

Testing Media Richness Theory in the New Media: The Effects of Cues, Feedback, and Task Equivocality

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Media richness theory argues that performance improves when team members use "richer" media for equivocal tasks. This experiment studied the effects of media richness on decision making in two-person teams using "new media" (i.e., computer-mediated and video communication). Media richness was varied based on multiplicity of cues and immediacy of feedback. Subjects perceived differences in richness due to both cues and feedback, but matching richness to task equivocality did not improve decision quality, decision time, consensus change, or communication satisfaction. Use of media providing fewer cues (i.e., computer mediated communication) led to slower decisions and more so for the *less* equivocal task. In short, the results found no support for the central proposition of media richness theory; matching media richness to task equivocality did not improve performance. (*Media Richness Theory; Information Cues; Feedback; Equivocality; Videoconferencing; Group Support System*)

1. Introduction

Communication has not only remained a constant and dominant part of the manager's day for the past half century, but the forms of communication have also stayed reasonably constant. Face-to-face communication makes up more than half the manager's day, with another third of their time spent in voice or written communications (Panko and Kinney 1995a). The dominance of face-to-face communication is changing, however, as organizations facing demands for improved productivity increasingly turn to teams whose members work in remote locations. While teams are still likely to work together in traditional face-to-face meetings, teamwork today is already characterized by much distributed work. A recent study of project teams showed that more than half of the projects had at least one member from another location, and 29 percent had half or more of their members from multiple

locations (Kinney and Panko 1996). Furthermore, team communication was dominated by informal communications (82 percent), augmenting face-to-face communication with use of the so-called "new media" (Rice 1984) that included voice mail and E-mail. One key issue facing managers is identifying which tasks teams can perform successfully using the new media and which tasks are better suited to traditional face-to-face meetings.

Many theories have been developed to explain media effects (see Fulk and Boyd 1991, Fulk and Collins-Jarvis in press, Walther 1992). In this study, we focus on only one widely known and widely used theory: media richness theory (Daft and Lengel 1986). Media richness theory initially evolved without direct consideration of the new media (El-Shinnawy and Markus 1992), but they have been retroactively fit into the theory's framework (e.g., Daft et al. 1987, El-Shinnawy

and Markus 1992, Rice 1992). The main premises of the theory are:

- Media differ in "richness" ("the ability of information to change understanding within a time interval" Daft and Lengel 1986, p. 560), with face-to-face communication being the richest, while other media capable of sending fewer cues (e.g., vocal inflection, gestures) or providing slower feedback (e.g., memos, voice-mail, or e-mail) are "leaner"; and

- Performance improves when managers use richer media for equivocal tasks (where there are multiple and possibly conflicting interpretations to the available information) and leaner media for nonequivocal tasks (Daft and Lengel 1986, Daft et al. 1987).

Proponents of media richness theory often fail to distinguish that these statements are what the theory proposes, not the results of empirical research. Of the numerous studies testing media richness theory, virtually all have examined the *perceptions* of media fit by surveying the *media choice* of message senders (or more accurately, the espoused choice), not by examining the *actual performance* effects of *media use*. Typically, researchers have asked managers to choose which medium they would use to send a set of hypothetical messages, looking to see if the managers' choices fit the propositions of media richness theory (e.g., Daft et al. 1987, El-Shinnawy and Markus 1992, Fann and Smeltzer 1989, Hunter and Allen 1992, Rice and Shook 1990, Russ et al. 1990, Trevino et al. 1990, Trevino et al. 1987). The results have not been completely supportive of media richness theory. In many cases, competent managers made different choices than those argued by media richness theory as being "best." Researchers have thus concluded that factors beyond media richness affect media choice (see Fulk and Boyd 1991 and Rice 1992 for reviews of media choice research).

However, because these studies have evaluated media choice rather than measuring media use, the central proposition of media richness theory remains largely untested (Rice 1992): does the use of richer rather than leaner media for equivocal tasks improve performance? Nonetheless, media richness theory has been one of the key theories in the research, applica-

tion, and use of the new media. This study examines the extent to which media richness theory is useful in predicting performance by examining the use of media, rather than managers' perceptions. This study focuses only on the new media and two key elements of media richness theory: cues and feedback.

2. Theoretical Framework

When teams of two or more individuals work together to complete a task they communicate through some medium. The most commonly used medium is face-to-face communication (Panko and Kinney 1995a). Face-to-face communication enables participants to use varying modes of communication: words, vocal cues (e.g., voice inflection, sighs), nonverbal communication (e.g., gestures, touch), and written or drawn communication (e.g., paper, blackboards). These modes combine to transmit factual information about the task and social information about the personal characteristics of team members. Other media have lesser abilities to transmit these different forms of communication. The degree to which media affect communication can change the way in which teams work and can lead to better or worse task performance.

2.1. Media Richness Theory

Daft and Lengel (1986), in their seminal work on media richness, argued that managers could improve performance by matching media characteristics to the needs of organizational information processing tasks. Daft and Lengel categorized tasks based on uncertainty and equivocality. Tasks of uncertainty lacked sufficient information and could be executed by obtaining and sharing the needed information. Equivocal tasks, on the other hand, were those which had multiple and possibly conflicting interpretations of the available information, presenting a challenge for participants to arrive at one shared meaning of the information.

Media richness theory also postulated that media varied in information richness (later called media richness) based on their capacity to facilitate this shared meaning within a given time interval. The theory asserted that four factors influenced this media richness: the ability of the medium to transmit multiple cues

(e.g., vocal inflection, gestures), immediacy of feedback, language variety, and the personal focus of the medium. Richer media, the theory claimed, enabled users to communicate more quickly and to better understand ambiguous or equivocal messages and, therefore, would lead to better performance on equivocal tasks. In contrast, leaner media were better for low equivocality tasks because rich media provided communicators with too much information and superfluous messages. Thus Daft and Lengel (1986, p. 558) concluded that the use of richer media (such as face-to-face meetings) would lead to better performance for equivocal tasks (such as deciding whether to acquire a company), while use of leaner media (such as written memos) would lead to better performance for less equivocal tasks (such as determining customer reactions to product labels).

At this point, media richness theory was a theory of media use, not media choice. It argued under what conditions each media would be most effective (i.e., how managers should use media) not how managers actually chose media. However, the first empirical test of media richness theory (Daft et al. 1987) studied media choice, not the effects of use. The tasks in this study were communications activities (e.g., praising a subordinate, explaining a complicated technical matter), not organizational information processing tasks as used in the theory (e.g., deciding whether to acquire a company). The research approach was to present managers with hypothetical communication tasks and to ask them to choose which media to use, to see if managers' perceptions of best media/task fit matched the predictions of media richness theory. Thus the first empirical test of media richness theory, while somewhat supportive (see Rice 1992 for a discussion of limitations), tested perceptions of message senders, not the actual performance of both message sender and receiver(s).

The ensuing years have witnessed a number of tests of media richness theory, many of which have suggested revised interpretations (e.g., Barnard 1991, El-Shinnawy and Markus 1992, Rice 1992, Fann and Smeltzer 1989, Hunter and Allen 1992). However, virtually all of these studies have followed the empirical work of Daft et al. (1987) and Trevino et al. (1990) by

examining hypothetical media choice (not use), perceptions of message senders (not actual performance of all participants), and communications tasks (not information processing tasks). While some studies have found limited support for the theory, in many cases managers have made different choices than those predicted by media richness theory, picking supposedly less rich media for equivocal tasks (see El-Shinnawy and Markus 1992, Lengel and Daft 1988, Rice 1992, Trevino et al. 1987). Fulk and Collins-Jarvis (in press) and Rice (1992) review this body of research and suggest that for tasks with low equivocality, the use of leaner media is not necessarily superior to use of richer media, but that the jury is still out on the equivocality half—mixed support exists for the argument that use of richer rather than leaner media leads to better performance on high equivocality tasks.

These studies, however, fail to examine the central proposition of media richness theory as proposed by Daft and Lengel (1986). Does the use of richer rather than leaner media for equivocal tasks improve actual performance? Despite the wealth of studies, researchers have yet to isolate the primary factors or combination of factors that can reliably predict performance when using different media in different situations. We are aware of only three published direct controlled tests of media richness theory. Two laboratory studies of decision making produced results that did not support the propositions of media richness theory (Kinney and Watson 1992, Valacich et al. 1994). A laboratory study of collaborative writing found mixed support (Kraut et al. 1992, p. 391-399).

If anything, the picture is becoming more inexplicable rather than distinct. While calling for theory to organize disparate factors into a unified whole, Fulk and Boyd (1991) stress that researchers must first clarify the core processes that drive media richness theory, and then explain how the four dimensions of richness combine to produce media richness. They also recommend returning to "global tasks" (i.e., information processing tasks such as decision making) as the theory initially proposed, rather than continuing to examine communication tasks that may be subject to individual communication style biases (see Rice et al. 1992).

In this study, we examine two of the four factors theorized to affect media richness (immediacy of feedback and multiplicity of cues) on two information processing tasks that differ in equivocality.¹ These are arguably the most important factors (c.f. Kraut, et al., 1992). The two other factors believed to affect media richness (natural language and personal focus) are experimentally controlled.² Therefore, our focus is on the two central propositions of media richness theory (Daft and Lengel 1986): (1) that greater immediacy of feedback and greater multiplicity of cues increases media richness, and (2) that the use of richer media rather than leaner media will lead to better task performance for high rather than low equivocality tasks.

¹Across their many papers, Daft and Lengel discuss five primary task-related factors that may affect performance: equivocality, uncertainty, routineness, complexity, and emotional content. Equivocality and uncertainty were initially described as two different factors, with uncertainty omitted in later studies. The three other factors were sometimes used interchangeably with equivocality. We do not necessarily agree that all tasks can be clearly categorized along these dimensions (e.g., they make no provisions for routine, complex tasks or nonroutine, simple tasks), nor do we necessarily agree that equivocality, complexity, nonroutineness, and high emotionality are synonymous (they may be task characteristics that frequently overlap). Nonetheless, in keeping with the direction Daft and Lengel were taking media richness theory, we choose to focus on equivocality, to match degree of routineness to level of equivocality, to disregard uncertainty as a separate factor, and to balance levels of complexity and emotional-content between the tasks.

²Daft and Wiginton (1979) identified nine different types of languages: art, nonverbal cues, poetry, general verbal expression, jargon, linguistic variables, computer languages, probability theory, and analytical mathematics. Daft et al. (1987) broadly group these alternatives into two categories: natural language and numbers. All three basic media (video, audio, and computer text) provide similar capabilities to use natural language and numbers excluding the variations provide by varying the first factor, multiple cues. Furthermore, the tasks chosen for this study require communicators to exchange information using both natural language and numbers, thus controlling for the variability.

Personal focus is the extent to which the sender can customize the message to meet the individual needs of the receiver. Media have often been generalized as having inherent degrees of personal focus (fliers, for example, cannot be personalized because of their wide general distribution). However, any medium directed to a specific individual can be personalized (Trevino et al. 1990). The media of interest in this study all easily support personalization. Furthermore, dyadic interactions provide fertile ground for personal communications. Thus, personal focus is balanced across conditions.

Media richness theory is imprecise about the definition and measurement of performance. Daft and Lengel (1986, p. 567-568) state that organizations process information to "attain adequate performance" without ever defining "performance." In a summary of media richness theory articulating its conceptual framework, Trevino et al. (1990) discuss performance in three terms: making better decisions (decision quality), establishing shared systems of meaning (consensus among participants), and making better use of participants' time (time required to reach conclusions). User satisfaction is also suggested as an element of performance, albeit less directly (see Lengel and Daft 1988). Satisfaction has long been a key element in group work (Hackman 1990, McGrath 1984), so we believe that communication satisfaction of sender and receiver(s) is another element of performance. We believe that this multidimensional definition (decision quality, consensus, time, satisfaction) provides a reasonable way to triangulate on the concept of "performance."

2.2. Immediacy of Feedback

Immediacy of feedback is the extent to which a medium enables users to give rapid feedback on the communications they receive (Daft and Lengel 1986). There are two parts to most communication: the sender presents the message and the receiver accepts it (Clarke and Brennan 1991). For communication to be successful, both the sender and receiver must mutually agree that the receiver has understood the message (Clarke and Wilkes-Gibbs 1986). Feedback from the receiver to the sender plays an important role in communicating to the sender that the receiver has understood the message.

There are two fundamental types of feedback: concurrent and sequential (Kraus and Weinheimer 1966). Concurrent feedback (also called "back channel" feedback: Duncan 1973, Yngve 1970) is feedback provided simultaneously with the delivery of the message. Concurrent feedback often takes the form of nonverbal gestures (e.g., head nods, quizzical expressions) or very brief messages that do not take the communication turn from the sender (e.g., "uh huh,") (Kraut et al. 1982). Sequential feedback occurs when the sender pauses (or the receiver interrupts) and the receiver

communicates to confirm understanding or to redirect the sender's presentation of the message. Here, the receiver takes a speech turn but quickly returns the floor to the sender.

Many categories or types of feedback have been identified (see Clarke and Brennan 1991, Clarke and Wilkes-Gibbs 1986, Clarke 1992). Four types are particularly relevant for understanding effects on media richness. The first is an acknowledgment that indicates understanding and can be delivered concurrently (e.g., head nods, "uh huh") or sequentially (e.g., by repeating a portion of the message). A second type, usually delivered sequentially, is a negative acknowledgment, indicating a lack of understanding by the receiver. A third type, usually delivered sequentially (often via an interruption), is the repair, in which the receiver corrects or clarifies the sender's message (e.g., sender: "We leave on Monday"; receiver: "You mean a week from tomorrow?"). A fourth type, also usually sequential, is the proxy in which the receiver completes the message for the sender (e.g., sender: "The car was . . . uh . . . uh"; receiver: "green").

Feedback is important to the speed and effectiveness of communication because it enables the sender to recognize the extent to which the receiver understands the message and to adjust the message presentation accordingly; a sender could recognize that the receiver understands the message and move on to new message(s), or recognize that the receiver does not understand the message and attempt to clarify it (Clarke 1992). Rapid feedback also enables the sender to use certain communication patterns that minimize the time required to achieve understanding. For example, the sender can use installment techniques (Clarke and Wilkes-Gibbs 1986) in which the sender delivers the message in installments, seeks feedback after each installment (i.e., acknowledgment or negative acknowledgment), and continues to elaborate on the message by adding additional installments only until the receiver indicates understanding, at which point the sender moves on to the next message. Immediate feedback also enables the sender to encourage proxy feedback or to use trial references (Clarke and Brennan 1991) in which the sender uses an uncertain reference and seeks an acknowledgment or repair from the receiver before continuing (e.g., sender: "The man's name was . . . John?"; receiver: "James.").

There is empirical evidence to suggest that the elimination of concurrent feedback increases the number of words senders use to communicate messages thus increasing the time required (Kraus and Bricker 1966, Kraus and Weinheimer 1966). As the delay between the sending of a message and the receipt of feedback increases, so too does the time required to complete a task (Kraus and Bricker 1966). The elimination of feedback also tends to reduce the accuracy of communication (Kraut et al. 1982, Leavitt and Mueller 1951). For these reasons, Daft and Lengel (1986) argue that media providing immediate feedback are richer than those that impose a delay on users.

2.3. Multiplicity of Information Cues

Multiplicity of information cues refers to the number of ways in which information can be communicated, such as text (e.g., the spoken or written words themselves), verbal cues (e.g., tone of voice), or nonverbal cues (e.g., physical gestures) (Daft and Lengel 1986, Daft and Wiginton 1979). There are at least four distinct theoretical ways in which multiplicity of cues may affect the communication and understanding of messages. First, verbal and nonverbal cues enable senders to include information beyond the words themselves when the message is transmitted. Verbal and nonverbal cues are often used to emphasize important points, to show doubt or uncertainty, to display acceptance, invoke dominance, and so on (Williams 1977). It is faster and more accurate for most people to send and receive the verbal and nonverbal cues in their native verbal or nonverbal format than to encode them in the text itself (Walther 1992, Walther and Burgoon 1992, Williams 1977). Therefore, when verbal and nonverbal cues are removed, it can take longer and be more difficult to fully understand a message.

Second, the use of typed medium such as computer-mediated communication rather than a spoken medium such as verbal or face-to-face interaction imposes significant transmission delays because it takes longer to type a message than to speak it (Chapanis 1988, Fowler and Wackerbarth 1980, Williams 1977). In this context, typing is best thought of as a delay cost (Reinsch and Beswick 1990) or a production cost (Clarke and Brennan 1991) that alters the way in which the sender creates messages and often reduces understanding.

Third, the inherent delay in typed media and the lack of verbal and nonverbal cues have significant effects on feedback. The elimination of verbal and nonverbal cues effectively eliminates concurrent feedback. The delay imposed by typing reduces the immediacy of sequential feedback. Thus the theorized effects due to reduced immediacy of feedback also apply to computer-mediated communication when compared to media with verbal and nonverbal cues and faster communication.

Finally, the lack of verbal and nonverbal cues can have significant effects on social perceptions (Williams 1977). In general, when verbal and nonverbal cues are removed there is a loss of social presence (Short et al. 1976, Rice 1993). The people with whom one is communicating become less like real people and more like objects (Williams 1977). This depersonalization can encourage people to become more self-centered (Sproull and Kiesler 1986) and exhibit antisocial behavior (Siegel et al. 1985), but it can lead to decisions based more on facts than personalities (Williams 1977). It could also have important effects on social facilitation. Social facilitation research suggests that working together in the presence of others on a shared task should increase the speed of a person's task performance, thus improving performance with simple tasks (or tasks believed to be simple a priori) and impairing performance with complex tasks (or tasks believed to be complex a priori) (Levine et al. 1993, Robinson-Staveley and Cooper 1990, Sanna 1992, Zajonc 1965). Thus the lack of social presence may decrease social facilitation effects and increase the time required.

Empirical studies have routinely found that decision time increases as the multiplicity of cues decreases, particularly for media requiring typing (Chapanis 1988, Siegel et al. 1983, Williams 1977). The effects of decreased cues on decision quality and attitudinal change are mixed, with no clear overall pattern emerging (Christie 1985, Fulk and Collins-Jarvis in press, Johansen, Vallee and Spangler 1979, Short et al. 1976, Williams 1977). The same can be said for satisfaction. While it is generally accepted that media with fewer cues are less friendly, more impersonal, more task focused, and even depersonalizing (Fulk and Collins-Jarvis in press, Walther 1992 and 1993), there is also evidence that groups using media with very few cues

can develop high levels of sensitivity and kindness (Kerr and Hiltz 1982), strengthen personal interaction (Vallee et al. 1978), and develop relationships (Walther 1992 and 1994). This suggests that media with fewer cues are less rich, but that the effects on task performance are not as clear.

2.4. Hypotheses

Media richness theory argues that (1) more immediate feedback and a greater multiplicity of cues increases media richness, and (2) use of richer media will lead to better performance for equivocal tasks while use of leaner media will lead to better performance for less equivocal tasks. Rice (1992) concludes that previous empirical research on user perceptions does not support media richness theory's contention that use of richer media impairs performance for less equivocal tasks, although other researchers disagree (cf. Hollingshead et al. 1993). It is difficult to make compelling theoretical arguments that reducing the immediacy of feedback should improve performance in terms of quality, time, consensus, or satisfaction for a less equivocal task. It is possible to develop scenarios where reduced multiplicity of cues might improve some aspects of performance (e.g., reduced ability for a group majority to dominate a minority), but linking these solely to task equivocality (not other situational factors) remains theoretically challenging.³

Previous empirical research on media use (not perceptions; see Rice 1992 for a summary of the perceptions research) has failed to find much support for media richness theory. Kinney and Watson (1992) found no task by media interactions for time, consensus change, or satisfaction for a decision making task. Valacich et al. (1994), who also studied a decision-making task, found no significant differences in decision quality by matching media to task equivocality. They did, however, find video to be significantly faster than CMC, telephone, or face-to-face interaction for equivocal tasks and telephone significantly faster than

³Lengel and Daft (1988) argue that richer media provide excess cues and surplus information for unequivocal messages, increasing decision time. However, considering the delay costs due to typing in CMC, and the overwhelming empirical evidence of increased time required when using CMC (Fulk and [Collins-Jarvis in press, Williams 1977], this argument is not tenable for CMC.

CMC, video, or face-to-face interaction for unequivocal tasks. Kraut et al. (1992), who studied how people edited text in a collaborative writing task, found the quality of editing for more equivocal writing errors to be higher when using verbal rather than written media. However, participants using verbal media were no more likely (and perhaps were even less likely) to correct more equivocal errors.

In building our hypotheses to test media richness theory, we first hypothesize that richer media will improve performance in general. Second, we hypothesize that richer media will improve performance to a greater extent for more equivocal tasks. Our hypotheses therefore become the following.

HYPOTHESIS 1a. *Performance improves as multiplicity of cues increases.*

HYPOTHESIS 1b. *Performance improves to a greater extent for more equivocal tasks than less equivocal tasks as multiplicity of cues increases.*

HYPOTHESIS 2a. *Performance improves as immediacy of feedback increases.*

HYPOTHESIS 2b. *Performance improves to a greater extent for more equivocal tasks than less equivocal tasks as immediacy of feedback increases.*

3. Method

The research design was a $2 \times 2 \times 2 \times 2$ repeated-measures design varying multiplicity of cues (high: audio-video, low: CMC), immediacy of feedback (immediate, delayed), task equivocality (the repeated factor with values of higher and lower equivocality), and treatment order (higher equivocality task first, lower equivocality task first). Subjects were assigned into one of the four media conditions (video-immediate feedback, video-delayed feedback, CMC-immediate feedback, and CMC-delayed feedback) and performed two tasks using that medium, one lower equivocality and one higher equivocality.

3.1. Subjects

Subjects were 132 sophomore, junior, and senior students recruited from a core business course with a requirement for experimental participation. The average age was 20.6 years, and 62 percent were male. Subjects

arrived at the research site in groups of four to eight people. They were randomly assigned into a two-person group (dyad) and the dyads randomly assigned to treatments. The laboratory setup permitted two dyads to be run simultaneously; when we had more than two dyads, the "surplus" dyads were used in another research study not discussed in this paper. The study design resulted in 14 video-immediate dyads, 18 video-delayed, 17 CMC-immediate, and 17 CMC-delayed.

3.2. Independent Variables

Cues. Media were varied first on multiplicity of cues. The highest multiplicity-of-cues level was provided by a condition in which subjects communicated through both video and audio channels. The subjects sat in separate rooms and communicated via a 27-inch TV screen and audio system. A professional video camera was mounted on top of the TV to minimize the distance between the camera and the screen (to better simulate eye contact). This system provided video and audio quality similar to that of commercial television broadcasts. In the leanest level, subjects in separate rooms interacted via CMC (discussed in more detail below).

Feedback. The second independent variable was immediacy of feedback. The audio-video/immediate-feedback condition was implemented by permitting simultaneous (i.e., synchronous or full-duplex) communication so that both subjects could send and receive auditory and visual messages at the same time. In the CMC-immediate-feedback condition, an application called "Chat" connected the subjects. Chat used a two-window split screen for simultaneous communication (one window for each participant) so that every keystroke by either participant was immediately displayed on both participants' screens.

In the delayed-feedback condition, only one subject could transmit information at a time; no feedback to the message sender from the recipient was possible during transmission (i.e., half-duplex). In the audio-video-delayed-feedback condition, the transmitting subject faced a blank, silent TV screen until he or she passed control to the other subject. The receiving subjects were able to see and hear their partners but could

not interrupt or respond until control was passed to them. Control was maintained by a switch in front of the TV that was pushed up to send and down to receive. In the CMC-delayed condition, subjects used the Group Outliner module of GroupSystems. Although both subjects could type at the same time, messages to partners were composed in a private screen and then sent as a whole to the public screen that each subject could view. While a subject was typing a message to transmit, the other subject could not see the message and thus could not provide feedback on the message until the entire message was sent.

Task. Our tasks were carefully selected to vary based on equivocality, not complexity (see footnote 1). Before conducting this experiment, we pilot tested over a dozen different sets of tasks or versions of each task with more than 230 subjects before selecting the two that we believed best met the criteria for lower and higher equivocality. Equivocality exists when multiple (and possibly conflicting) interpretations for available information exist or when the framework within which to interpret the information is unclear (Daft and Lengel 1986).

The higher equivocality task was a version of the undergraduate admissions task drawn from Dennis (1996). This task asked subjects to rank order from best to worst five students seeking admission to the university's undergraduate business program. Each subject was presented with incomplete information so that she or he needed to pool the information to reach a decision (i.e., a hidden profile task; see Stasser 1992). Several pieces of information had several interpretations that the subjects had to resolve, such as the relative merit of grade point average versus SAT scores, of extracurricular activities versus a part-time job, and so on. In several groups, resolving the relative importance of this information generated lively discussions.⁴

⁴In addition to the expected discussions of the relative merit of key items, subjects argued that in-state students should receive priority over out-of-state students, that students whose parents were university alumni should receive priority over nonalumni (even at this state university), that males should receive priority over females, that education majors should receive priority over English majors, that [perceived] poor students should receive priority over [perceived] rich students, and vice-versa. The gender and alumni issues generated the most heated discussion.

The lower equivocality task was a set of four questions similar to those used on Scholastic Aptitude Tests. The set included one each of a mathematical, geometric, physics, and logical reasoning question, each of which provided a clear framework for problem resolution. Subjects received incomplete information requiring them to share facts to form the complete information necessary to complete correctly the task. For example, one question read, "Find the equation of the line passing through the points (1,2) and (5,6)." Each subject received one of the two formulas necessary to solve the problem. Both tasks informed subjects they had incomplete information. Both tasks were ones with which the subjects had some degree of familiarity.

3.3. Procedures

The subjects first completed both tasks individually and recorded their individual decisions. They were then introduced to their partners through the medium and completed a warm-up task designed to familiarize the subjects both with each other and with the medium. Next, they worked as a dyad to complete the first task, reaching a shared decision. Then each individually completed a questionnaire and made another individual decision on the same task, a decision that could be either the same as or different from the dyad's decision. They then completed the second task as a dyad and individually completed the questionnaire, making an independent decision.

3.4. Measures

The dependent variables were measured at either the individual or dyadic level. Time, consensus, and decision quality are necessarily dyadic measures because they depend on the information processing of both participants. Perceptions (communication satisfaction and perceptions of richness, equivocality and task complexity) were measured at the individual level because they represent the individual, subjective viewpoint of the sender and receiver. A 2×2 ANOVA with task as a repeated measure and task order as another factor was used for all analyses. A dyad-nested-within-treatment term was included in the individual level analyses to account for the possible correlation between responses from subjects in the same dyad (see Dennis 1996, p. 444-445, and Walther and Burgoon 1992, p. 67).

Decision time was measured by the number of minutes required for the dyad to agree on the decision for each task. To avoid skewing the data in the CMC and delayed conditions, no time limits were imposed (see Walther 1992 for a discussion of the impact of time limits).

For the lower equivocality task, decision quality was measured by counting the number of correct answers for the four questions composing the task. This raw score was then converted to a z-score (i.e., $(x - \text{mean})/\text{standard deviation}$) to make it easier to compare between the two tasks. The higher equivocality task was designed following the university's undergraduate admissions regulations to provide a correct rank ordering of the five candidates. Seven experts (the director and assistant director of undergraduate admissions, plus five admissions officers) independently evaluated the candidates. They unanimously agreed on the rankings for the top two candidates but did not agree on the rankings for the remaining three. Therefore, decision quality was measured by counting the number of correct rankings of only the top two candidates. This raw score was then converted to a z-score.

Consensus change was measured by examining changes in agreement among subjects' pre- and post-discussion individual choices. This was calculated as the number of identical answers on individual post-discussion decisions minus the number of identical answers on individual pre-discussion decisions all divided by the number of answers (see Watson et al. 1988). Positive values mean increased agreement after discussion. For example, suppose the subjects agreed on two out of the four answers for the lower equivocality task prior to discussion, and three out of four after discussion. Consensus change would be $(3 - 2)/4 = 0.25$.

Communication satisfaction was measured using the Communication Satisfaction Inventory (Hecht 1978a). This instrument provided an appraisal of the degree of enjoyment, interest, sense of accomplishment, and overall communication satisfaction between partners using 19 items on a 1 to 7 Likert scale. Refer to the appendix for the questionnaire items. Reliability was adequate ($\alpha = 0.91$).

We also included three perceptual measures on the questionnaire as manipulation checks. Equivocality

(six items, Likert scale format, $\alpha = 0.84$) included the three questions that Daft and Macintosh (1981) used to measure equivocality plus three more questions drawn from Daft and Lengel's (1986) definition of equivocality. Complexity (two items, Likert scale format, $\alpha = 0.85$) used a straightforward measure of task simplicity and difficulty. Perceived media richness (eight items, Likert scale format, $\alpha = 0.89$) was based on eight questions: four criteria for high media richness (Daft and Lengel 1986) and four reversed scored measures for low media richness.⁵ Refer to the appendix for the questionnaire items for these measures.

4. Results

Table 1 shows the correlations among the major dependent variables. Table 2 shows the means, standard deviations, and 95-percent confidence intervals for the dependent measures (before the transformations described below). Table 3 shows the results of the statistical analyses.

4.1. Manipulation Checks

The higher equivocality task was perceived to be more equivocal than the lower equivocality task ($F(1,64) = 175.74, p = 0.001$). No significant difference in complexity was found between the two tasks ($F(1,64) = 3.09, p = ns$). Perceived media richness was higher with increased multiplicity of cues ($F(1,63) = 13.82, p = 0.001$) and increased immediacy of feedback ($F(1,63) = 8.04, p = 0.006$).

⁵While a few studies have attempted to measure media richness by asking about cues, feedback, language, and personal focus, this is a serious confound. Cues, etc. are theorized to affect richness; they are not part of richness. For example, suppose the theory was called "media satisfaction theory" rather than media richness theory, and "media satisfaction" was supposedly affected by cues, etc. We would measure "media satisfaction" by asking about satisfaction (e.g., "how satisfied are you?"), not by asking about cues, etc. and attempting to infer satisfaction (e.g., "how rapidly did you receive a response?"). Media richness is defined as "the ability of information to change understanding within a time interval" (Daft and Lengel 1986, p. 560); the key items here are "change understanding" and "time." In other papers, Daft and Lengel refer to "shared understanding." Our measure attempts to capture these key themes.

Table 1 Correlations (and p-Values) Among Dependent Measures

	Quality Low	Quality High	Time Low	Time High	Consensus Low	Consensus High	Satisfaction Low	Satisfaction High
Mean	0.00	0.00	9.23	8.13	0.27	0.46	4.94	4.94
Std. Dev.	(1.00)	(1.00)	(2.38)	(2.29)	(0.35)	(0.46)	(0.57)	(0.61)
Quality Low	1.000 (0.000)	0.097 (0.939)	-.066 (0.601)	0.163 (0.192)	0.326 (0.008)	0.189 (0.128)	0.185 (0.138)	0.223 (0.072)
Quality High		1.000 (0.000)	-.123 (0.324)	-.031 (0.806)	0.004 (0.975)	0.055 (0.661)	0.069 (0.583)	0.016 (0.901)
Time Low			1.000 (0.000)	0.440 (0.001)	0.132 (0.290)	0.360 (0.003)	0.016 (0.899)	-.054 (0.666)
Time High				1.000 (0.000)	-0.42 (0.738)	-.072 (0.565)	0.223 (0.072)	0.163 (0.190)
Consensus Low					1.000 (0.000)	0.280 (0.023)	0.150 (0.228)	0.132 (0.290)
Consensus High						1.000 (0.000)	0.280 (0.023)	0.360 (0.003)
Satisfaction Low							1.000 (0.000)	0.837 (0.001)
Satisfaction High								1.000 (0.000)

Notes:

1. "Low" and "high" refer to the lower and higher equivocality task, respectively. For example, Quality High refers to decision quality for the higher equivocality task.
2. The individual satisfaction scores were averaged to produce an overall group satisfaction score for use in the correlation analysis.
3. Quality was measured using z-scores, so means and standard deviations are 0.00 and 1.00 by definition.

4.2. Decision Time

A Hartley test found that the variance of the decision time measure was not homogeneous across treatments ($H(8, 15) = 9.39, p < 0.01$). The standard deviation appeared to increase with the treatment means, so a square-root transformation was applied to the data before performing the ANOVA (the transformation was $\text{root}(x) + \text{root}(x + 1)$; see Kirk 1968, p. 64-65). There were significant main effects for decision time due to task, multiplicity of cues, and feedback; see Table 3. Only one of the three equivocality interaction effects were significant (the cues \times task interaction). However, the effect was in the *opposite* direction from the predictions of media richness theory (the use of CMC rather than video increased decision time to a greater extent for the lower equivocality task than for the higher equivocality task).

4.3. Decision Quality

There were no significant main or interaction effects for decision quality.

4.4. Consensus Change

Consensus change was measured as a proportion, so an arcsine transformation was used to reduce nonnormality (see Neter et al. 1985, p. 616). There was a significant main effect due to task but no other significant effects. The higher equivocality task showed a greater increase in consensus change.

4.5. Communication Satisfaction

No statistically significant main or interaction effects were found for communication satisfaction.

4.6. Summary

In general, the results support Hypotheses 1a and 2a, that increased multiplicity of cues and increased im-

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Table 2 Means, [Standard Deviations], and 95% Confidence Intervals of Dependent Measures

Multiplicity of Cues Immediacy of Feedback		High (Audio-Video)		Low (Computer-Mediated)	
Measure	Task	Immediate	Delayed	Immediate	Delayed
Decision Time ^a	Low Equivocality	12.21 [4.18]	17.00 [8.23]	26.29 [8.09]	31.53 [12.81]
	95% CI	10.97 – 13.45	15.88 – 18.12	25.17 – 27.41	30.41 – 32.65
	High Equivocality	13.14 [5.08]	14.35 [8.15]	18.71 [10.65]	23.71 [9.94]
	95% CI	11.90 – 14.38	13.23 – 16.47	17.59 – 19.82	22.59 – 24.83
Decision Quality ^b	Low Equivocality	0.11 [0.83]	0.07 [0.99]	-0.03 [0.96]	-0.14 [1.22]
	95% CI	-0.35 – 0.59	-0.42 – 0.56	-0.53 – 0.47	-0.77 – 0.49
	High Equivocality	0.32 [1.11]	-0.03 [0.95]	-0.19 [0.90]	-0.05 [1.07]
	95% CI	-0.32 – 0.96	-0.52 – 0.44	-0.65 – 0.27	-0.60 – 0.50
Consensus Change ^c	Low Equivocality	0.30 [0.24]	0.35 [0.21]	0.22 [0.50]	0.21 [0.38]
	95% CI	0.04 – 0.56	0.12 – 0.57	-0.01 – 0.45	-0.02 – 0.44
	High Equivocality	0.48 [0.42]	0.54 [0.45]	0.44 [0.48]	0.37 [0.49]
	95% CI	0.22 – 0.74	0.31 – 0.77	0.21 – 0.67	0.14 – 0.60
Communication Satisfaction ^d	Low Equivocality	4.87 [1.03]	5.02 [0.75]	5.02 [0.68]	4.84 [0.72]
	95% CI	4.47 – 5.27	4.69 – 5.33	4.77 – 5.27	4.58 – 5.10
	High Equivocality	4.89 [0.99]	5.17 [0.69]	4.92 [0.82]	4.76 [0.64]
	95% CI	4.52 – 5.26	4.84 – 5.30	4.61 – 5.23	4.49 – 4.99

Measurement scales: ^aMinutes; ^bStandardized z-scores; ^c-1 to +1; ^d1 (low) to 7 (high).

Table 3 F- (and p-Values) for Statistical Tests on Dependent Measures

DEPENDENT MEASURES	df	MAIN EFFECTS			INTERACTION EFFECTS			
		Multiplicity of Cues	Immediacy of Feedback	Task	Cues * Feedback	Cues * Task	Feedback * Task	Cues * Feedback * Task
Time	58	43.39 (0.001)	6.67 (0.013)	13.54 (0.001)	0.04 (0.837)	4.25 (0.044)	0.09 (0.759)	0.27 (0.607)
Decision Quality	58	1.03 (0.315)	0.17 (0.679)	0.06 (0.811)	0.71 (0.402)	0.07 (0.800)	0.03 (0.860)	0.85 (0.361)
Consensus Change	58	0.94 (0.335)	0.01 (0.910)	18.89 (0.001)	0.14 (0.711)	0.01 (0.926)	0.00 (0.962)	0.02 (0.902)
Communication Satisfaction	63	1.09 (0.300)	0.00 (0.996)	0.00 (0.969)	2.06 (0.156)	2.88 (0.095)	0.42 (0.520)	0.45 (0.504)

mediacy of feedback would lead to better performance, respectively. While not all outcome measures display this pattern, decision makers often trade off outcomes (particularly time and quality) so that effects sometimes appear in only one measure (Beach and Mitchell 1978, Payne 1982). However, Hypotheses 1b and 2b, that multiplicity of cues and feedback would be more important for more equivocal tasks, were not supported.

5. Discussion

While subjects in this study perceived differences in media richness as predicted by media richness theory, using richer media rather than leaner media did not lead to better performance on the higher equivocality task. Thus for the new media studied here, our results find no support for the central proposition of media richness theory that matching medium to task equivocality improves performance. No outcome measure (decision time, decision quality, consensus change, or communication satisfaction) improved by matching media richness to task equivocality. We found significant media differences for decision time due to multiplicity of cues and immediacy of feedback, but not those proposed by media richness theory; the use of "leaner" media resulted in slower performance overall, but had a greater effect on the less equivocal task—the opposite effect to the predictions of media richness theory. These results are consistent with those of Kinney and Watson (1992) and Valacich et al. (1994), empirical studies of media use that also found little support for media richness theory.

5.1. Alternative Explanations

At least four plausible explanations exist to explain why our findings failed to support media richness theory for these media. One explanation is that our tasks failed to differ in terms of equivocality. We drew our criteria for equivocality directly from media richness research: the existence of multiple or conflicting interpretations of an event (Daft and Weick 1984); and answers must be created through the development of shared meanings between communicators (Trevino et al. 1990). The tasks were extensively pilot tested. A manipulation check found that subjects perceived the tasks to be significantly different in equivocality in the

expected direction—they perceived the higher equivocal task to be significantly more equivocal than the lower equivocal task. Furthermore, the panel of admissions officers agreed on the rank order of the top two alternatives in the equivocal task but did not agree on the rank ordering of the remaining alternatives, suggesting that they had multiple interpretations of the task information (the definition of equivocality). Therefore, we believe that our tasks differed in equivocality.

A second explanation might be that the media tested did not vary in media richness. Again we drew heavily on Daft and Lengel's (1986) definitions in constructing the media conditions and again, the subjects reported significant differences in perceptions of media richness that matched predictions of media richness theory. Therefore, we believe the media differed in richness.

A third potential explanation may be that our dependent measures were not sensitive enough to detect differences. Communication satisfaction was measured by a questionnaire proven valid and reliable in extensive prior research (Hecht 1978a and 1978b, Hecht et al. 1984, Rubin and Rubin 1989). Our approaches to measuring decision quality and consensus change have also been used in earlier studies and have found significance in studies with fewer teams (Kinney and Watson 1992, Raman et al. 1993, Watson et al. 1988, Watson et al. 1994). In this study, the measures of time and consensus change found significant differences, just not those predicted by media richness theory. Finally, a power analysis found adequate power. Cohen (1988) uses three levels to conceptualize power: a "small effect" is one in which the treatment means differ by 1 percent; a "medium effect" is one in which they differ by 6 percent; a large effect is one in which they differ by 15 percent. In this study, the power for each statistical test (whether main effect or interaction effect) was 0.20 for a small effect, 0.80 for a medium effect, and 0.99 for a large effect. Our primary interest was testing the three media-task interaction effects hypothesized by media richness theory (task \times cues, task \times feedback, task \times cues \times feedback). For a medium-sized effect, the power of each test is 0.80, meaning that the probability of not finding an interaction that actually exists (beta) is 0.20. The probability of not finding one interaction effect if three interaction effects exist is

about 0.01 ($0.20 \times 0.20 \times 0.20 = 0.008$). Therefore, we believe that these measures were appropriate.

A final plausible explanation for our results is that media richness theory failed to predict the findings—matching media richness to task equivocality did not improve performance. We are confident that our tasks differed in equivocality, our media differed in richness, and our measures were appropriate. Therefore, we conclude that for these teams, tasks, and media, media richness theory did not hold.

5.2. Limitations

Clearly, questions remain as to the generalizability of these results to other teams, tasks, and media. This study suffers from the weaknesses inherent in laboratory research. The subjects were students who may be unaccustomed to performing this type of task. Rewards were not contingent on subjects' performance, so they may not have been motivated to invest effort in performing the tasks. While we have no evidence of such apathy, the lack of findings may be due to the subjects' lack of involvement in the task.

The subjects had only a limited history of working together and few established social norms—a form of collaboration that occurs naturally in organizations (Galegher and Kraut 1990). We believe that our use of subjects with limited prior experience with each other and these media strengthens our findings. Media expertise has been proposed to influence one's perception of a medium's richness (Schmitz and Fulk 1991, Fulk 1993). Teams with histories of working together and experience with lean media can often communicate rich messages through lean media (Lee 1994, Ngwengama and Lee 1997, Yates and Orlikowski 1992) and develop relationships (Walther 1993 and 1994). For the teams in our study, who had no such shared history, the leaner media were clearly quite lean.

Another limitation is that we studied only one size of team, dyadic. Most (60 percent) managerial meetings are dyadic (Panko and Kinney 1995a) and most communication technologies are designed primarily for dyadic communication (Panko and Kinney 1992). Communication may become more difficult in larger groups, so media richness may have greater effects.

The subjects worked together for only a short period of time—while some tasks necessarily entail larger

teams working for long periods of time, many managerial meetings (between 21 and 34 percent) are best handled through one time contacts (Kinney and Panko 1996, Monge et al. 1989) in short periods of time (Galegher and Kraut 1990). Tasks that require longer to resolve may also pose more communication problems for groups, a situation again that may increase the importance of media richness.

5.3. Understanding Differences from Prior Research

Why do our results differ from those of prior media richness theory research? This study differs from prior studies in at least two significant ways.

Tasks. One major difference lies in the tasks studied. Virtually all previous research supporting media richness theory has examined communication tasks such as providing cost figures, praising a subordinate, explaining how to do something, and so on (Daft et al. 1987). In contrast, this study focused on decision making tasks that require participants to arrive at a joint decision. It may be that our contrary findings are due to the type of task. While media richness theory was developed specifically for the type of information processing task used in this study, it may be that media richness theory is only appropriate for more simple communication tasks.

The tasks in this study were what Christie (1985) would term "task-oriented" or McGrath (1984), "choice" tasks. Tasks in many prior studies have included both task-oriented tasks as well as more relationship-oriented or "person-oriented" tasks (Christie 1985), such as praising a subordinate (Daft et al. 1987). Social presence theory contends that performance will improve when a medium's ability to transmit social presence is matched to the social needs of the task (Christie 1985). The theory predicts that task-oriented activities (such as information exchange or problem solving) can be carried out equally well using any medium but that media conveying low social presence (such as text-only) should prove unsatisfactory only for tasks requiring high personal involvement (such as getting to know someone). Thus the supportive findings for media richness theory in prior studies may be due to primarily to the inclusion of both person-oriented and task-oriented tasks.

Perceptions. The second major difference is the study of perceptions versus actual performance. Managers' perceptions of performance can't be wrong—can they? Perceptions serve as representations of reality, sometimes even in the face of contradictory facts.⁶ Early empirical work on telephone and video conferencing described by Short et al. (1976) found that participants perceived less rich media such to be less effective, but in carefully controlled studies, less rich media were as effective as richer media, even for socially oriented tasks such as getting to know someone. One possibility is therefore that studies based on perceptions have produced erroneous results, because participants' perceptions are not accurate.

Future Research

One important direction for future research is to conduct more studies of media richness theory that examine actual performance, not perceptions. This will enable us to rule out perceptions as a possible source of bias in studies.

Obviously, a second direction is to more closely examine the nature of tasks used. We need more research comparing different types of tasks such as communications tasks to decision making tasks to determine whether media richness theory only applies to communications tasks. We also need to study task-oriented tasks versus person- or relationship-oriented tasks.

Since there were so few significant media effects in this study, one could argue that the subjects adapted their communication behavior to the media (Kerr and Hiltz 1982, Williams 1977) so that, on average, they were as successful using one media as another, with the exception, of course, that reduced cues and immediacy of feedback led to slower decisions. Further research is needed on the communication and decision processes to understand how participants adjust their communication processes to adapt to different media.

A final issue for future research is the level of analysis. Like most prior studies, we examined the mean response to the media. Substantial evidence exists that even in studies finding differences in media effects,

⁶For example, managers continue to brainstorm in groups, although decades of research have shown that this is a horribly ineffective technique; it is far more effective to brainstorm individually and pool the results (Mullen et al. 1991).

they are so small as to be inconsequential, regardless of task (Johansen et al. 1979). Johansen et al. conclude that appropriate media choice is more a function of preference, convenience, and cost than of task-media fit. Individual differences may play a key role (Trevino et al. 1990). Individuals differ in their ability to process images, verbal information, and written information so that performance for some individuals may depend heavily on the format of the information as communicated through the medium. Studying variances from the mean may provide important clues to increasing the effective use of media. Until the factors that contribute to the wide variability in subject response can be identified, we may be unable to make accurate statements about the general effects of media use.

6. Conclusions

Our results challenge media richness theory, at least for the new media studied here: computer-mediated and audio-video-mediated. We found that while subjects were able to recognize differences in media richness, the media itself had no significant effect on decision quality, consensus, and communication satisfaction. The only effect of varying media richness was on time—richer media supported quicker decision making, regardless of task equivocality; and again, this may be due simply to structural limitations of the media (i.e., it takes longer to type). The results suggest that media richness matters, but it does not interact with task equivocality (at least not in the manner proposed by media richness theory). Based on this study and prior research, we conclude that matching media richness to task equivocality does not improve performance for the new media.

One study cannot cause us to discard a well-established, albeit aging, theory. Media richness theory may be a useful theory for the "old" media, such as letters and memos, whose levels of feedback and cues are far below those of the "new" media tested in this study. The new "lean" media may be just rich enough to enable users to successfully communicate for moderately equivocal tasks.

In some respects, media richness theory has stayed one step ahead of the empirical evidence, being continually revised as new empirical data arrived that did

not support its current incarnation. Undertaking another revision based on these data is tempting. After all, media richness theory has such high face validity it must be a good theory, if only we adapt it again.

We think not. The data in this study speak to the central proposition of the theory—matching richness to equivocality—and find no support for it. We believe media richness theory is not a useful theory for explaining the effects of the use of the new media on task performance. Media richness theory tries to explain a complex weave of interactions with a simple interpretation. We believe it is now time to move on to new theories that better explain performance effects in the new media, rather than attempting to adapt a theory from the old media.

In absence of such a theory, our advice is *not* to choose communication media based on a perceived fit between task equivocality and media richness. The effort will likely not improve performance. Instead, we recommend that managers seeking to improve performance (and researchers seeking to understand performance effects) should examine the fundamental aspects of media. For example, if high feedback is needed to rapidly converge on a decision, then the use of media providing high feedback should improve performance. If the goal is to disseminate and share information, feedback may be less important than the rapid presentation of information in a form easily and rapidly understood by the message recipient. The best media for disseminating information may not be the best for converging on a decision, and often both are needed to perform a given task. Media switching may be the best choice for optimum performance in tasks that require both information dissemination and convergence on a decision (cf. Markus 1994).

Taking a closer look at the tasks used in prior studies also provides some insight. For example, the low equivocality task in Daft et al. (1987) (providing cost figures to a subordinate) differs from the high equivocality task (explaining a complicated technical matter) in ways other than equivocality. In this case, the number of conversation turns required to complete the task (see Clarke and Brennan 1991) is greater for the high equivocality task, and thus this task may be better suited to media providing higher feedback. Thus many of the results in prior studies attributed to matching

richness equivocality may in fact be better attributed to matching other media characteristics (e.g., feedback) to some other task factor(s) that co-varied with equivocality (e.g., number of conversation turns).

Feedback also needs to be considered in context. Face-to-face communication has higher feedback compared to computer-mediated communication such as electronic mail when both parties are co-located and easily accessible. If parties are not co-located, then telephone may provide faster feedback than face-to-face communication. If parties are not easy accessible, electronic mail may provide faster feedback than playing telephone tag or attempting to schedule a face-to-face meeting. Furthermore, people sometimes choose a medium specifically to avoid faster feedback. A manager may deliberately choose a text-based medium for emotionally laden information to allow the receiver time and privacy to respond appropriately to the information.

Likewise, for what Christie (1985) would classify as “person-oriented” or social tasks, a medium’s multiplicity of cues or its social presence—not its richness—may be important. If the goal is to socialize or get to know someone, using a medium providing high social presence may lead to more successful outcomes than one providing less social presence. However, anecdotes abound on the successful use of computer-mediated communication for many social tasks, even dating, suggesting that at least some individuals can successfully adapt their communication behavior to communicate very personal information and build relationships through media with very low social presence (Walther and Burgoon 1992, Walther 1993 and 1994).

In these examples, the key determinant of success is not the “richness” construct but the more fundamental constructs of feedback and social presence cues. Other, more fundamental, constructs inherent in different media are also likely to influence performance; Clarke and Brennan (1991, p. 142–145) provide a good discussion of many other media characteristics and the differential effects they are likely to have on the sender and receiver(s). Likewise, many factors beyond the medium itself are likely to affect performance, such as organizational norms, and personal characteristics and shared histories of the sender and receiver(s) (Fulk and

Boyd 1991, Fulk and Collins-Jarvis in press, Ngwengama and Lee 1997, Rice 1992, Trevino et al. 1990).

In our opinion, the traditional idea of matching media richness to equivocality is unlikely to improve performance when using the new media. We believe that the limiting factor in the successful use of so-called "lean" media may not be the media itself but merely our preconceived perceptions of their limitations.⁷

Appendix Manipulation Checks and Constructs

Equivocality

- Different people could have different opinions about the best solution for this task.*
- Most people would clearly agree on what information is important and unimportant for this task.
- The information needed to solve this task can be interpreted differently by different people.*
- More than one reasonable solution exists for the problems faced in this task.*
- The information needed to complete this task can be found in books.
- The rules and criteria for solving this problem are clear and can be found in books.

Complexity

- This was a simple task to complete.
- This was a difficult task to complete.*

Perceived Media Richness

- When we disagreed, the communication conditions made it more difficult for us to come to agreement.
- When we disagreed, our communication environment helped us come to a common position.*
- The conditions under which we were communicating got in the way of our sharing of opinions.
- I could easily explain things in this environment.*
- The communication conditions helped us communicate quickly.*
- I couldn't easily communicate some ideas to my partner because of the communication conditions.
- The communication condition under which we

communicated helped us to better understand each other.*

- The communication condition under which we were communicating slowed down our communications.

Communication Satisfaction

- I had something else to do.
 - Nothing was accomplished.
 - I did not enjoy the interaction.
 - The interaction went smoothly.*
 - We each got to say what we wanted.*
 - I was very satisfied with the interaction.*
 - I felt that we could laugh easily together.*
 - I was very dissatisfied with the conversation.
 - We talked about something I was NOT interested in.
 - I would like to have another interaction like this one.*
 - The other person genuinely wanted to get to know me.*
 - I felt I could talk about anything with the other person.*
 - The other person showed me that he/she understood what I said.*
 - The other person expressed a lot of interest in what I had to say.*
 - The other person let me know that I was communicating effectively.*
 - The other person did NOT provide support for what he/she was saying.
 - During the interaction I was able to present myself as I wanted the other person to view me.*
 - The other person changed the topic when his/her feelings were brought into the interaction.
 - The other person frequently said things which added little to the interaction.
- Scoring. All 7-point Likert scales scored 1 for "strongly agree" and 7 for "strongly disagree." *Starred items indicate reverse scoring. High scores indicate high presence of measured construct.

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