effort to complete than tasks that are not functionally similar at all to ancient tasks. This study will only be using one task, a

hidden-profile decision-making task, and thus this principle should not have any direct implications on the study as it mainly argues that there may be differences between tasks in how much effort is needed. Furthermore, communicating and sharing information should be a simple task that has been present since ancient times and should not require significantly more effort to accomplish.

The compensatory adaptation principle argues that "Individuals using media that suppress elements of face-to-face communication do not accept the obstacles posed by unnatural media passively. Instead they compensate by changing their communication behavior..."(Hantula et al, 2011, p.347). An example would be using emoticons and emojis in e-mails and text messages to express feelings in a medium that would normally prevent that type of information from being exchanged. This principle, when used in conjunction with the learned schema diversity principle, suggests that although humans are evolutionary predisposed to FTF communication, through experience and schema acquisition, we can adapt ourselves to the limitations of the CMC by altering the manner in which we communicate in those mediums. Furthermore, this means that it is not only an issue of what CMC is being used, but also how effectively you are able to adapt to the strengths and limitations of the CMC. This allows for the possibility that one individual may be more adapted to using a leaner medium through frequent use, such as e-mail, and perform better with it, but fail to communicate effectively with a richer medium such as video-conferencing because he/she has not had an opportunity to acquire experience with the medium. This suggests that there may be a powerful individual quality that can influence success in virtual teams. One stream of research that supports this view is the research associated with the Social information Processing Theory (SIPT) (Walther, 1996). Walther found that while the manner in which we exchange and receive information may be limited by the virtual context (such as lack

of contextual/social cues), given adequate time to communicate and interact, individuals were able to develop meaningful relationships with one another by adapting the manner in which they exchange and interpret information (Tidwell & Walther, 2002; Walther, 1992, 1996; Walther & Burgoon, 1992).

The media humanness principle argues that when the computer interface of the CMC incorporates elements that make them "look and feel" more human, they will also be perceived as more natural. This would suggest that when we design programs or tools that are similar to humans (e.g. giving the name "Siri" to the artificial intelligence (A.I.). on the Iphone) they become more natural and we treat them as another social actor. In the context of this study, participants will be using Skype which is not designed to emulate humans, and thus this principle should not come into play. However, this principle would suggest that if a computer A.I. confederate was used in a study, it would beneficial if it was designed to resemble human speech patterns and responses.

The Cue Removal principle contends that "media that provide stimuli (or cues) but block people from sensing the information accompanying those cues will require more effort and adaptation than media that do not provide such cues at all." (Hantula et al., 20011, p. 349). This principle is important as it argues that more is not always better, as extraneous information can increase cognitive load without necessarily providing important information. More importantly, in the Hidden Profile paradigm where being able to maximize unique information is key, CMCs higher in richness may actually use up more cognitive resources for attending to information that is not necessary to solving the task at hand. For example, instances where the video aspect of the video conferencing was not needed all for the task and ended up only as a distraction, especially if the video started chopping up or cutting out. In decision-making tasks, the content of the

information is more important than how it's presented. Being able to perceive a teammate's eye color or shirt color does not add any incremental value to the task at hand. As such, extraneous information channels in the CMC may actually detract from the efficiency of the team's information sharing by increasing cognitive load and forcing team members to attend to irrelevant information. Thus it would make sense that in decision-making tasks, the addition of audio and/or video information may detract from the experience rather than add to it.

The final principle of the Media Compensation Theory is the speech imperative principle, which argues a medium's ability to convey speech is significantly more important than the medium's ability to convey facial expressions or body language. This principle was derived from evolutionary literature that suggests more costly adaptations (evolutionary changes in our body) are also more important for the underlying tasks they support. As evolving the larynx to allow us the ability to speak also significantly increased our susceptibility to choking, it is thought that this "cost" we exchanged for the ability to speak represents how important speech is to us. This suggests individuals may be more accustomed to and prefer CMCs that include speech as a component, although the authors failed to make any claims on this principle's effect on performance and communication.

Unfortunately, the Media Compensation Theory has never been tested empirically, but some of its principles are useful to this study by bringing to light that individuals can vary in their understanding and familiarity with different communication schemas (learned schema diversity), that individuals are able to overcome limitations of CMCs by adapting their behavior (compensatory adaptation) and that sometimes CMCs that provide unnecessary cues may actually hinder performance by causing more effortful processing (cue removal).

CMC Competence and Individual Differences

One issue with all of the central CMC theories introduced earlier (Media Richness Theory, Media Naturalness Theory, and Media Compensation Theory) are that they largely ignore the role of the individuals utilizing the CMCs. Media richness theory generally argues that the richer the medium, the more it would benefit all users as it should provide more types of information to be communicated and more quickly. Thus, everyone should prefer richer mediums. Media naturalness hypothesis would argue that the more natural the better, and that all individuals will prefer CMCs that are more similar to face to face communication because that is what we have evolved to prefer. Media compensation theory does provide some acknowledgement of differences between individuals in their learned schema diversity principle, acknowledging that some people may be more skilled in using certain CMCs as a result of acquiring different communication schemas, but their general premise is that people will need to use more effort to adapt to less natural mediums and should generally be more efficient using more natural CMCs.

These theories have largely ignored the issue of variability between individuals in both their preference for CMCs and competence in using CMCs. However, there is a body of research that has shown that individual differences (e.g. personality, self-esteem, self-efficacy) can have significant effects on how people approach and utilize CMCs. For example, Joinson (2004) noted that low self-esteem internet users preferred e-mail communications much more than high self-esteem users, and that increased chances of rejection in a scenario led to much higher preferences for virtual communication than face to face communication. This shows that people may have individual preferences to certain CMCs that have little to do with whether the CMC is fit for it or how similar it is to face to face communication

CMC competence is a term coined by Spitzberg (2006) and represents an individual's competence and effectiveness in using CMCs. The main facets of CMC competence are CMC motivation, CMC knowledge and CMC skills thought to correspond to their parallels in FTF communication (e.g. composure, attentiveness, coordination). The origins of this conceptualization stem from work done by Ring and colleagues using a dramaturgical perspective in conceptualizing an actor's performance (Ring, Braginsky, & Braginsky, 1966; Ring, Braginsky, Levine, & Braginsky, 1967). They argue that an actor needs to be motivated to give a good performance, but motivation by itself is insufficient if the actor does not have the script for how the play should go (knowledge). However, even possessing both the motivation and knowledge is insufficient if the actor lacks the skills to translate that motivation and knowledge into competent action. Using this broad conceptual model of competence as being a function of the motivation, knowledge and skills of the individual, Spitzberg translated it to the CMC context to develop his conceptualization of CMC competence.

CMC motivation is meant to capture the range of constructs that would endear a person to look favorably upon CMC such as willingness to adopt new communication technologies, satisfaction, gratifications, and positive attitudes toward such technologies. Individuals with high CMC motivation are characterized by confidence and comfort in using CMCs whereas negative motivation towards CMC use is characterized by anxiety, apprehension, apathy or even disinterest towards using CMCs. Spitzberg formally defined CMC motivation as "the ratio of approach to avoidance attitudes, beliefs, and values in a given CMC context." (p. 640). As such, it would suggest that individuals may differ in their willingness to use CMCs, independent of the richness or naturalness of the CMC.

CMC knowledge is formally defined "as the cognitive comprehension of content and procedural processes involving in conducting appropriate and effective interaction in the computer-mediated context." (p. 641). Thus, an individual possessing a high amount of knowledge regarding CMCs would be expected to be able to effectively adapt their communication style to the CMC context, and also possess the procedural knowledge needed for utilizing different CMCs (e.g. understanding the role of emoticons in messages, knowing that "tweets" have a 140 character limit). While all knowledge and skill acquisition must be acquired through some type of learning, it is relatively rare for individuals to learn to use CMCs through formal training or lecture. One manner in which individuals may come to acquire CMC knowledge is through experiences and repeated interactions with CMC. As such, one manner in which we can view CMC knowledge is by the breadth and depth of communication schemas attained through past experiences (i.e. learned schema diversity principle).

Spitzberg defined skills as "the repeatable, goal-oriented behavioral tactics and routines that people employ in the service of their motivation and knowledge." (p. 638). In a previous study, Spitzberg and Cupach (2002) identified over 100 distinct skills in the communication competence literature, but ultimately were able to refine them into 4 central skill clusters: attentiveness (i.e., displaying concern for, interest in, and attention to the other person or persons in the interaction), composure (i.e., displaying assertiveness, confidence, being in control), coordination (i.e., displaying deft management of timing, initiation and closure of conversations, topic management), and expressiveness (i.e., displaying vividness and animation in verbal and nonverbal expression). It is thought that these skills reflect basic principles of effective communication, and thus an individual high in CMC competence should be able to adapt these skills into the CMC context. Several studies have shown evidence that these skills exist in the

CMC context and are beneficial towards effective communication. For example, Bunz and Campbell (2004) found that participants were more likely to reply to e-mails politely when there were politeness cues embedded within the e-mail, suggesting that showing concern/interest in others is likely to be reciprocated in a CMC context. Castella, Abad, Alonso, and Silla (2000) found that familiar individuals communicating virtually adapted their messages to be more informal, including emoticons and humor to better express themselves to their friends.

All in all, it is expected that an individual highly competent in using CMCs must not only possess the knowledge to effectively communicate using CMCs, they must also possess the skills to apply that knowledge into the CMC context. Additionally, an individual competent in CMC must also have the motivation to use CMCs, otherwise they will be unable to leverage their knowledge and skills. For example, an individual may possess high knowledge regarding Formula 1 racing, extensively studying videos about how to properly corner and have read books on how to shift gears efficiently. However, just possessing the knowledge is insufficient for competency. If the individual lacks the skills to actually transfer that knowledge (e.g. having the motor coordination to shift gears in time, having the hand-eye coordination necessary to properly corner) then all that knowledge would be useless. Likewise, the opposite is also true. Possessing high motor skills and being able to shift gears smoothly, does not make one a competent F1 driver by default if one lacks the knowledge on when it is appropriate to apply these skills (e.g. randomly shifting gears when it is an inappropriate time to so may damage the vehicle). Lastly, both knowledge and skills come to naught if the person lacks the motivation to put them to use. A racer that has suffered an accident may still retain the knowledge and skills necessary to race at a top level, but has lost the motivation and confidence to race again and cannot be called a competent F1 driver any longer.

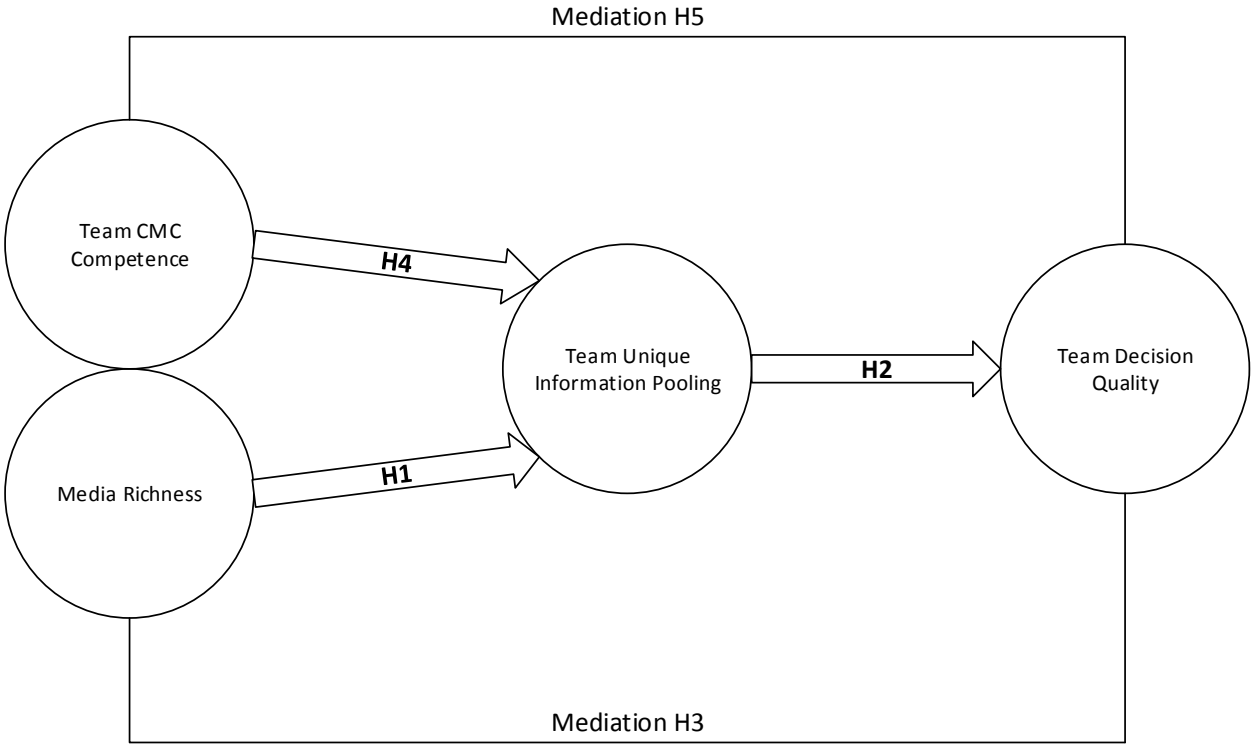
As decision-making teams typically require input from all members, it would be expected that the average CMC competence of the team, or team CMC competence, would be one indication of whether a virtual team would be expected to successfully pool unique information. I argue that CMC competence can be aggregated into a compositional team variable and can be used for meaningful comparisons between teams. Specifically, it would be expected that teams with a lower team CMC competence score would perform more poorly than teams with higher team CMC competence because its members will be less motivated, possess less knowledge and less skills than members in the high CMC competence team.

While CMC competence is predicted to be one of the two main predictors of unique information pooling in this model, an alternative perspective might argue that CMC competence is actually just self-efficacy with a different label. Self-efficacy was first coined by Bandura, and is commonly defined as one's belief in one's own ability to complete tasks and reach goals (Bandura, 1977, 1982). The self-efficacy literature has shown that one's perception of self-efficacy is a strong predictor for behavior and numerous self-efficacy measures have been developed ranging from exercise to internet usage, to breast feeding (Eastin & LaRose, 2000; Kingston, Cindy-Lee, & Sword, 2007; Marcus, Selby, Niaura, & Rossi, 1992). It is highly likely that the two will be highly correlated as CMC competence, is overall, a measure of perceived ability to successfully communicate using a CMC. However, the difference lies in that a truly CMC competent individual must possess all three components of motivation, knowledge and skills to effectively utilize CMC, whereas a highly self-efficacious individual only needs to believe they can do well, regardless of their actual skills and knowledge. As such, CMC competence is a more specific construct that should provide explanations for when outcomes do

not match perceptions of ability (e.g. may have the motivation and confidence to do well, but lack the knowledge and skills to back up that confidence).

Model & Hypotheses

Figure 2. Model of Team Decision-Making



Presented above is my model for the proposed relationships between media richness, unique information pooling, decision quality and CMC competence. I predict that media richness is negatively related to team unique information pooling, and that generally lower media richness CMCs will out pool higher media richness CMCs. I predict that team CMC competence is positively related to team unique information, and that teams with higher CMC competence will pool more unique information than teams with lower CMC competence. Lastly

I predict that the unique information pooling mediates the relationship between both media richness and team CMC competence to team decision quality.

Contrary to what has been suggested by Media Richness Theory, I argue that more is not always better. Specifically, lower media richness teams should be more task focused via Cues-Filtered Out Theory leading to more effective utilization of time, receive less cognitive burden via the Cue Removal Principle from Media Compensation Theory, and also promote more equal participation from team members via Status Generalization; allowing for more unique information to be shared and pooled. For example, in the high media richness condition, individuals may be reluctant to speak out of turn when a higher status member is speaking, allowing for one person to dominate the conversation. Conversely, in the instant messaging condition, people can type and input text without interrupting one another as the transmitting of one text does not prevent the transmission of another's text. Furthermore, instant messaging requires very little bandwidth and there are less issues with "lag" such as screen blurring/freezing and/or audio cutting off intermittently, which in video conference calls, may frustrate user collaboration and hamper the sharing/understanding information being discussed (i.e. cue removal principle). While some researchers have previously found no effects for communication technology on unique information pooling and decision quality (Lu et al., 2012), I contend that previous research was handicapped by the time period in which they were conducted as virtual communication was still in its relative infancy and participant familiarity with the technology relatively low. Additionally, previous studies have largely ignored the differences between CMCs and inappropriately grouped together multiple CMCs into one category. I contend that there are differences in media richness, the speed of which information can be communicated and the type of information which can be communicated, within the broad

family of CMCs. Furthermore, some individuals may be more competent with CMCs as opposed to others because of differences in motivation, knowledge and skill regarding CMCs that resulted from different experiences and communication schemas acquired. For the purpose of this study I will be comparing a low media richness CMC, instant messaging, against a high media richness medium, video conferencing, to showcase the differences that are inherent between different types of CMCs. Thus I propose the following:

H1: Media richness of CMC is negatively related to team unique information pooling such that teams using CMCs with high richness will pool less unique information than teams using CMCs with low media richness.

Unique information pooling is one of the most significant predictors of decision accuracy within the information sharing literature (Lu et al., 2012; Mesmer-Magnus & DeChurch, 2009). Teams that are able to discover and share more unique pieces of information are more likely to correctly solve the hidden profile. As such, I would expect my findings to fall in line with the rest of the field in this regard, that there is a positive relationship between unique team sharing and team decision quality (whether or not the team makes the correct choice in the hidden profile task). The level of analysis for this is necessarily at the team level because decision quality will be assessed by the team's decision.

H2: Team unique information pooling positively predicts team decision quality.

In virtual teams, media richness is expected to influence team decision quality by changing the manner in which team members communicate, limiting the type and speed of information able to be conveyed. The medium by itself does not lead directly to changes in

decision quality; rather it should affect the degree to which the team is able to successfully pool unique information which may then impact decision quality. As such I propose the following:

H3: Team unique information pooling mediates the relationship between media richness of CMC and team decision quality.

Next I propose that team CMC competence also positively predicts unique information pooling in conjunction with media richness. This predicted effect is supported by the learned schema diversity principle and the compensatory adaptation principle of Media Compensation Theory(Hantula et al., 2011); the Social Information Process Theory(Walther & Burgoon, 1992); and also broadly by motivation and self-efficacy research. The introduction of this relationship is meant to clarify the conflicting findings of virtual team performance by looking at beyond just the capabilities of the medium, but also the inter-individual differences in skills, knowledge, and motivation of the teams using the CMCs. Just as one would not expect a novice violinist to perform better simply by handing them a Stradivarius, one would not expect an individual to be able to effectively utilize a medium he/she has no knowledge of or unconfident in using. A virtual team that is motivated, knowledgeable and skillful in using CMCs is much more likely to be able to leverage the capabilities of the CMC they are utilizing. Thus, on average, a team with higher CMC competence should be more likely to correctly solve the hidden profile task than a team with a lower CMC competence score. And thus I propose:

H4: Team CMC competence positively predicts unique information pooling.

Similar to H3, I predict that team CMC competence influences team decision quality by changing the amount of unique information the team is able to pool; teams filled with motivated, skillful and knowledgeable members are much more likely to overcome the shared information bias and thus I propose my final hypothesis:

H5: Team unique information pooling mediates the relationship between team CMC competence and team decision quality.

Method

Participants

Participants were undergraduate college students recruited from a large Midwestern university through the psychology department's experimental research website. Participants were given credits for participation that were either required for psychology courses or could be used as extra credit for certain courses. There were minimal restrictions for participation in the study besides the requirement to be able to speak and read English fluently.

After accounting for teams with missing data and mechanical failures (1 team was removed because the session could not be completed due to mechanical failure, 1 was removed because the chat log was lost), the final sample size consisted of 234 participants spread across 78 teams (38 instant messaging, 40 video conferencing). The average age of participants was 19.33 (SD = 1.57). Participants were predominantly female (184 females to 50 males) and Caucasian (168 Caucasian/234 total).

Measures

The primary constructs of interest in my model are CMC competence, unique information pooling and team decision quality. However, I also measured virtual decision-making self-efficacy to show that CMC competence is a distinct construct from self-efficacy. Additionally, I also included a measure of engagement in my study to address concerns of an alternative model of decision-making quality where it is thought that participant engagement would predict decision quality rather than unique information pooling. In my study I believe that decision quality is predicted by media richness and team CMC competence, mediated through unique information pooling, rather than engagement in the task.

CMC Competence: To measure CMC Competence, I used a sub-scale of the IMPACCT measure (Spitzberg, 2011) that was developed as an advancement of the initial CMC Competence Measure proposed in Spitzberg (2006). The IMPACCT measure was originally developed to survey student communication and critical thinking skills and has been empirically tested to be reliable (a=.96) using a 1,880 student sample. This sub-scale was developed specifically to measure individual competence regarding the appropriate and effective use of CMC technologies for communication. I updated the measure slightly to account for changes in technology (e.g. providing updated examples of common CMCs as referents and removing some attention check items that were unneeded in our study, resulting in a 25-item measure (see Appendix A for items). Participants indicated the extent to which each statement on the measure accurately described them using a 7-point scale ranging from 1 (*Not at all true of me*) to 7 (*Very true of me*). Individual CMC competence was computed by calculating the average of each individual's score and team CMC competence was computed by averaging the CMC competence of each individual within the team (compositional variable). The internal consistency reliability of the measure is .92.

During the analysis phase I conducted an exploratory factor analysis (full results shown in Appendix B) with the CMC competence scale and the virtual decision-making self-efficacy measure to see if the constructs clearly mapped onto separate factors. In this process I also identified 7 items that showed poor loadings and that seemed to map onto a different construct (all the CMC adaptability skill items mapped separate from the other CMC competence items, and were dropped). The final measure contained 18-items and had an internal consistency reliability of .92 (see Appendix C for final item set).

It should be noted that this CMC competence measure is targeted at the broad level of competence towards all CMCs, rather than towards a specific CMC (i.e. competence toward video conferencing). It was not expected that there would be significant differences in competence toward either CMC in this study as they are both components of the same program (i.e. Skype) and commonly used in conjunction.

Virtual Decision Making Self-Efficacy: To measure virtual decision making self-efficacy, I adapted a 12-item measure created by (Howard, 2014) that was originally created to measure an individual's self-efficacy when using a computer. The measure was adapted such that each item referred to CMCs instead of computers where appropriate, and the items were framed to a virtual decision making context (i.e. "When I am in a virtual decision-making team using CMC, I am confident that…"). Participants indicated their agreement with each statement using a 5-point scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). An individual's score on the measure was calculated by computing the average of their responses across the 12 items, and the team-level virtual decision making self-efficacy was the average of each team members' scores (see Appendix A for items). After dropping 1 item that loaded poorly from the exploratory factor analysis, the final measure contained 11 items and had an internal consistency reliability of .86 (see Appendix C for final item set).

Engagement: To measure participant engagement in the task, I adapted a portion of the User Engagement Scale (UES) (O'Brien & Toms, 2013). In their study they found that the original 28-item measure loaded cleanly on 4 different underlying factors, one of which was theorized to represent user engagement and experience (the other factors were concerned with usability/utility, aesthetics and focused attention). I slightly adapted the items from their proposed sub-scale to create a 9-item measure on engagement (see Appendix A for items).

Participants indicated their agreement with each statement using a 5-point scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). An individual's engagement score was calculated by computing the average of their responses across the 9-items and team-level engagement was computed by averaging each team members' score. The internal consistency reliability of the measure is .87.

Unique Information Pooling: Unique information pooling was computed via text and audio coding of the number of pieces of unique information mentioned during the discussion phase of the experiment. There were a total of 31 pieces of unique information (12 regarding Company A, 19 regarding Company B) that could be mentioned by each team. All initial coding was done by two undergraduate research assistants who were trained on how to code by the primary investigator. They were trained together for 4 hours using pilot study data and initial inter-rater reliability based on the pilot study was .91 which was deemed sufficient for data collection for the main study to commence. Inter-rater reliability for the main study was .61 as calculated using Cohen's kappa, which is considered moderate agreement. Disagreements were resolving in subsequent re-coding sessions through rater consensus.

Decision Quality: Decision quality was operationalized as whether the team made the correct decision in the experiment (coded dichotomously as either 0 = Incorrect or 1 = Correct).

Apparatus/Materials

The hidden-profile task was chosen because the group outcomes of task types that require persuasion or consensus are thought to be more highly influenced by communication mediums (Straus & McGrath, 1994). For this study the ACME Hidden Profile Task created by Dr. Poppy L. McLeod was used. It is a standard hidden profile task in which the participants are given the

role of a top management team tasked with deciding on a firm to acquire out of three potential firms (see Appendix D). Each information packet contained information about three companies that were potential acquisition targets as well as the criteria on which they should evaluate each company on. The criteria were 1) which company had the most promising future and would give the highest return over the long run, 2) the probability of you getting a return on your investment and whether these projections are accurate, 3) potential growth of the market in the future, 4) self-sufficient management team that does not require micro-managing, and 5) overall general strategy and business policies. Each company profile contained information about their name, products, location, size, age, financials (e.g. investment return rate, sales growth rate), strategic assets (e.g. management team, market share, product) and labor (e.g. labor costs, training, turnover). The instructions were adapted slightly to allow for single-choice rather than rank-ordering. As with other typical, solvable hidden profile tasks, there is one company that is the "best" choice (in our scenario, Company A), but that choice is not immediately obvious. Each member received a different packet of information that contained some common information regarding the companies, but also some uniquely held information about the companies. The full information set contained 95 items 13 positive items, 7 neutral items, and 13 negative items on Company A (Net Score = 0); 11 positive items, 8 neutral items, and 19 negative items on Company B (Net Score = -8); 5 positive items, 7 neutral items and 11 negative items on Company C (Net Score = -6). There were three separate packets used for this task, each differing in their information composition. A breakdown of how the information was distributed is shown below in Table 1.

Table 1. Distribution of Information in Hidden Profile Task

Information Distribution	Packet A (Full)	Packet B	Packet C
Common Company A	21(2+,6=,13-)	21(2+,6=,13-)	21(2+,6=,13-)
Common Company B	19 (11+, 7=, 1-)	19 (11+, 7=, 1-)	19 (11+, 7=, 1-)
Common Company C	23(5+, 7=, 11-)	23(5+, 7=, 11-)	23(5+, 7=, 11-)
Unique Company A (A only)	13 (11+, 1=, 1-)		
Unique Company B Set 1 (A only)	9 (1=, 8-)		
Unique Company B Set 2 (A & B only)	5 (5-)	5 (5-)	
Unique Company B Set 3 (A & C only)	5 (5-)		5 (5-)
Total Items	**95**	**68**	**68**
Net Score Company A	0	-11	-11
Net Score Company B	-8	5	5
Net Score Company C	-6	-4	-4

Note: (+) denotes positive, (=) denotes neutral, (-) denotes negative

Packet A contained the full information set, and also served as a manipulation check for the solvability of the hidden profile. Provided the full information set, it was expected that the participants would be able to discern the objectively best Company (Company A) for investment (Net score of 0 vs. -8 and -6). However, the common information was biased towards selection of Company B, and participants with incomplete information sets (Packets B and C) should prefer Company B (Net score of 5 vs. -11 and -4). This sets up a situation where a majority of the team members should prefer selection of the Company B, meaning that it would necessitate the use of unique information to overcome the shared information bias for Company B.

Participants were required to use a windows-based personal computer, a headset and a webcam for the task. The study used the Skype communication program, with certain functions disabled, as the CMC medium that teams communicated through. All measures were presented virtually through online surveys hosted on the Qualtrics survey website and the information packets were stored in Microsoft Word documents.

Procedure

There were two conditions in my research study to represent low vs. high media richness: an instant messaging condition (low media richness) and a video conferencing condition (high media richness). In both conditions the participants used the Skype program to communicate, but were limited to certain functions within the program. In the instant messaging condition participants were only allowed to communicate via a 3-way instant messaging chat room and were not allowed to use the program's audio or video capabilities. In this condition messages were not transmitted until the message author pressed the enter key on the keyboard. In the Video-Conferencing condition participants were provided a microphone and a webcam and were forced to communicate through a 3-way video conferencing call. They were only allowed to communicate through audio and not allowed to type to one another.

Upon arrival at the research lab, participants were greeted by the experimenter and told that they would be participating in a study of virtual team decision-making and that they will be asked to work together to solve a team decision-making task. They were assigned a participant code for confidentiality purposes, and then given an informed consent form detailing what they could expect from the study, requesting their permission to be recorded, and informing them that they would have different pieces of information in their information sets later on in the task. Participants were then grouped into ad-hoc teams of 3 participants and randomly assigned into a condition. Each team had 3 members that would participate in the main task, while the 4^{th} participant was given an alternative task and served as an additional manipulation check for the solvability of the hidden profile task. The 4^{th} participant was given the full information set and used as a reference to assess how difficult the task would be to solve if all information was readily available.

After the consent forms were signed, participants in the team task were randomly assigned to a station, each of which contained a different information packet (A, B or C) while the individual participant was told to await further instructions. Each station faced a different side of the wall so that no participant would be in view of each other throughout the rest of the experimental session. Additionally, each member was given a noise-canceling headphone to wear for the discussion phase so that cues outside of the CMC they were using would be minimized. Participants in the team task were given approximately 5 minutes to complete an online survey containing the CMC competence, virtual decision making self-efficacy and personality measures. After everyone was finished with the online survey, they were instructed to maximize the word document containing the information set and given 20 minutes to memorize as much information as they could about each company and make a decision for which company they prefer prior to team discussion. At this time, the 4th participant was given a hard copy of the full information data set to study and likewise given 20 minutes to study the information and come to a decision. During the memorization phase they were instructed to study independently without taking notes, relying only on their memorization. They were not allowed to communicate with each other during this phase and were told to pay particular attention to what criteria they should be basing their decision on and that they should do their best to remember specific facts and/or numbers to use in their discussion phase.

At the conclusion of the 20 minute study phase, participants were required to close the word document containing the information set and write down what their pre-discussion preference was. This was used as a manipulation check that the common information biased the decision towards Company B (for packets B and C) and to assess the solvability of the hidden profile (packet A and individual participant). Afterwards, participants in the team task were

instructed to switch over to Skype and given 25 minutes to discuss their preferences and come to a consensus about which company they would acquire. Participants in the instant messaging condition were only allowed to type to each other in the 3-way chat, while participants in the video conferencing condition were only allowed to communicate verbally (with video) to each other. After collecting the individual participants' choice, they were allowed to leave as they would not participate in the discussion phase. During the discussion phase the participants were instructed that they must utilize the full 25 minutes of discussion time and were reminded periodically that they should do their best to use statistics or specific points to argue their choices and that they should try to recall the criteria used for evaluating the companies. At the end of the 25 minutes, participants were asked if they had reached a consensus. If they had, they were told to quit Skype and then finish another online survey with the engagement measure and demographics questionnaire. It should be noted here that every team reached consensus, but if they had not reached consensus the data would have been retained for alternative analyses.

After completing the online survey, participants were asked to come together to fill out a form where they were instructed to copy their pre-discussion choice from the slip they wrote earlier, their choice as a team, and also a checklist (see Appendix E) where they were asked to indicate which pieces of unique information they had mentioned. Originally the idea had been to use the checklist as a self-report measure of unique information pooled, but subsequent analyses revealed that the checklist showed very poor reliability with rater coding in the pilot study and thus unique information pooling was ultimately assessed only through rater coding.

Results

Means, standard deviations, and correlations for individual level variables are presented in Table 2. The individual mean of CMC competence was 5.18 (*SD* = .72), suggesting that most participants considered themselves to be competent in using CMCs (a rating of 5 on the CMC competence scale represented "Somewhat true of me") and the low *SD* suggests that very few people considered themselves to be incompetent at CMCs. Virtual decision-making self-efficacy (*M* = 3.64, *SD* = .49), likewise suggested that most participants considered themselves to be efficacious in virtual contexts without too many participants straying far from the mean. Engagement (*M* = 3.82, *SD* = .58) suggested that most participants were moderately interested and engaged in the task. CMC competence was significantly correlated with age ($r(231) = -.23$, $p < .01$) and virtual decision-making self-efficacy ($r(232) = .58$, $p < .01$). These results suggested that younger participants were more likely to rate themselves as being competent in CMCs and that as CMC competence increased, so did one's perceptions of virtual decision-making self-efficacy.

Engagement was found to be positively related to CMC competence ($r(232) = .28$, $p < .01$) and virtual decision-making self-efficacy ($r(232) = .24$, $p < .01$), suggesting that participants who were more competent and efficacious were the ones more engaged in the task. Participants were not told whether their team made the correct decision prior to the collection of the engagement ratings, so it was unlikely that engagement ratings were influenced by feedback on actual performance on the task.

Table 2. Means, Standard Deviations, and Correlations among Individual-Level Variables

Variables	*M*	*SD*	1	2	3	4	5
1. Age	19.33	1.67	___				
2. Gender	0.21	0.41	.14*	___			
3. CMC Competence	5.18	0.72	-.23**	-.20**	___		
4. Virtual Decision-Making Self-Efficacy	3.64	0.49	-.09	.02	.58**	___	
5. Engagement	3.82	0.58	-.09	.10	.28**	.24**	___

Note: Overall N = 234.Correlation coefficients marked with an asterisk were statistically significant (* = $p < .05$, ** = $p < .01$)

Gender was coded as 0=Female, 1= Male. CMC-Competence was rated on a 1-7 scale, Virtual Decision-Making Self-Efficacy and Engagement on a 1-5 scale.

To further clarify the findings, an exploratory linear multiple regression was run with media richness (condition), CMC competence, virtual decision-making and self-efficacy predicting engagement. While not a part of my initial hypotheses, it was thought that this exploratory analysis would provide useful insight into how my constructs might impact engagement, an important construct in the performance literature. The results are presented in Table 3. The analyses revealed that the overall model was significant and accounted for 13% of the variance in engagement, $R^2 = .13$, $F(5, 228) = 6.92$, $p < .01$. However, only CMC competence ($\beta = .17$, $p < .05$) and media richness ($\beta = -.17$, $p < .01$) emerged as significant predictors. The results suggest that although engagement was correlated with multiple variables, it was mainly media richness and CMC competence accounting for the variance between individuals in engagement.

Table 3. Regression Analysis Predicting Engagement (Individual-level)

Variables	Engagement		
Predictors	B	SE(B)	β
Media Richness	-.20	.07	-.17**
CMC Competence	.14	.06	.17*
Virtual Decision-Making Self-Efficacy	.12	.09	.10
R^2		.13	

Note: N = 234. Regression coefficients marked with an asterisk were statistically significant (* = $p < .05$, ** = $p < .01$)

The results of the manipulation check revealed that the task showed relatively high solvability, with 64% of participants in the individual task solving the task correctly and 78% percent of participants given Packet A (full-information set) selecting Company A (the correct answer) as their pre-discussion choice. Furthermore, the manipulation check also revealed that 80% of participants receiving Packet B and 82% of participants receiving Packet C selected Company B as their pre-discussion choice, providing evidence that the manipulation for biasing the common information towards Company B succeeded.

Means, standard deviations, and correlations are presented for team level variables in Table 4. Mirroring the individual-level relationships, CMC competence, virtual decision-making self-efficacy and engagement were significantly related to one another. Once again, this suggests teams that were competent in CMCs also indicated higher virtual decision-making self-efficacy and engagement in the task. The mean of unique information pooling was 9.65 (SD = 4.18), which was quite concerning as there were a total of 48 pieces of unique information available. This means that teams generally pooled less than a quarter of the unique information available to them. This provides some context as to why teams fared so poorly in making the correct decision (M = .33, SD = .47). With a 33% accuracy rate and 3 possible choices, the teams' decision accuracy was effectively at chance.

A significant correlation emerged between media richness and team-level engagement ($r(76) = -.30$, $p < .01$), and unique information pooling ($r(76) = .26$, $p < .05$). As media richness was operationalized via condition (low media richness vs. high-media richness condition) and coded as a binary variable, these correlations are point-biserial correlations. The significant negative correlation between media richness and engagement falls in line with the regression analysis conducted earlier to parse out the main predictors of engagement, showing that teams

were more likely to have lower engagement in the video conferencing condition. The significant positive correlation between media richness and unique information pooling, however, was unexpected as Hypothesis 1 had predicted a negative relationship between media richness and unique information pooling (i.e. teams in the instant messaging condition will pool more unique information that teams in the video conferencing condition). Results indicated that the video conferencing condition pooled more unique information (M = 10.73, SD = 4.14) than the instant messaging condition (M = 8.53, SD = 3.98). As such, Hypothesis 1 was not supported.

Team CMC competence did not significantly correlate with media richness ($r(76) = .00$, $p > .05$), unique information pooling ($r(76) = -.02$, $p > .05$) or decision quality ($r(76) = -.17$, $p > .05$). The lack of a significant relationship between media richness and CMC competence was reassuring as this meant there weren't any significant differences in competence between the two conditions. Not finding a significant correlation between team CMC competence and unique information pooling did suggest that there was no main effect of team CMC competence on unique information pooling, and as such Hypothesis 4 was not supported.

Table 4. Means, Standard Deviations, and Correlations among Team-Level Variables

Variables	*M*	*SD*	1	2	3	4	5	6
1. Media Richness (Condition)	___	___	___					
2. CMC Competence	5.18	0.38	.00	___				
3. Virtual Decision-Making Self-Efficacy	3.64	0.26	-.23	.46**	___			
4. Engagement	3.82	0.36	-.30**	.34**	.25**	___		
5. Unique Information Pooling	9.65	4.18	.26*	-.02	.07	-.03	___	
6. Decision Quality	0.33	0.47	.04	-.17	-.12	-.03	-.03	___

Note: Correlation coefficients marked with an asterisk were statistically significant (* = $p < .05$, ** = $p < .01$)

CMC Competence was rated on a 1-7 scale. Virtual Decision-Making Self-Efficacy, and Engagement on a 1-5 scale. Media richness was coded dichotomously as 0 = Instant Messaging, 1 = Video conferencing.

To test for Hypothesis 2, which stated that team unique information pooling positively predicts decision quality, I conducted a logistic regression where decision quality was coded as a binary variable with 0 = incorrect, and 1 = correct. The results are presented in Table 5. Interpretation of the model chi-Square statistic revealed that the overall model with unique information pooling as the main predictor, was not significant $p = .77$. Additionally, unique information pooled was not a significant predictor of decision quality ($p = .77$) with an odds ratio (e^{β}) of .98, meaning Hypothesis 2 was not supported. The e^{β} represents the change in probability of the team reaching the correct decision for each one unit change in unique information pooling. An e^{β} of .98, if it had been significant, would have suggested that for each additional piece of unique information pooled, the team was 2% more likely to make the incorrect decision.

Table 5. Logistic Regression Analysis of Unique Information Pooling on Decision Quality

Predictors	β	*SE β*	Wald's X^2	*df*	*p*	e^{β}
Constant	.53	.61	.77	1	.38	.59
Unique Information Pooling	-.02	.06	.08	1	.77	.98
	X^2	*df*	*p*	2ll	Cox & Snell	Nagelkerke
Overall Model	.08	1	.77	99.21	.00	.00

Note: N = 78. Regression coefficients marked with an asterisk were statistically significant (* = $p < .05$)

Hypothesis 3 predicted that team unique information pooling would mediate the relationship between media richness and decision quality. However, because there was no significant relationship between unique information pooling and decision quality (H2), there was

no possibility of a mediation effect occurring and thus Hypothesis 3 was also unsupported. Likewise, Hypothesis 5 predicted that team unique information pooling would mediate the relationship between team CMC competence and decision quality. However, because there was no significant relationship between neither unique information pooling and decision quality (H2) or between team CMC competence and unique information pooling, Hypothesis 5 was also unsupported.

As all of my hypotheses were unsupported, even those that have been reliably replicated in literature (i.e. H2), I re-examined my data to see if perhaps I had retained too many teams. I decided to rerun my analyses using a more stringent cut-off to remove teams that were very unlikely to have been actively participating. Unfortunately, I also could not remove too many teams as that might too severely limit my power to detect effects. Ultimately, I settled on removing teams that pooled less than 5 pieces of unique information pooled, ultimately removing 6 teams that were all from the instant messaging condition.

Comparing tables 6 and 7 to tables 2 and 3 we see that there was only one major change, the positive relationship between media richness and unique information pooling disappeared. Otherwise, decision quality remained at 33% and the mean unique information pooled per team went up to 10.19, but otherwise did not significantly change any other relationships.

Unfortunately, this new set of analyses also failed to support my original hypotheses. The correlation between media richness and unique information pooled was not significant ($r(70) = -.07$, $p > .05$) and thus Hypothesis 1 was not supported. The correlation between team CMC competence and unique information pooled was also not significant ($r(70) = .15$, $p > .05$) and thus Hypothesis 4 was not supported. The binary logistic regression results shown in table 8

reveal that unique information pooling still failed to predict decision quality $p = .76$ and thus Hypothesis 2 remained unsupported. In the following discussion I will be mainly referring to the initial findings as these subsequent analyses did not reveal anything new with the exception of the relationship between media richness and unique information pooling which disappeared due to the removal of the 6 low performing teams that were all in the instant messaging condition.

Table 6. Means, Standard Deviations, and Correlations among Individual-Level Variables (Alt.)

Variables	*M*	*SD*	1	2	3	4	5	6
1. Media Richness (Condition)	___	___	___					
2. CMC Competence	19.33	1.71	-.02	___				
3. Self-Efficacy	0.20	0.40	-.01	.13	___			
4. Engagement	5.20	0.83	.00	-.19**	-.16*	___		
5. Unique Information Pooling	3.65	0.53	-.12	-.08	.04	.60**	___	
6. Decision Quality	3.82	0.58	-.18**	-.09	.11	.30**	.22**	___

Note: Overall N = 218.Correlation coefficients marked with an asterisk were statistically significant (* = $p < .05$, ** = $p < .01$)

Gender was coded as 0=Female, 1= Male. CMC-Competence was rated on a 1-7 scale, Virtual Decision-Making Self-Efficacy and Engagement on a 1-5 scale.

Table 7. Means, Standard Deviations, and Correlations among Team-Level Variables (Alt.)

Variables	*M*	*SD*	1	2	3	4	5	6
1. Media Richness (Condition)	___	___	___					
2. CMC Competence	5.20	0.44	-.01	___				
3. Self-Efficacy	3.63	0.27	-.01	.47**	___			
4. Engagement	3.82	0.38	-.31**	.37**	.26**	___		
5. Unique Information Pooling	10.19	3.88	.15	-.07	.12	-.03	___	
6. Decision Quality	0.33	0.47	.04	-.19	-.14	-.01	-.04	___

Note: Correlation coefficients marked with an asterisk were statistically significant (* = $p < .05$, ** = $p < .01$)

CMC Competence was rated on a 1-7 scale. Virtual Decision-Making Self-Efficacy, and Engagement 1-5 scale. Media richness was coded dichotomously as 0 = Instant Messaging, 1 = Video conferencing.

Table 8. Logistic Regression Analysis of Unique Information Pooling on Decision Quality (Alt.)

Predictors	β	*SE β*	Wald's X^2	*df*	*p*	e^{β}
Constant	-.49	.71	.48	1	.48	.61
Unique Information Pooling	-.02	.07	.09	1	.76	.98
	X^2	*df*	*p*	2ll	Cox & Snell	Nagelkerke
Overall Model	.09	1	.76	91.57	.00	.00

Note: N = 72. Regression coefficients marked with an asterisk were statistically significant (* = $p < .05$)

Discussion

My study proposed a model of virtual decision-making whereby team decision quality in virtual teams would be influenced by the media richness of the CMC being utilized by the team and the CMC competence of team members. Pulling from the Media Naturalness Hypothesis, Media Compensation Theory and Cues-Filtered Out Theory among others, I had predicted teams using CMCs lower in media richness would pool more unique information than teams using CMCs with higher media richness (H1) because it was thought that teams using low media richness CMCs would suffer from less cognitive load, be more-task focused and have more equal participation amongst team members. Additionally, I sought to replicate the common finding in the decision-making literature that unique information pooling would positively predict decision quality (H2). Combining H1 and H2 together, I had hypothesized that the relationship between media richness on decision quality would be mediated by the amount of unique information pooled (H3). Furthermore, I had also hypothesized that team CMC competence would likewise positively predict unique information pooling (H4) as it was thought that teams possessing higher CMC competence, characterized by higher motivation, knowledge and skills, would be more suited to communicating via CMC when compared to team's low in CMC competence. Likewise I had expected this relationship team CMC competence would thus indirectly influence team decision quality through unique information pooling (H5).

In the analyses, it was discovered that age was found to have a significant negative correlation with CMC competence. This relationship suggests that younger people view themselves as being more technologically literate and competent, reinforcing the rationale provided earlier that past findings on CMC technology need to be interpreted with caution society becomes increasingly competent with technology as time passes. As the effect emerged

even within a relatively homogeneous sample in terms of age, one might expect a much stronger effect when comparing individuals in organizations which generally contain much more variation in age. If the relationship were to be replicated in a worker sample, it would suggest that older workers may possess lower CMC competence, possessing lower motivation to collaborate virtually and lacking the skills and knowledge to utilize CMC to its full effect. Furthermore, CMC competence had a fairly large correlation with virtual decision-making self-efficacy. The relationship between CMC competence and virtual decision-making self-efficacy makes quite a bit of sense intuitively; a person that view himself/herself as being highly skilled in communicating via CMCs will also likely consider themselves to be highly efficacious in regards to communicating and collaborating virtually. Likewise, a person that views himself/herself as being incompetent in using CMCs would feel powerless and apprehensive in situations where they have to collaborate virtually, resulting in low virtual decision-making self-efficacy. This would have powerful implications in regards to team composition and selection of the appropriate communication medium for virtual teams. Teams that are more homogeneous in age may share similar levels of CMC competence, meaning younger workers may be more familiar and confident in using newer technologies, whereas older workers may benefit more from less virtual communication. When teams are comprised of workers varying vastly in age, and CMC use is necessary, it may be beneficial to select a CMC that everyone has familiarity with (e.g. e-mail). Otherwise, effective team performance may be hampered by a lack of self-efficacy and the skills/knowledge necessary to collaborate virtually through CMC use. Overall, this suggests that age may be an important variable of interest in studying the relationships between CMC use and team performance for future studies.

However, it should also be noted that there was high levels of range restriction within my sample in regards to age, gender, CMC competence, self-efficacy, and engagement. This range restriction could be a key factor in not finding the expected relationships especially given that teams did not access enough information to make an informed decision.

I also discovered a counter-intuitive relationship between media richness and engagement whereby participants in the video conferencing condition rated themselves as being less engaged in the task. One would typically imagine that being able to see and hear your teammates should increase one's engagement and enjoyment of the task, especially when the contrasting condition was where one typed to each other in silence. This finding also runs counter to the Media Naturalness Hypothesis which, in part, states that more natural mediums should lead to increased physiological arousal and thus engagement in the task. However, I do want to stress that this finding should be interpreted with caution as it may not necessarily be only the characteristics of the medium that has caused this relationship. Media richness is defined, in part, by the capacity and speed of which information can be transmitted through the medium, thus richer mediums should naturally be able to communicate more quickly. From my observations, participants typically reached consensus rather quickly in the video conferencing condition, perhaps as a byproduct of being able to exchange information so rapidly. However, they were not allowed to end their discussion until the end of the allotted time period, resulting in long pauses and awkward silences in the conversation. Additionally, being able to see your teammates sitting in silence with bored expressions might have detracted from the experience, resulting in lower engagement scores. On the other hand, in the instant messaging condition the amount of perceivable cues was decreased and breaks in communication were more normal since participants had to take time to think and type up their responses. It may be prudent to measure

time to decision to see whether it was the amount of "dead airtime" after reaching a consensus that may have influenced engagement scores.

However, if the relationship was in fact due to media richness, one possible interpretation is that extraneous information provided in the video conferencing CMC led to lowered engagement, perhaps through cognitive overload or fatigue. In the video conferencing condition, participants have to constantly attend to visual and audio cues over an extended period of time which may drain cognitive resources. Furthermore, when participants know that they are being visually observed they may feel ill at ease, requiring them to continually self-regulate their behavior and expressions. On the other hand, participants in the instant messaging condition may have felt less need to regulate their behaviors/expressions as there are no visual or audio cues information being exchanged (e.g. body posture, facial expressions, eye gaze, tone, etc.), resulting to less drain in cognitive resources. If the decrease in engagement is in fact due to the cognitive overload/fatigue, then it might be prudent for future studies to measure cognitive overload/fatigue and how it is influenced by time (as it is unlikely for a 5 minute conversation to be very taxing cognitively). Basically, how long is too long and what characteristics of the CMC are more taxing than others? Broader implications for the workplace might be that workers will have difficulty being engaged in long virtual meetings where they have to attend to multiple sources of information, and that perhaps there is a good reason for why past studies have shown that many managers prefer e-mails over other forms of communication(Markus, 1994).

Another possible interpretation is that this finding reflects the cue-removal principle of Media Compensation Theory, whereby the visual/audio cues presented in the video conferencing condition are imperfect and/or not matched with other expected cues (i.e. perceiving someone speaking from the video, but having the sound coming out delayed; expecting to see someone

making gestures when they are debating heatedly). Hantula et al. (2011) theorized that sometimes rich mediums such as video-conferencing might actually be more cognitively taxing than less media rich mediums like instant-messaging if they present information and cues imperfectly, or fail to supplement the information with expected cues. An example might be an instance where latency causes a discrepancy between the video stream and the audio stream. In the visual stream of information you see your teammate speaking, providing you with a visual cue that you should expect audio information as well. However, the delay has mismatched the audio such that sometimes their mouth is moving but no audio is coming through, or conversely where you hear words but the speaker's mouth is not moving in the video stream. The cue-removal principle argues it requires more effortful processing of information when individuals have to actively suppress the confusion over why the information associated with certain cues is not occurring. This may, once again, lead to a draining of cognitive resources and/or cognitive fatigue, leading to less engagement in the task.

Unfortunately, none of my main hypotheses were supported in the study. I found no evidence that groups using a lower media richness CMC medium pooled more unique information than groups using a higher media richness CMC medium (H1). In fact, I found an effect in the opposite direction of what I had predicted, with groups in the video-conferencing condition (high media richness) pooling significantly more unique information. This finding, while not in line with my initial prediction, is important as it suggests that media richness can have significant effects on unique information pooling and that there are differences between CMCs. Previous studies have focused almost exclusively on an inappropriate FTF vs. CMC dichotomization (Lu et al., 2012). By lumping together all CMCs into one general category we have lost sight of the significant differences that are present between CMCs, especially in

regards to its media richness. Furthermore, this finding reaffirms the need for researchers to stop generalizing the effects of one CMC across all CMCs and serves as a call to arms for researchers to pinpoint the key characteristics within CMCs that may be impacting information pooling and decision making (e.g. media richness).

Support for Hypothesis 2 was also not found. There was no effect of unique information pooling on decision quality. This was surprising, especially considering the robustness of the relationship found in the literature. However, this might have been in part due to the overall low amount of unique information pooling witnessed across conditions. With the average team failing to pool even a quarter of the total available unique information, it is highly possible that the failure to replicate the effect might have been due to the low performance of the sample. Additionally, it may be possible that my stringent operationalization of decision quality (right vs. wrong) decreased my ability to detect small increases in performance. Some previous studies have included multiple dimensions of decision quality such as performance across multiple trials, time to decision or confidence in decision, which might have made it easier detect increases in performance(Kerr & Murthy, 2009; Mesmer-Magnus et al., 2011). Furthermore, there is a small likelihood that the task possessed a "critical threshold" of unique information that needed to be reached for the correct decision to be made; meaning any increases in unique information pooled below the critical amount would not have impacted decision quality as it was operationalized in the study. It may be prudent for future studies to include multiple dimensions of decision quality and perhaps simplify the task so that gains in performance can be seen, even with relatively low pooling involved.

There is also the possibility that some participants were simply unable to accurately interpret the unique information being pooled. From my observations, many times participants

would erroneously interpret some clues (e.g., viewing aggressive labor unions as a positive when it should be viewed as a negative for investment purposes) or bring along personal bias into interpreting clues (e.g., "oil spills are not a big deal, look at BP they're still doing just fine"). Additionally, participants would frequently forget about what criteria they were supposed to be evaluating the companies on or introduced their own criteria for evaluation such as age of company or industry (e.g., many participants viewed Company B much more favorably as they viewed oil companies as being very lucrative companies). Some may also wonder about the difficulty or suitability of the task, since participant sample was predominantly students in the social sciences whereas the task was a business decision task (company acquisition). However, the manipulation check showed that given a complete information set, most participants were able to reach the correct decision; suggesting that overall the task was quite solvable, even in lieu of personal bias.

Finally, it may have been that the composition of unique information pooled mattered more than the overall amount of unique information pooled. The pieces of unique information were divided between companies A and B, all of which could be objectively interpreted as either positive or negative towards the evaluation of the company. Since the common information was biased towards the selection of company B, it would requires teams to pool more positive information about A and negative information on B to overcome the bias from the common information. Furthermore, some teams may have pooled unique information equally about both companies and "canceled out" the positives and negative clues. Since overall pooling was so low, even if the majority of the unique information pieces pooled were towards the correct choice, it might not have been enough to overcome the common information. Lastly, as participant A was given the full information set, he/she had the most cognitive load and was also the only one

biased towards Company A, so the onus of reaching the correct decision was largely in their hand. In future studies it may be necessary to reduce the overall initial bias present in the common information, so that there is no majority opinion effect. Additionally, it might be necessary to reduce the cognitive load on participant A so that he/she does not need to attempt to remember so many pieces of information at once.

Since I failed to find an effect for Hypothesis 2, my mediation hypotheses (Hypothesis 3 and 5) were also rejected as a consequence. Overall the analyses showed no significant difference between conditions in decision accuracy, with teams in both condition selecting the correct decision effectively at chance (33%). Interestingly, the results showed that teams in the high media richness condition pooled more unique information and also had higher average ratings of engagement in the task when compared to teams in the low media richness condition. If Hypothesis 2 had been supported it might have suggested that teams using high media richness CMCs pools more unique information and makes better decisions than teams using low media richness CMCs. This finding would have fallen in line with Media Richness Theory, which argues for a positive linear effect of increased media richness on unique information pooling and decision-making quality.

Finally, although CMC competence was not found to predict unique information pooling, there were significant correlations between CMC competence and virtual decision-making self-efficacy and engagement. This suggests that while CMC competence may not influence actual performance, it definitely does influence perceptions of self-efficacy and engagement in the task. In the post-hoc analyses it was discovered that CMC competence accounted for significant variance over and above media richness in predicting engagement. This suggests that CMC competence may have relationships with other important outcomes beyond what was originally

hypothesized and merits future study. For example, employee engagement is commonly thought to be associated with higher productivity, job satisfaction and overall performance in organizations (Harter, Schmidt, & Hayes, 2002). Measuring CMC competence in highly virtualized workplaces may increase our understanding of how CMCs influence worker engagement and provide us cues for when training interventions may be warranted to increase CMC competency and bolster engagement.

Limitations and Future Directions

While I failed to find support for my main hypotheses, I was able to find significant differences between conditions for unique information pooled and engagement. However, this relationship needs to be assessed with caution as it disappeared with the removal of 6 teams from the data set. Also, while CMC competence did not significantly predict unique information pooling, post-hoc analyses revealed that it did significantly predict engagement. These findings suggest that CMC competence may be a meaningful construct to examine in regards to improving workplace engagement, which is often an important correlate of job performance and satisfaction.

While I had argued for a negative relationship between media richness and unique information pooling, after some consideration it would actually make more sense for the relationship to be curvilinear, such that at extremely low levels of media richness (e.g. sending letters) teams would likely perform more poorly than teams using teleconferencing or videoconferencing. I would predict that instant messaging would be near the apex of the relationship between media richness and information pooling, with extremely low CMCs (e.g. e-mail) performing similarly to videoconferencing.

One major issue in the study was the overall low performance of the student sample on the task. With an accuracy rate at chance (33%) and the average team pooling only a quarter of the total unique information available, changes are warranted for future data collection attempts. It may be prudent to institute some type of incentive for performance, although the high engagement scores do suggest that lack of engagement with the task was not the main issue. It may also be beneficial to include a forced recall test so that students would be more motivated to memorize specific points of information.

This study specifically looked at decision-making teams utilizing CMCs as their main form of communication. Using an ad-hoc student sample I was unable to analyze the effects of member familiarity, which have been known to bolster the effects of performance and satisfaction in virtual teams(Adams, Roch, & Ayman, 2005), but it would be recommended for future studies to see how team member familiarity may decrease the need for high team competence. For example, familiar teams may already have specific Transactive Memory Systems in place to facilitate information sharing, and also foster a safe psychological climate, further increasing the chances of participation even from members lower in CMC competence. Similarly, at this time I am unable to compare teams with the same mean CMC competence but different compositions (e.g. one extremely competent member with two incompetent members, vs. three average competence members). Unfortunately, with such low standard deviations within the sample in regards to CMC competence, it is unlikely that I would be able to attain this type of information using a student sample. Since a significant relationship between age and CMC competence was discovered, a study using an organizational sample comprising of workers from many different generations would be ideal for exploring compositional differences as well as further clarifying the relationship between age and CMC competence.

Additionally, in this study I used a broad measure of CMC competence that was not limited to a specific CMC, however, it is possible that some individuals are much more skilled in certain types of CMCs as opposed to others. As such, future studies may benefit from creating alternate measures of CMC competence that are adapted to the specific medium the participant will be using, especially when comparing CMCs that are drastically different (e.g. e-mail vs. video conferencing).

The sample was also predominantly female and relatively young, raising potential concerns regarding the generalizability of the findings and whether a gender effect was masked because of the low number of male participants. Furthermore, my analyses revealed potential issues with range restriction that may further hamper generalizability. While it would definitely help to conduct subsequent follow-up studies using samples of workers to confirm generalizability, this study still provides valuable insight into a young, technologically competent generation that should generalize well for the next generation of workers.

Finally, in this study I was primarily interested in showing the difference in media richness between CMCs (i.e. instant messaging, vs. video-conferencing) so each team was restricted to a specific medium, but in practice teams may communicate utilizing multiple CMCs or use a mixture of FTF and CMCs. There has been some promising research on the concept of "virtuality," or the degree to which a team collaborates and communicates virtually as mentioned in the work by (Mesmer-Magnus et al., 2011), but that is beyond the scope of this investigation.

APPENDICES

Appendix A: Initial Measures
CMC Competence Measure

Instructions: People differ quite a bit in terms of how skilled they are at using **computer media** (including instant messaging, e-mail, Instagram, Twitter, Facebook, etc.) in communicating and conversing with others. For the following statements, we would like you to estimate, **compared to typical people** you encounter, how skilled you are in using **computer-mediated communication** (i.e., CMC). **CMCs** include things such as Facebook, Skype, e-mail, Twitter, Instagram, Google Hangout and so forth, basically whenever you are communicating using a computer or smartphone rather than face to face you are using a CMC to communicate. In the following questions, use the scale to select the response that best describes you.

1 = Not at all true of me 2 = Mostly not true of me 3 = Somewhat not true of me

4 = Neither true nor untrue of me; undecided 5 = Somewhat true of me

6 = Mostly true of me 7 = Very true of me

Select the response that best describes you. Reminder: CMCs are communication mediums such as Facebook, e-mail, Twitter, Skype, etc.

1. I enjoy communicating using CMCs.
2. I am nervous about using CMCs to communicate with others. [R]
3. I am very motivated to use CMCs to communicate with others.
4. I look forward to using CMCs to communicate with others.
5. Communicating through CMCs makes me anxious. [R]\
6. I am very knowledgeable about how to communicate using CMCs.
7. I am never at a loss for something to say using CMCs.
8. I am very familiar with how to communicate using CMCs.
9. I always seem to know how to say things the way I mean them using CMCs.
10. When communicating with someone through CMCs, I know how to adapt my messages to the medium.
11. I know when and how to close down a topic of conversation when using CMCs.
12. I manage the give and take of CMC interactions skillfully.

13. I am skilled at timing when I send my responses to people who contact me through CMCs.
14. I ask questions of the other person in CMC conversations so I know exactly what they mean and/or show them I'm paying attention.
15. I show concern for and interest in people I'm conversing with through CMCs.
16. I make sure my objectives are emphasized in my CMC messages.
17. My CMC messages are written in a confident style.
18. I am skillful at revealing composure and self-confidence in my CMC interactions.

I choose which medium (i.e., e-mail, Facebook, Twitter, Skype, etc.) to communicate based on...

19. …how quickly I need to get a message out to people.
20. …how lively the interaction needs to be.
21. …how much access the person I need to communicate with has to the CMC medium.
22. …how much information is involved in the message I need to communicate.
23. …how much access I have to the CMC medium. [R]
24. …how much personal or intimate the information in the message is.

Virtual Decision-Making Self-Efficacy Measure

1 = Strongly disagree 2 = Disagree 3 = Neither agree nor disagree

4 = Agree 5 = Strongly agree

When I am in a virtual decision-making team using CMC, I am confident that...

1. ...I can always manage to overcome issues with gathering information and/or making decisions virtually if I try hard enough.
2. ...if I encounter difficulties, I can find the means and ways to get what I want.
3. ...it will be easy for me to stick to my aims and get my point across, or get information from others using CMC.
4. ...I can deal with unexpected issues with gathering information and making decisions using CMC.
5. ...I can solve most problems if I invest the necessary effort.
6. ...I can remain calm when facing difficulties with CMC and/or making decisions virtually because I can rely on my abilities.
7. ...when I have to make a decision using CMC, I can usually find several solutions.
8. ...I can usually handle whatever problem that comes my way.
9. ...setbacks and failures I encounter while working in the team will only make me try harder.
10. ...I do not need assistance from others to utilize the CMC medium to its full potential.
11. ...there are few decisions I would be uncomfortable making using CMC.
12. ...I can persist and solve most any problem using CMC.

User Engagement Measure

Please select the response that best describes your experience in today's experiment.

1 = Strongly disagree 2 = Disagree 3 = Neither agree nor disagree

4 = Agree 5 = Strongly agree

1. I felt interested in the decision-making task.
2. The content of the company profiles incited my curiosity.
3. The discussion with my team was fun.
4. I felt involved in the decision-making process.
5. My overall experience was rewarding.
6. I would recommend this experiment to my friends and classmates.
7. I was really drawn into the discussion.
8. I consider our performance successful.
9. Talking to each other through CMC was worthwhile.

Appendix B: Exploratory Factor Analysis Results – Principal Axis Factor Extraction, Direct Oblimin Rotation

Items	Factor		
	1	2	3
I enjoy communicating using CMCs.	.86		
[Reverse]I am nervous about using CMCs to communicate with others.	.33		
I am very motivated to use CMCs to communicate with others.	.74		
I look forward to using CMCs to communicate with others.	.80		
[Reverse]Communicating through CMCs makes me anxious.			
I am very knowledgeable about how to communicate using CMCs.	.61		
I am never at a loss for something to say using CMCs.	.45		
I am very familiar with how to communicate using CMCs.	.53		
I always seem to know how to say things the way I mean them when using CMCs.	.55		
When communicating with someone through CMCs, I know how to adapt my messages to the medium.	.54		
I know when and how to close down a topic of conversation when using CMCs.	.53		
I manage the give and take of CMC interactions skillfully.	.62		
I am skilled at timing when I send my responses to people who contact me through CMCs.	.63		
I ask questions of the other person in CMC conversations so I know exactly what they mean and/or to show them I'm paying attention.	.50		
I show concern for and interest in people I'm conversing with through CMCs.	.53		
I can show compassion and empathy with others through CMCs.	.41		
I make sure my objectives are emphasized in my CMC messages.	.56		

My CMC messages are written in a confident style.	.52		
I am skillful at revealing composure and self-confidence in my CMC interactions.	.48		
I choose which medium (i.e., e-mail, Facebook, Twitter, Skype, etc.) to communicate based on...-...how quickly I need to get a message out to people.		-.75	
I choose which medium (i.e., e-mail, Facebook, Twitter, Skype, etc.) to communicate based on...-...how lively the interaction needs to be.		-.66	
I choose which medium (i.e., e-mail, Facebook, Twitter, Skype, etc.) to communicate based on...-...how much access the person I need to communicate with has to the CMC medium.		-.77	
I choose which medium (i.e., e-mail, Facebook, Twitter, Skype, etc.) to communicate based on...-...how much information is involved in the message I need to communicate.		-.74	
[Reverse] I choose which medium (i.e., e-mail, Facebook, Twitter, Skype, etc.) to communicate based on...-...how much access I have to the channel or medium.		.69	
I choose which medium (i.e., e-mail, Facebook, Twitter, Skype, etc.) to communicate based on...-...how personal or intimate the information in the message is.		-.67	
When I am in a virtual decision-making team using CMC, I am confident that...-...I can always manage to overcome issues with gathering information and/or making decisions virtually if I try hard enough.			.49
When I am in a virtual decision-making team using CMC, I am confident that...-...if I encounter difficulties, I can find the means and ways to get what I want.			.58
When I am in a virtual decision-making team using CMC, I am confident that...-...it will be easy for me to stick to my aims and get my point across, or get information from others using CMC.			.50
When I am in a virtual decision-making team using CMC, I am confident that...-...I can deal with unexpected issues with gathering			.61

information and making decisions using CMC.	
When I am in a virtual decision-making team using CMC, I am confident that...-...I can solve most problems if I invest the necessary effort.	.65
When I am in a virtual decision-making team using CMC, I am confident that...-...I can remain calm when facing difficulties with CMC and/or making decisions virtually because I can rely on my abilities.	.63
When I am in a virtual decision-making team using CMC, I am confident that...-...when I have to make a decision using CMC, I can usually find several solutions.	.60
When I am in a virtual decision-making team using CMC, I am confident that...-...I can usually handle whatever problem that comes my way.	.78
When I am in a virtual decision-making team using CMC, I am confident that...-...setbacks and failures I encounter while working in the team will only make me try harder.	.40
When I am in a virtual decision-making team using CMC, I am confident that...-...I do not need assistance from others to utilize the CMC medium to its full potential.	.46
When I am in a virtual decision-making team using CMC, I am confident that...-...there are few decisions I would be uncomfortable making using CMC.	
When I am in a virtual decision-making team using CMC, I am confident that...-...I can persist and solve most any problem using CMC.	.61

Appendix C: Revised Measures
CMC Competence Measure

Instructions: People differ quite a bit in terms of how skilled they are at using **computer media** (including instant messaging, e-mail, Instagram, Twitter, Facebook, etc.) in communicating and conversing with others. For the following statements, we would like you to estimate, **compared to typical people** you encounter, how skilled you are in using **computer-mediated communication** (i.e., CMC). **CMCs** include things such as Facebook, Skype, e-mail, Twitter, Instagram, Google Hangout and so forth, basically whenever you are communicating using a computer or smartphone rather than face to face you are using a CMC to communicate. In the following questions, use the scale to select the response that best describes you.

1 = Not at all true of me 2 = Mostly not true of me 3 = Somewhat not true of me

4 = Neither true nor untrue of me; undecided 5 = Somewhat true of me

6 = Mostly true of me 7 = Very true of me

Select the response that best describes you. Reminder: CMCs are communication mediums such as Facebook, e-mail, Twitter, Skype, etc.

1. I enjoy communicating using CMCs.
2. I am nervous about using CMCs to communicate with others. [R]
3. I am very motivated to use CMCs to communicate with others.
4. I look forward to using CMCs to communicate with others.
5. I am very knowledgeable about how to communicate using CMCs.
6. I am never at a loss for something to say using CMCs.
7. I am very familiar with how to communicate using CMCs.
8. I always seem to know how to say things the way I mean them using CMCs.
9. When communicating with someone through CMCs, I know how to adapt my messages to the medium.
10. I know when and how to close down a topic of conversation when using CMCs.
11. I manage the give and take of CMC interactions skillfully.
12. I am skilled at timing when I send my responses to people who contact me through CMCs.

13. I ask questions of the other person in CMC conversations so I know exactly what they mean and/or show them I'm paying attention.
14. I show concern for and interest in people I'm conversing with through CMCs.
15. I make sure my objectives are emphasized in my CMC messages.
16. My CMC messages are written in a confident style.
17. I am skillful at revealing composure and self-confidence in my CMC interactions.

Virtual Decision-Making Self-Efficacy Measure

1 = Strongly disagree 2 = Disagree 3 = Neither agree nor disagree

4 = Agree 5 = Strongly agree

When I am in a virtual decision-making team using CMC, I am confident that...

1. ...I can always manage to overcome issues with gathering information and/or making decisions virtually if I try hard enough.
2. ...if I encounter difficulties, I can find the means and ways to get what I want.
3. ...it will be easy for me to stick to my aims and get my point across, or get information from others using CMC.
4. ...I can deal with unexpected issues with gathering information and making decisions using CMC.
5. ...I can solve most problems if I invest the necessary effort.
6. ...I can remain calm when facing difficulties with CMC and/or making decisions virtually because I can rely on my abilities.
7. ...when I have to make a decision using CMC, I can usually find several solutions.
8. ...I can usually handle whatever problem that comes my way.
9. ...setbacks and failures I encounter while working in the team will only make me try harder.
10. ...I do not need assistance from others to utilize the CMC medium to its full potential.
11. ...I can persist and solve most any problem using CMC.

Appendix D: Task Information Packets
Hidden Profile Packet A/Individual Participant Task (Full Information Set):

ACME Inc.: Group Decision-Making for Investments

Instructions

~~~

Most companies make important investment decisions using a team approach. Your group here today represents the top management team of ACME ("Acquiring Companies Means Employment!"), Inc. Your company has been presented with the opportunity to acquire three smaller firms. ACME has $100 million to invest, which will allow the acquisition of only one of these firms. The Chairperson of the Board has appointed you to research the three acquisition targets and to recommend which one of them would be best for ACME.

There are a number of key factors that you should consider carefully in evaluating these companies. First, ACME prefers to acquire firms that will maximize wealth, over the long term. Which of these companies has the most promising future? Therefore you should consider the potential return on your investment. A second consideration is the likelihood of you actually getting that return, in the long run. That is, how precise is the projection and what is the probability that your actual return will be significantly different than the best estimate? Third, you should also consider the growth potential of each company's market. You would prefer to invest in a company that competes in a growing market. A fourth consideration is the quality of the company's management team. ACME takes a "hands-off" approach with its subsidiaries. Therefore, you prefer to invest in companies whose management team can achieve the profitability you desire. Finally, you should judge each company's general strategy and business policies. Do they seem like policies that will lead the company to profitability in the future?

In order to help you evaluate these companies, your in-house financial analyst has researched each company. Further, you have retained the consulting services of Smith, Barney & Howe, a highly respected and successful investment consulting firm, also to analyze these three companies. The results appear in the reports contained in your information packets. You should review all of this information, and based upon it, come to a conclusion about which of these three companies would be the right acquisition for ACME.

The Chair of the Board wants each of you individually to submit your personal recommendation, whether or not it agrees with the team recommendation. After you have studied the material and recorded your personal recommendation, you will decide as a team which of the three companies ACME should acquire. **There must be consensus agreement on the top ranked company**.
~~~

Company A
"Whiz-Bang Electronics"

Industry:	Industrial Electronics
Products:	Electronic manufacturing control devices
Location:	Metropol, California
Size:	$50 million in sales; 200 employees
Age:	Established 5 years ago

I. Financial

Your internal financial analyst estimates that the internal rate of return (i.e., the return on your investment) will be 15% annually over the next 10 years. This analyst believes the chances of you actually getting this return is 70 percent. Further, the analyst estimates that there is a 15 percent chance that ACME will either double this return (thereby providing a 30% return) or will have a zero return. The Smith, Barney & Howe consultants concur with the conclusions of your in-house analyst. In fact, SBH believes that there is an 80 percent chance of your obtaining the projected return. Both your internal financial analyst and the SBH consultants agree, however, that there is a near certain probability that ACME will suffer a loss during the first year, and that you would not achieve any return until after that time. This company's growth in sales has been positive, hovering around 5% annually from the beginning, but early projections indicate an increase to 8% for the next fiscal year. Further, this market is expected to grow in the foreseeable future.

II. Strategic

Whiz-Bang Electronics is young, and was founded by a group of bright and talented entrepreneurs whose management experience was limited, at the start. The company has an innovative and promising product line. The inexperience of the management team led to some early mistakes in marketing and distribution such that customer awareness of the products is low. As a result the company has only a 6% market share and low customer perceptions of service. Furthermore, Whiz-Bang Electronics' pricing structure is not suitable for its target customers. The company leadership team has been actively developing their professional managerial skills through workshops and close work with experienced consultants. Industry watchers have noted that this group seems to be making more effective decisions, which are probably responsible for the recent sales growth.

III. Labor

Whiz-Bang Electronics has very high labor costs. It spends a lot of money on employee development. They offer training in a variety of business-related skills ranging from communication to accounting principles. The company's recruiting processes are drawn-out, but very thorough and careful. Recruiting expenses represent a very large chunk of the company's operating budget. They provide fitness facilities and on-site child care for all employees.

Company B
"Power Energy"

Industry:	Energy
Products:	Power for heavy manufacturing
Location:	Bigtown, Texas
Size:	$50.5 million in sales; 225 employees
Age:	Established 25 years ago

I. Financial

Your internal financial analyst estimates that the internal rate of return (i.e., the return on your investment) will be 25% annually over the next 10 years. This analyst believes the chances of you actually getting this return is 70 percent. Further, the analyst estimates that there is a 15 percent chance that ACME will either double this return (thereby providing a 50% return) or have a zero return. The Smith, Barney & Howe consultants disagree with the conclusions of your in-house analyst, however. They believe that the rate of return will be lower. In fact, SBH estimates the rate of return will only be 5%, and that the chance of you getting that return will be 40 percent. Further, SBH expects a 30% chance either way that the return could double (thereby providing a 10% return) or that it could be zero. Power Energy historically has experienced growth in sales averaging 10% annually. It experienced record growth of 15% five years ago. The growth figures since then have been 12%, 10%, 9.3%, and 8%. The best estimates indicate flat growth in the overall market over the near future.

II. Strategic

Power Energy has a 30% share of the market. The company also enjoys strong name recognition among the public. The current management team is responsible for moving this company to the top of its market, 20 years ago. Their management style has evolved to a "maintenance" strategy, and some in the industry view them as being out of touch with current trends in their markets. Growing concern for the environment, especially related to energy consumption, have started to mandate changes in the way that energy companies deliver product to their customers. Companies able to offer innovations that reduce negative environmental impact will almost certainly merge to the market forefront soon.

The company has been involved in off-shore oil drilling and exploration, and has made significant profits. A recent fine and responsibility for some clean-up costs, however has resulted in a 6% reduction in bottom line profits over the next 2 years. One concern is that a number of foreign companies, whose off-shore explorations are subsidized by their governments, are poised to enter Power Energy's market.

III. Labor

Power Energy's labor force consists primarily of semi-skilled workers and engineers who think of this company as offering them lifetime employment. The company is also known for its generous compensation and benefits packages.

Company C
"Quality Tool & Die"

Industry:	Industrial Products
Products:	Tool & Die for heavy manufacturing
Location:	Midville, Indiana
Size:	$50.2 million in sales; 175 employees
Age:	Established 17 years ago

I. Financial

Your internal financial analyst estimates that the internal rate of return (i.e., the return on your investment) will be 8% annually over the next 10 years. This analyst believes the chance of you actually getting this return is 60 percent. Further, the analyst estimates that there is a 20 percent chance either way that ACME will double this return (thereby providing a 16% return) or will have a zero return. The analysis indicates further that there is a near certain probability that you will suffer a loss during the first year, and that you would not achieve any return until after that time. The Smith, Barney & Howe consultants agree with your analyst's conclusions. Growth in sales has been averaging around 6% annually.

II. Strategic

Quality Tool & Die is in a mature industry with very little change forecasted for the foreseeable future. They have managed to maintain their 12% market share in an environment which is expected to remain in a competitive equilibrium in the near future. Their management team is solid and respectable. They have not been known to make any major mistakes, nor have they contributed major innovations to their industry.

III. Labor

Their labor force is unionized, composed mostly of unskilled workers employed in assembly line jobs who receive their training on-the-job. The company has managed to keep the relationship with the unions relatively trouble-free, but a the newly elected union leadership is known to have an aggressive and confrontational attitude toward management. The company's labor turnover has been low.

Hidden Profile Packet B:

ACME Inc.: Group Decision-Making for Investments

Instructions

****

Most companies make important investment decisions using a team approach. Your group here today represents the top management team of ACME ("Acquiring Companies Means Employment!"), Inc. Your company has been presented with the opportunity to acquire three smaller firms. ACME has $100 million to invest, which will allow the acquisition of only one of these firms. The Chairperson of the Board has appointed you to research the three acquisition targets and to recommend which one of them would be best for ACME.

There are a number of key factors that you should consider carefully in evaluating these companies. First, ACME prefers to acquire firms that will maximize wealth, over the long term. Which of these companies has the most promising future? Therefore you should consider the potential return on your investment. A second consideration is the likelihood of you actually getting that return, in the long run. That is, how precise is the projection and what is the probability that your actual return will be significantly different than the best estimate? Third, you should also consider the growth potential of each company's market. You would prefer to invest in a company that competes in a growing market. A fourth consideration is the quality of the company's management team. ACME takes a "hands-off" approach with its subsidiaries. Therefore, you prefer to invest in companies whose management team can achieve the profitability you desire. Finally, you should judge each company's general strategy and business policies. Do they seem like policies that will lead the company to profitability in the future?

In order to help you evaluate these companies, your in-house financial analyst has researched each company. Further, you have retained the consulting services of Smith, Barney & Howe, a highly respected and successful investment consulting firm, also to analyze these three companies. The results appear in the reports contained in your information packets. You should review all of this information, and based upon it, come to a conclusion about which of these three companies would be the right acquisition for ACME.

The Chair of the Board wants you to decide, as a team, which of the three companies ACME should acquire. **There must be consensus agreement on which company to acquire**.

Company A
"Whiz-Bang Electronics"

Industry:	Industrial Electronics
Products:	Electronic manufacturing control devices
Location:	Metropol, California
Size:	$50 million in sales; 200 employees
Age:	Established 5 years ago

I. Financial

Your internal financial analyst estimates that the internal rate of return (i.e., the return on your investment) will be 15% annually over the next 10 years. Further, the analyst estimates that there is a 15 percent chance that ACME will have a zero return. The Smith, Barney & Howe consultants concur with the conclusions of your in-house analyst. Both analyses agree that there is a near certain probability that ACME will suffer a loss during the first year, and that you would not achieve any return until after that time. This company's growth in sales has been halting, hovering around 5% annually from the beginning.

II. Strategic

Whiz-Bang Electronics is young, and was founded by a group whose management experience was limited. The inexperience of the management team led to some early mistakes in marketing and distribution such that customer awareness of the products is low, and so are perceptions of service. Furthermore, the pricing structure is not suitable for their target customers. As a result the company has been a market laggard, averaging only a 6% market share. The company leadership has been trying to address these issues head-on.

III. Labor

Whiz-Bang Electronics has very high labor costs. It spends a lot of money on employee development, such as providing on-site fitness facilities. Their recruiting processes are drawn-out. These expenditures represent a very large chunk of the company's operating budget.

Company B
"Power Energy"

Industry:	Energy
Products:	Power for heavy manufacturing
Location:	Bigtown, Texas
Size:	$50.5 million in sales; 225 employees
Age:	Established 25 years ago

I. Financial

Your internal financial analyst estimates that the internal rate of return (i.e., the return on your investment) will be 25% annually over the next 10 years. This analyst believes the chances of you actually getting this return is 70 percent. Further, the analyst estimates that there is a 15 percent chance that ACME will double this return (thereby providing a 50% return). The Smith, Barney & Howe consultants estimated a lower rate of return than did your internal analyst, and they believed there would be a 30 percent chance of doubling their estimated return. Power Energy historically has experienced growth in sales averaging 10% annually. It experienced record growth of 15% five years ago. Last year's growth was 8%.

II. Strategic

Power Energy has been the market leader for over two decades. It dominates the market with 30% share. The company enjoys strong name recognition among the public. The current management team is responsible for moving this company to the top of its market 15-20 years ago. Growing concern for the environment, especially related to energy consumption, have started to mandate changes in the way that energy companies deliver product to their customers.

The company has been involved in the risky field of off-shore oil drilling and exploration, and has made significant profits. A recent problem, however, resulted in the company receiving a fine and being responsible for some clean-up costs.

III. Labor

Power Energy's labor force consists primarily of semi-skilled workers and engineers. The company has had the reputation of offering job security and generous compensation and benefit packages.

Company C
"Quality Tool & Die"

Industry:	Industrial Products
Products:	Tool & Die for heavy manufacturing
Location:	Midville, Indiana
Size:	$50.2 million in sales; 175 employees
Age:	Established 17 years ago

I. Financial

Your internal financial analyst estimates that the internal rate of return (i.e., the return on your investment) will be 8% annually over the next 10 years. This analyst believes the chance of you actually getting this return is 60 percent. Further, the analyst estimates that there is a 20 percent chance either way that ACME will double this return (thereby providing a 16% return) or will have a zero return. The analysis indicates further that there is a near certain probability that you will suffer a loss during the first year, and that you would not achieve any return until after that time. The Smith, Barney & Howe consultants agree with your analyst's conclusions. Growth in sales has been averaging around 6% annually.

II. Strategic

Quality Tool & Die is in a mature industry with very little change forecasted for the foreseeable future. They have managed to maintain their 12% market share in an environment which is expected to remain in a competitive equilibrium in the near future. Their management team is solid and respectable. They have not been known to make any major mistakes, nor have they contributed major innovations to their industry.

III. Labor

Their labor force is unionized, composed mostly of unskilled workers employed in assembly line jobs who receive their training on-the-job. The company has managed to keep the relationship with the unions relatively trouble-free, but the newly elected union leadership is known to have an aggressive and confrontational attitude toward management. The company's labor turnover has been low.

Hidden Profile Packet C:

ACME Inc.: Group Decision-Making for Investments

Instructions

******

Most companies make important investment decisions using a team approach. Your group here today represents the top management team of ACME ("Acquiring Companies Means Employment!"), Inc. Your company has been presented with the opportunity to acquire three smaller firms. ACME has $100 million to invest, which will allow the acquisition of only one of these firms. The Chairperson of the Board has appointed you to research the three acquisition targets and to recommend which one of them would be best for ACME.

There are a number of key factors that you should consider carefully in evaluating these companies. First, ACME prefers to acquire firms that will maximize wealth, over the long term. Which of these companies has the most promising future? Therefore you should consider the potential return on your investment. A second consideration is the likelihood of you actually getting that return, in the long run. That is, how precise is the projection and what is the probability that your actual return will be significantly different than the best estimate? Third, you should also consider the growth potential of each company's market. You would prefer to invest in a company that competes in a growing market. A fourth consideration is the quality of the company's management team. ACME takes a "hands-off" approach with its subsidiaries. Therefore, you prefer to invest in companies whose management team can achieve the profitability you desire. Finally, you should judge each company's general strategy and business policies. Do they seem like policies that will lead the company to profitability in the future?

In order to help you evaluate these companies, your in-house financial analyst has researched each company. Further, you have retained the consulting services of Smith, Barney & Howe, a highly respected and successful investment consulting firm, also to analyze these three companies. The results appear in the reports contained in your information packets. You should review all of this information, and based upon it, come to a conclusion about which of these three companies would be the right acquisition for ACME.

The Chair of the Board wants you to decide, as a team, which of the three companies ACME should acquire. **There must be consensus agreement on which company to acquire**.

Company A
"Whiz-Bang Electronics"

Industry:	Industrial Electronics
Products:	Electronic manufacturing control devices
Location:	Metropol, California
Size:	$50 million in sales; 200 employees
Age:	Established 5 years ago

I. Financial

Your internal financial analyst estimates that the internal rate of return (i.e., the return on your investment) will be 15% annually over the next 10 years. Further, the analyst estimates that there is a 15 percent chance that ACME will have a zero return. The Smith, Barney & Howe consultants concur with the conclusions of your in-house analyst. Both analyses agree that there is a near certain probability that ACME will suffer a loss during the first year, and that you would not achieve any return until after that time. This company's growth in sales has been halting, hovering around 5% annually from the beginning.

II. Strategic

Whiz-Bang Electronics is young, and was founded by a group whose management experience was limited. The inexperience of the management team led to some early mistakes in marketing and distribution such that customer awareness of the products is low, and so are perceptions of service. Furthermore, the pricing structure is not suitable for their target customers. As a result the company has been a market laggard, averaging only a 6% market share. The company leadership has been addressing these issues head-on.

III. Labor

Whiz-Bang Electronics has very high labor costs. It spends a lot of money on employee development, such as providing on-site fitness facilities. The company's recruiting processes are drawn-out, and these expenditures represent a very large chunk of the company's operating budget.

Company B
"Power Energy"

Industry:	Energy
Products:	Power for heavy manufacturing
Location:	Bigtown, Texas
Size:	$50.5 million in sales; 225 employees
Age:	Established 25 years ago

I. Financial

Your internal financial analyst estimates that the internal rate of return (i.e., the return on your investment) will be 25% annually over the next 10 years. This analyst believes the chances of you actually getting this return is 70 percent. Further, the analyst estimates that there is a 15 percent chance that ACME will double this return (thereby providing a 50% return) or will have a zero return. The Smith, Barney & Howe consultants estimated a lower rate of return than did your internal analyst, and they believed there would be a 30 percent chance of doubling their estimated return. Power Energy historically has experienced growth in sales averaging 10% annually. It experienced record growth of 15% five years ago. The best estimates indicate flat growth in the overall market over the near future.

II. Strategic

Power Energy has been the market leader for over two decades. It dominates the market with 30% share. The company enjoys strong name recognition among the public. The current management team is responsible for moving this company to the top of its market.

The company has been involved in off-shore oil drilling and exploration, and has made significant profits, despite recent problems. One concern is that a number of foreign companies, whose off-shore explorations are subsidized by their governments, are poised to enter Power Energy's market.

III. Labor

Power Energy's labor force consists primarily of semi-skilled workers and engineers. The company has had the reputation of offering job security and generous compensation and benefit packages.

Company C
"Quality Tool & Die"

Industry:	Industrial Products
Products:	Tool & Die for heavy manufacturing
Location:	Midville, Indiana
Size:	$50.2 million in sales; 175 employees
Age:	Established 17 years ago

I. Financial

Your internal financial analyst estimates that the internal rate of return (i.e., the return on your investment) will be 8% annually over the next 10 years. This analyst believes the chance of you actually getting this return is 60 percent. Further, the analyst estimates that there is a 20 percent chance either way that ACME will double this return (thereby providing a 16% return) or will have a zero return. The analysis indicates further that there is a near certain probability that you will suffer a loss during the first year, and that you would not achieve any return until after that time. The Smith, Barney & Howe consults agree with your analyst's conclusions. Growth in sales has been averaging around 6% annually.

II. Strategic

Quality Tool & Die is in a mature industry with very little change forecasted for the foreseeable future. They have managed to maintain their 12% market share in an environment which is expected to remain in a competitive equilibrium in the near future. Their management team is solid and respectable. They have not been known to make any major mistakes, nor have they contributed major innovations to their industry.

III. Labor

Their labor force is unionized, composed mostly of unskilled workers employed in assembly line jobs who receive their training on-the-job. The company has managed to keep the relationship with the unions relatively trouble-free, but the newly elected union leadership is known to have an aggressive and confrontational attitude toward management. The company's labor turnover has been low.

Appendix E: Checklist Form

Checklist Form

Here are some pieces of information that were mentioned in some of your information packets. We wanted to see which pieces of information you shared with the group. Please put a checkmark next to each information piece that was mentioned during your conversation with the group, regardless of whether you considered it an "important" piece or not. Remember, this is only what you specifically said or wrote, not what you remembered seeing from the study materials. Also, please provide us with your preference prior to discussing with the team.

Member A Choice:
Member B Choice:
Member C Choice:
Team Choice:
Independent Choice:

Company A -- "Whiz Bang Electronics"

Part 1

_____ 1. Internal analyst expects 15 percent chance of 30% IRR (i.e., double estimated return)

_____ 2. Near certain probability of first year loss.

_____ 3. Halting sales growth

_____ 4. Low customer perceptions of service

_____ 5. Pricing structure may not be suitable

_____ 6. Company has been market laggard

_____ 7. Company leadership addressing problems head on

_____ 8. Employee expenditures take a large chunk of company budget

_____ 9. Internal analyst expects 70 percent chance of 15% IRR

_____ 10. Internal analyst expects fifteen percent chance of 0 IRR "

_____ 11. SBH expects 80 percent chance of 15% IRR

_____ 12. Early projection indicate 8% increase in sales growth for next year (i.e., positive sales growth)

_____ 13. Market expected to grow in near future

_____ 14. Founded by bright & talented entrepreneurs

_____ 15. Innovative and promising product line

_____ 16. Management team actively developing professional managerial skills (i.e., participating in workshops and working with consultants)

_____ 17. Industry watchers note the group is making more effective decisions/more effective decisions probably responsible for recent sales increase

_____ 18. Company offers employees training in business-related skills

_____ 19. Company as thorough and careful recruiting process

_____ 20. Company provides on-site child care

Company B -- "Power Energy"

_____ 21. Internal analyst estimates 70 percent chance of return 25% IRR

_____ 22. Internal analyst estimates fifteen percent chance of 50% IRR

_____ 23. Company has made significant profits in off-shore drilling

_____ 24. Company dominates market/ leader for 2 decades

_____ 25. Company has strong name recognition

_____ 26. Management team's reputation well respected

_____ 27. SBH expects 30 percent chance of getting 10% IRR (i.e., double estimated return)

_____ 28. Reputation for job security

_____ 29. Generous compensation benefits

_____ 30. Last year's growth was 8%

_____ 31. Off-shore drilling and exploration are risky

_____ 32. Company's recent problem has resulted in fines & clean-up costs.

_____ 33. Estimates indicate flat growth in the market

_____ 34. Foreign competition poised to enter market

_____ 35. Foreign competitors have government subsidy

_____ 36. Company has had recent problem

_____ 37. Management team moved company to top of market 15-20 years ago.

_____ 38. Growing concern for environment mandating changes in energy companies

_____ 39. Internal analyst estimates fifteen percent chance of 0 IRR

_____ 40. SBH disagrees with the internal analyst

_____ 41. SBH estimates a 5% IRR

_____ 42. SBH estimates 40 percent chance of 5% IRR

_____ 43. SBH expects 30 percent chance of getting 0 IRR.

_____ 44. Growth figures for last few years have been 12%, 10%, 9%, 3% (i.e., declining sales growth)

_____ 45. Fine & clean-up costs result in 6% reduction in bottom line profits

_____ 46. Management team style has evolved to "maintenance" strategy/ some view management team as out of touch

_____ 47. Companies with reduced negative environment impact will emerge as leaders

_____ 48. Employees see company as offering lifetime employment

REFERENCES

REFERENCES

Adams, S. J., Roch, S. G., & Ayman, R. (2005). Communication medium and member familiarity: The effects on decision time, accuracy, and satisfaction. *Small Group Research, 36*(3), 321-353. doi: 10.1177/1046496405275232

Adrianson, L., & Hjelmquist, E. (1991). Group Processes in Face-to_face and Computer-Mediated Communication. *Behaviour & Information Technology, 10*(4), 281-296.

Baltes, B. B., Dickson, M. W., Sherman, M. P., Bauer, C. C., & LaGanke, J. S. (2002). Computer-Mediated Communication and Group Decision Making: A Meta-Analysis. *Organizational Behavior and Human Decision Processes, 87*(1), 156-179. doi: http://dx.doi.org/10.1006/obhd.2001.2961

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215. doi: 10.1037//0033-295x.84.2.191

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*(2), 122-147. doi: 10.1037//0003-066x.37.2.122

Berger, J., Cohen, B. P., & Zelditch, M. (1972). Status Characteristics and Social Interaction. *American Sociological Review, 37*(3), 241. doi: 10.2307/2093465

Bunz, U., & Campbell, S. W. (2004). Politeness accommodation in electronic mail. *Communication Research Reports, 21*(1), 11-25.

Castella, V. O., Abad, A. M. Z., Alonso, F. P., & Silla, J. M. P. (2000). The influence of familiarity among group members, group atmosphere and assertiveness on uninhibited behavior through three different communication media. *Computers in Human Behavior, 16*(2), 141-159.

Copeland, M. V. (2006). The Mighty Micro Multi-National. *Business 2.0, 7,* 106-114.

Crede, M., & Sniezek, J. A. (2003). Group judgment processes and outcomes in video-conferencing versus face-to-face groups. *International Journal of Human-Computer Studies, 59*(6), 875-897. doi: 10.1016/j.ijhcs.2003.07.001

Culnan, M., & Markus, M. L. (1987). *Information Technologies.* Newbury Park, CA: Sage.

Daft, R. L., & Lengel, R. H. (1984). Information Richness - A New Approach to Managerial Behavior and Organization Design. *Research in Organizational Behavior, 6*, 191-233.

Daft, R. L., & Lengel, R. H. (1986). Organizationl Information Requirements, Media Richness and Structural Design. *Management Science, 32*(5), 554-571.

Daft, R. L., & Wiginton, J. C. (1979). Language and Organization. *The Academy of Management Review, 4*(2), 179-191. doi: 10.2307/257772

Dennis, A. R., & Kinney, S. T. (1998). Testing Media Richness Theory in the New Media: The Effects of Cues, Feedback, and Task Equivocality. *Information Systems Research, 9*(3), 256-274. doi: doi:10.1287/isre.9.3.256

Driskell, J. E., & Mullen, B. (1990). Status, Expectations, and Behavior: A Meta-Analytic Review and Test of the Theory. *Personality and Social Psychology Bulletin, 16*(3), 541-553. doi: 10.1177/0146167290163012

Driskell, J. E., Radtke, P. H., & Salas, E. (2003). Virtual teams: Effects of technological mediation on team performance. *Group Dynamics-Theory Research and Practice, 7*(4), 297-323. doi: 10.1037/1089-2699.7.4.297

Eastin, M. S., & LaRose, R. (2000). Internet Self-Efficacy and the Psychology of the Digital Divide. *Journal of Computer-Mediated Communication, 6*(1), 0-0. doi: 10.1111/j.1083-6101.2000.tb00110.x

ElShinnawy, M., & Markus, M. L. (1997). The poverty of media richness theory: Explaining people's choice of electronic mail vs. voice mail. *International Journal of Human-Computer Studies, 46*(4), 443-467. doi: 10.1006/ijhc.1996.0099

Graetz, K. A., Boyle, E. S., Kimble, C. E., Thompson, P., & Garloch, J. L. (1998). Information Sharing in Face-to-Face, Teleconferencing, and Electronic Chat Groups. *Small Group Research, 29*(6), 714-743. doi: 10.1177/1046496498296003

Hantula, D. A., Kock, N., D'Arcy, J. P., & DeRosa, D. M. (2011). *Media Compensation Theory: A Darwinian Perspective on Adaptation to Electronic Communication and Collaboration*. Berlin: Springer-Verlag Berlin.

Harter, J. K., Schmidt, F. L., & Hayes, T. L. (2002). Business-unit-level relationship between employee satisfaction, employee engagement, and business outcomes: A meta-analysis. *Journal of Applied Psychology, 87*(2), 268-279. doi: 10.1037//0021-9010.87.2.268

Hiltz, S. R., Johnson, K., & Turoff, M. (1986). Experiments in Group Decision Making: "Communication Process and Outcome in Face-to-Face Versus Computerized Conferences". *Human Communication Research, 13*(2), 225.

Howard, M. C. (2014). Creation of a Computer Self-Efficacy Measure: Analysis of Internal Consistency, Psychometric Properties, and Validity. *Cyberpsychology Behavior and Social Networking, 17*(10), 677-681. doi: 10.1089/cyber.2014.0255

Joinson, A. N. (2004). Self-esteem, interpersonal risk, and preference for e-mail to face-to-face communication. *Cyberpsychology & Behavior, 7*(4), 472-478. doi: 10.1089/cpb.2004.7.472

Kerr, D. S., & Murthy, U. S. (2009). The effectiveness of synchronous computer-mediated communication for solving hidden-profile problems: Further empirical evidence. *Information & Management, 46*(2), 83-89. doi: 10.1016/j.im.2008.12.002

Kiesler, S., Siegel, J., & McGuire, T. W. (1984). Social Psychological - Aspects of Computer-Mediated Communication. *American Psychologist, 39*(10), 1123-1134. doi: 10.1037//0003-066x.39.10.1123

Kiesler, S., & Sproull, L. (1992). Group decision making and communication technology. *Organizational Behavior and Human Decision Processes, 52*(1), 96-123. doi: http://dx.doi.org/10.1016/0749-5978(92)90047-B

Kingston, D., Cindy-Lee, D., & Sword, W. (2007). Exploring Breast-feeding Self-efficacy. *Journal of Perinatal & Neonatal Nursing, 21*(3), 207.

Kirkman, B. L., & Mathieu, J. E. (2005). The dimensions and antecedents of team virtuality. *Journal of Management, 31*(5), 700-718. doi: 10.1177/0149206305279113

Kock, N. (2004). The psychobiological model: Towards a new theory of computer-mediated communication based on Darwinian evolution. *Organization Science, 15*(3), 327-348. doi: 10.1287/orsc.1040.0071

Kock, N. (2005). Media richness or media naturalness? The evolution of our biological communication apparatus and its influence on our behavior toward e-communication tools. *Ieee Transactions on Professional Communication, 48*(2), 117-130. doi: 10.1109/tpc.2005.849649

Lam, S. S. K., & Schaubroeck, J. (2000). Improving Group Decisions by Better Pooling Information: A Comparative Advantage of Group Decision Support Systems. *Journal of Applied Psychology, 85*(4), 565-573. doi: 10.1037//0021-9010.85.4.565

Lu, L., Yuan, Y. C., & McLeod, P. L. (2012). Twenty-Five Years of Hidden Profiles in Group Decision Making: A Meta-Analysis. *Personality and Social Psychology Review, 16*(1), 54-75. doi: 10.1177/1088868311417243

Marcus, B. H., Selby, V. C., Niaura, R. S., & Rossi, J. S. (1992). Self-efficacy and the stages of exercise behavior change*Research Quarterly for Exercise and Sport, 63*(1), 60-66.

Markus, M. L. (1994). Electronic Mail as the Medium of Managerial Choice. *Organization Science, 5*(4), 502-527. doi: 10.1287/orsc.5.4.502

Martins, L. L., Gilson, L. L., & Maynard, M. T. (2004). Virtual teams: What do we know and where do we go from here? *Journal of Management, 30*(6), 805-835. doi: 10.1016/j.jm.2004.05.002

Mesmer-Magnus, J. R., & DeChurch, L. A. (2009). Information Sharing and Team Performance: A Meta-Analysis. *Journal of Applied Psychology, 94*(2), 535-546. doi: 10.1037/a0013773

Mesmer-Magnus, J. R., DeChurch, L. A., Jimenez-Rodriguez, M., Wildman, J., & Shuffler, M. (2011). A meta-analytic investigation of virtuality and information sharing in teams. *Organizational Behavior and Human Decision Processes, 115*(2), 214-225. doi: 10.1016/j.obhdp.2011.03.002

O'Brien, H. L., & Toms, E. G. (2013). Examining the generalizability of the User Engagement Scale (UES) in exploratory search. *Information Processing & Management, 49*(5), 1092-1107. doi: 10.1016/j.ipm.2012.08.005

Piaget, J., & Cook, M. T. (1952). *The origins of intelligence in children.* New York, NY: International University Press.

Rice, R. E. (1993). Media Appropriateness - Using Social Presence Theory to Compare Traditional and New Organizational Media. *Human Communication Research, 19*(4), 451-484. doi: 10.1111/j.1468-2958.1993.tb00309.x

Rice, R. E., & Shook, D. E. (1990). Relationships of Job Categories and Organizational Levels to Use of Communication Channels, Including Electronic Mail - A Metaanalysis and Extension. *Journal of Management Studies, 27*(2), 195-229. doi: 10.1111/j.1467-6486.1990.tb00760.x

Ring, K., Braginsky, D., & Braginsky, B. (1966). Performance styles in interpersonal relations: a typology. *Psychological Reports, 18*(1), 203-220. doi: 10.2466/pr0.1966.18.1.203

Ring, K., Braginsky, D., Levine, L., & Braginsky, B. (1967). Performance styles in interpersonal behavior: an experimental validation of a typology. *Journal of Experimental Social Psychology, 3*(2), 140-159. doi: 10.1016/0022-1031(67)90018-2

Rosen, B., Furst, S., & Blackburn, R. (2007). Overcoming Barriers to Knowledge Sharing in Virtual Teams. *Organizational Dynamics, 36*(3), 259-273. doi: http://dx.doi.org/10.1016/j.orgdyn.2007.04.007

Siegel, J., Dubrovsky, V., Kiesler, S., & McGuire, T. W. (1986). Group processes in computer-mediated communication. *Organizational Behavior and Human Decision Processes, 37*(2), 157-187. doi: http://dx.doi.org/10.1016/0749-5978(86)90050-6

Spitzberg, B. H. (2006). Preliminary development of a model and measure of computer-mediated communication (CMC) competence. *Journal of Computer-Mediated Communication, 11*(2), 41.

Spitzberg, B. H. (2011). The interactive media package for assessment of communication and critical thinking (IMPACCT©): Testing a programmatic online communication competence assessment system. *Communication Education, 60*(2), 145-173. doi: http://dx.doi.org/10.1080/03634523.2010.518619

Spitzberg, B. H., & Cupach, W. R. (2002). *Interpersonal Skills*. Thousand Oaks, CA: Sage.

Sproull, L., & Kiesler, S. (1986). Reducing Social Context Cues: Electronic Mail in Organizational Communication. *Management Science, 32*(11), 1492-1512.

Stahl, G. K., Maznevski, M. L., Voigt, A., & Jonsen, K. (2010). Unraveling the effects of cultural diversity in teams: A meta-analysis of research on multicultural work groups. *Journal of International Business Studies, 41*(4), 690-709. doi: 10.1057/jibs.2009.85

Stasser, G., & Titus, W. (1985). Pooling of unshared information in group decision making: Biased information sampling during discussion. *Journal of Personality and Social Psychology, 48*(6), 1467-1478. doi: 10.1037/0022-3514.48.6.1467

Stasser, G., & Titus, W. (1987). Effects of information load and percentage of shared information on the dissemination of unshared information during group discussion. *Journal of Personality and Social Psychology, 53*(1), 81-93. doi: http://dx.doi.org/10.1037/0022-3514.53.1.81

Straus, S. G., & McGrath, J. E. (1994). Does the Medium Matter - The Interaction of Task Type and Technology on Group-Performance and Member Reactions. *Journal of Applied Psychology, 79*(1), 87-97. doi: 10.1037/0021-9010.79.1.87

Tidwell, L. C., & Walther, J. B. (2002). Computer-mediated communication effects on disclosure, impressions, and interpersonal evaluations: Getting to know one another a bit at a time. *Human Communication Research, 28*(3), 317-348. doi: 10.1111/j.1468-2958.2002.tb00811.x

Tosun, L. P., & Lajunen, T. (2010). Does Internet use reflect your personality? Relationship between Eysenck's personality dimensions and Internet use. *Computers in Human Behavior, 26*(2), 162-167. doi: 10.1016/j.chb.2009.10.010

Walther, J. B. (1992). Interpersonal Effects in Computer-Mediated Interaction - A Relational Perspective. *Communication Research, 19*(1), 52-90. doi: 10.1177/009365092019001003

Walther, J. B. (1996). Computer-mediated communication: Impersonal, interpersonal, and hyperpersonal interaction. *Communication Research, 23*(1), 3-43. doi: 10.1177/009365096023001001

Walther, J. B., & Bunz, U. (2005). The rules of virtual groups: Trust, liking, and performance in computer-mediated communication. *Journal of Communication, 55*(4), 828-846. doi: 10.1111/j.1460-2466.2005.tb03025.x

Walther, J. B., & Burgoon, J. K. (1992). Relational Communication in Computer-Mediated Interaction. *Human Communication Research, 19*(1), 50-88. doi: 10.1111/j.1468-2958.1992.tb00295.x