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EFFECTS OF COMMUNICATION MEDIA ON INTELLECTIVE AND NEGOTIATION TASK PERFORMANCE

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Abstract

Among several theories to explain how different communications media affect task performance, media richness theory is one of the most frequently cited. Media richness theory proposes that task performance will be improved when task information requirements are matched to a medium's ability to convey information.

The main objective of this research is to examine the media richness theory in a laboratory experiment. The investigation focuses on the effect of four different communication media (text, audio, video, and face-to-face) on objective task performance on an intellective task and a negotiation task. For the negotiation task, a social psychological factor, consonancy, was involved to examine the interaction effect with media on performance.

The results of this study did not support media richness theory in general. Audio was the most efficient medium for the intellective task, but there was no significant difference among medium groups in terms of effectiveness measure. For the negotiation task, this study failed to support the combined theory of media richness and social psychology. There was no significant media-by-consonancy interaction on the negotiation payoff.

1. INTRODUCTION

Media richness theory (Daft and Lengel 1984, 1985), a widely cited theory on media usage, argues that task performance will be improved when task information requirements are matched to a medium's ability to convey information. For example, a lean medium is sufficient to exchange an unequivocal message (e.g., routine communication), while a rich medium is recommended to resolve an equivocal situation (e.g., negotiation).

Even though this theory seems to have a high face validity, it was not well supported (or was at best partially supported) by the previous empirical studies (Kinney and Watson 1992; Kinney and Dennis 1994; Valacich et al. 1994; Markus 1994). Criticisms fall into two categories: one directed at the theory itself and one at the prior research testing the theory. Media richness theory (MRT) has been faulted for its failure to consider situational factors (e.g., time and place) that might affect behavior and social factors (e.g., social norm and attitude) that might shape perceptions of media (Markus 1994). Meanwhile, Kinney and Dennis argued that most tests (Daft, Lengel and Trevino 1987; Trevino, Lengel and Daft 1987; El-Shinnawy and Markus 1992; Rice 1992) of the theory had examined perceptions of media fit by surveying the media choice of message senders, not by examining the actual performance effects of media use. Because perceptions of effectiveness may differ from actual effectiveness, they encouraged researchers to seek more empirical data on actual performance to support or refute previous findings.

One type of task that is especially sensitive to the characteristics of media is that involving negotiation. Several studies (Morley and Stephenson 1969, 1970; Short 1974) in the communication media research found significant interaction effects between communication media and social psychological factors on the negotiation process and result. For example, Morley and

Stephenson (1977) found that the side with the stronger case was more successful in telephone situations than in face-to-face situations. This finding suggests that it might be useful to consider social psychological factors as additional variables in studying MRT, especially for the negotiation task.

The main objective of this paper is to examine the MRT in a laboratory experimental design accommodating some of the above criticism and findings. The investigation focuses on the effect of four different communication media (text, audio, video, and face-to-face) on objective task performance on an intellective task and a negotiation task.

2. PRIOR RESEARCH

2.1 Media Richness Theory

Media richness theory, a widely cited theory on media use, argues that task performance will be improved when information requirements of the task are matched to a medium's ability to convey information richness (Daft and Lengel 1984, 1985). Communication media differ in the richness of information processed, and the richness of media is based on feedback, multiple cues, language variety, and personal focus. The more a medium possesses these characteristics, the richer that medium is. Face-to-face is considered the richest communication medium because it allows rapid mutual feedback, permits the simultaneous communication of multiple cues (e.g., body language, facial expression, tone of voice), uses high-variety natural language, and conveys emotion. The telephone, addressed written documents (e.g., notes, memos, letters), and unaddressed documents (e.g., bulletins, standard reports) follow face-to-face communication in media richness, in descending order.

Empirical research related to MRT can be classified into two streams: the media characteristics approach and the social information processing approach. Fulk et al. (1987) summarized the key assumptions of the two approaches shown in Table 1. The social information processing approach is useful to explain managers' communication and media choice behavior in the organizational context from a descriptive perspective, and it may explain patterns of findings that are not explainable from a media characteristics perspective (Fulk et al. 1987; Markus 1994). On the other hand, the media characteristics approach is more appropriate to examine individual-level rational choice of media from a prescriptive perspective. Since this study scrutinizes the effect of a match between information requirements of the task and a medium's ability to convey information richness at the individual level, the media characteristics perspective is adopted and the literature review is concentrated on the studies related to this perspective.

Kinney and Watson conducted a laboratory experiment examining dyadic communication in face-to-face, audio, and computer-mediated text modes using a high equivocality task involving a budget-allocation problem and a low equivocality task involving Graduate Record Exam (GRE) problems. Their dependent variables were decision time, consensus change, and communication satisfaction. While the findings supported the hypothesis that decision time varied as a function of medium, they failed to support similar hypotheses for consensus change and communication satisfaction. In general, MRT was not supported in this study.

Table 1. A Comparison of the Assumptions of the Media Characteristics and Social Information Perspective

	Media characteristics perspective	Social information perspective
Properties of media	objective – inherent, physical attributes recognizable by users	subjective – influenced by attitudes, statements, and behaviors of others
Salience of media properties	a function of individuals' perceptions of media properties and task attributes	a function of the assessments of coworkers (including supervisors)
Media choice process	rationality based on a matching of media attributes with task requirements	rationality influenced by past statements and behaviors, as well as social norms

Source: Fulk et al. (1987)

Kinney and Dennis examined the effects of media richness on decision-making in dyadic communication for a higher and a lower equivocal task. The higher equivocal task was a college admissions task, and the lower equivocal task was a set of Scholastic Aptitude Test (SAT) problems. Subjects in this laboratory experiment received two treatments related to media richness: three levels in multiplicity of cues (face-to-face, audio-video, and computer-mediated text) and two levels of immediacy of feedback (immediate versus delayed). Even though subjects perceived differences in media richness due to cues and feedback, and social presence due to cues, varying cues and feedback had no effect on decision quality, consensus change or communication satisfaction. The results did not support the MRT.

Valacich et al. (1994) conducted a laboratory experiment comparing face-to-face, video, audio, and computer-mediated text modes in a dyadic communication environment. Two types of tasks, intellective (low equivocal) and cognitive conflict (high equivocal), were involved in this study. The intellective task was a directory and map-searching problem and the cognitive conflict task was a budget-allocation problem. For perceptual satisfaction measures, the study results presented partial support for the MRT. The results followed a predictable pattern of higher richness leading to higher satisfaction for the cognitive conflict task, but no pattern showed for the intellective task. The pattern of objective performance measures was not consistent across tasks or media, and did not support the MRT.

2.1 The Social Psychology of Bargaining

Certain social psychological factors influence the process of bargaining. Morley and Stephenson (1977) have focused on collective bargaining between representatives of groups. Their approach derives in part from Douglas' suggestion (1957) that negotiations can be characterized according to changes in the balance between the interpersonal and interparty forces involved. According to them, negotiators have to respond to requests to represent their parties on one hand, and maintain a personal relationship with their opposites on the other.

Morley and Stephenson (1969, 1970) designed two experiments to test effects of communication media on social psychological factors in a negotiation. Subjects playing the role of either the management or the union representative communicated either by telephone or face-to-face to negotiate a settlement of a simulated industrial wage dispute. Specimen arguments from each side were provided, giving an initially stronger case either to the management representative (Morley and Stephenson 1969) or the union representative (Morley and Stephenson 1970).

In both experiments, the side with the stronger case was more successful in telephone conditions than in face-to-face conditions. Morley and Stephenson argued that in a telephone conversation there would be a greater emphasis on the interparty exchange at the expense of the interpersonal exchange. In other words, negotiators in a telephone condition were likely to pay more attention to what was being said and be more task-oriented, and to be less concerned with the presentation of self. This would lead to a greater likelihood of a settlement in accordance with the objective merits of the case (the interparty considerations) compared to a face-to-face situation.

Short designed an experiment which examined the complementary situation of Morley and Stephenson (1969, 1970). In Morley and Stephenson's experiments, the intrusion of interpersonal considerations in the face-to-face exchange was expected to disadvantage the stronger case. On the other hand, in Short's experiment, the intrusion of interpersonal considerations was expected to give an advantage to the stronger case, because its strength was based in interpersonal considerations rather than in interparty considerations as was the case in Morley and Stephenson.

In this experiment, the scores of subjects performing a budget-allocation task over one of three communication media (face-to-face, closed circuit television, or a loud-speaking audio link) were compared. One person was required to argue a case which reflected his personal views (i.e., consonant type), while the other person was required to argue a case that bore no necessary relationship to his personal views (i.e., non-consonant type). The medium of communication had a significant effect on the outcome of the negotiation: consonant type was more successful in face-to-face than in audio-only communication, while non-consonant type was more successful in telephone than in face-to-face communication. Results in the video situation resembled those in the face-to-face condition.

In summary, prior research related to the media characteristics perspective has failed to support, or, at best, only partially supported the MRT (Kinney and Watson 1992; Kinney and Dennis 1994; Valacich et al. 1994). Most of the previous studies employed two or three media to examine the effects of the medium of communication. While the study by Valacich et al. (1994) involved four media, as the authors mentioned, the low video image quality and periodic delay of the picture transmission in video condition might affect the results. For thoroughness, this study employed four media: face-to-face, video, audio, and computer-mediated text including state-of-the-art personal video communication systems. Most tests of MRT have examined perceptions as substitute measures of task performance, especially for high equivocal tasks. This study measured actual performance for all the tasks. It also accommodated consonancy as an additional variable for the negotiation task.

3. THEORETICAL FOUNDATIONS AND RESEARCH MODEL

The MRT by Daft and Lengel (1984, 1985) provides a conceptual foundation for this research. Even though this theory is criticized by lack of considering situational and symbolic constraints, it will continue to guide research as a theory-in-use, especially for the individual-level rational choice part (Markus 1994). McGrath and Hollingshead (1993) presented the two independent variables and the effect of their fit on performance in a 4-by-4 matrix form (Figure 1) as a modification to the MRT. The matrix classifies patterns of differential fit between the information richness requirements of the tasks assigned and the information richness capability of the communication media involved.

Increasing potential richness required for task success	Communication Media			
	Increasing potential richness of information →			
Task type (s)	Computer Text Systems	Audio Systems	Video Systems	Face-to-Face Communications
Generating ideas and plans	Good fit	Marginal fit Info too rich	Poor fit Info too rich	Poor fit Info too rich
Choosing correct answer: intellective tasks	Marginal fit Medium too constrained	Good fit	Good fit	Poor fit Info too rich
Choosing preferred answer: judgment tasks	Poor fit Medium too constrained	Good fit	Good fit	Marginal fit Info too rich
Negotiating conflicts of interest	Poor fit Medium too constrained	Poor fit Medium too constrained	Marginal fit Info too lean	Good fit

Source: McGrath and Hollingshead (1993)

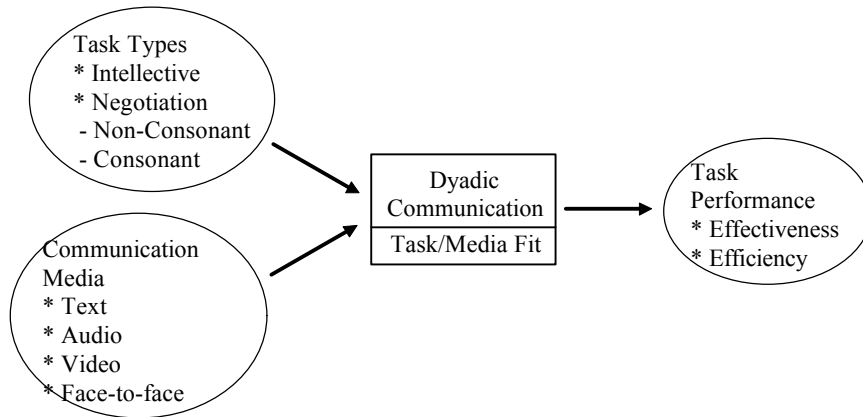**Figure 1. The Task and Media Fit on Information Richness**

Figure 2. The Research Model

The best fits between media and task lie near the main diagonal of the matrix. Task/media combinations northeast of the diagonal tend to be inefficient because the media might be too rich for the task and cause the distraction of communications that are not essential for the effective communication. On the other hand, task/media combinations southwest of the diagonal tend to be ineffective because the media might be too lean for the task and incapable of transmitting information sufficiently.

3.1 Research Model

The research model of this study is shown in Figure 2. There were two independent variables involved in this study. Media characteristics were operationalized into text, audio, video (including audio), and face-to-face modes. All four modes were synchronous; an asynchronous environment is not considered in this study.

Task types were operationalized into an intellective task and a negotiation task. Among the four tasks mentioned by McGrath and Hollingshead, only two task types were selected because of practical limitations such as experiment time and cost. Since it has been repeatedly reported that tasks requiring groups to generate ideas were most effectively conducted in a computer-mediated text mode (Gallupe et al. 1992; Dennis and Valacich 1993; Valacich, Dennis and Connolly 1994), the idea-generation task was excluded. Among the remaining three tasks, the intellective and negotiation tasks were chosen to maximize the treatment effect. The negotiation task was further divided into consonant and non-consonant types to accommodate social psychology factors.

Objective task performance is one of the most important dependent variables. It was measured in terms of efficiency and effectiveness in this study.

3.2 Hypotheses

The general effects of a misfit between task and media on task performance can be summarized into two types (McGrath and Hollingshead 1993). If a medium is too rich for the task, then it is vulnerable to inefficiency caused by the distraction of communications that are not essential. If a medium is too lean for the task, then it is vulnerable to ineffectiveness due to its incapacity for transmitting information sufficiently.

The best-fitting combinations for the intellective task (refer to Figure 1) are an audio and a video mode. The computer-mediated text mode is too lean for the task, thus effectiveness is expected to be decreased. In terms of efficiency (decision time), computer-mediated text mode is expected to be least efficient. Several studies (Sheffield 1989; Chapanis 1988; Kinney

and Watson 1992; Kinney and Dennis 1994) have consistently shown that written communication or communication requiring keyboarding involved more time than voice communication.

On the other hand, the face-to-face mode is too rich for the intellective task, but this will not alter effectiveness even though it might reduce efficiency. In other words, face-to-face dyads will take more time than the audio and the video dyads because they are vulnerable to the exchange of nonessential facts which do not increase (nor decrease) task effectiveness.

> H1. For the intellective task, correctness of the text mode will be the worst.

> H2. For the intellective task, decision time will be longest in the text mode, followed by the face-to-face.

In this study, the negotiation task was a kind of zero-sum game between the consonant subject and the non-consonant subject. The sum of their payoff was always 270 points (refer to the Dependent Variables section for details). Thus, even though the MRT argues that the best-fitting combination for the negotiation task is a face-to-face mode, it is not meaningful to compare negotiation payoff (effectiveness) among the media without considering the consonancy factor. According to Short's study, the subjects whose interests were consonant with their convictions were relatively more successful in the face-to-face mode than in the leaner mode (i.e., telephone), while the reverse held for the non-consonant subjects. One of the main differences between the consonant and non-consonant groups was the perceived reasonableness of their case. Since the case of non-consonant groups was so weak, it was probable that they were compelled to lie. With the removal of certain nonverbal cues to deceit, deception might be easier in a leaner communication medium than in the face-to-face mode. Thus, it is expected that the payoff of the consonant subjects will be higher as the richness of the medium increases.

In terms of negotiation time (efficiency), the richer the medium is, the more efficient it is, because the negotiation task requires an exchange of rich information.

> H3. For the negotiation task, the consonant subjects will be most successful in terms of payoff in the face-to-face mode, followed by video, audio, and text.

> H4. For the negotiation task, decision time will be longest in the text mode, followed by audio, video, and face-to-face.

4. RESEARCH METHOD

A laboratory experiment with 2 x 4 factorial design incorporating communication media and task types was used to answer research questions. Communication media were divided into four levels: computer-mediated text, audio, video, and face-to-face, while task types had two levels: intellective and negotiation. Each member assigned to the negotiation dyads took one of the two roles of consonant or non-consonant subjects. The research design and subject numbers assigned in each cell are shown in Figure 3.

Task \ Media	Communication Media			
	Text	Audio	Video	Face-to-Face
Intellective	40 (20 dyads)	40 (20 dyads)	40 (20 dyads)	40 (20 dyads)
Negotiation	c. 19; n.c. 19 (19 dyads)	c. 20; n.c. 20 (20 dyads)	c. 19; n.c.19 (19 dyads)	c. 20; n.c. 20 (20 dyads)

Note: c.=consonant subject; n.c.=non-consonant subject

Figure 3. Research Design

4.1 Subjects

Subjects were drawn from undergraduate business classes at a large Korean university. Mostly sophomore and junior students whose ages ranged from 19 to 27, they were randomly assigned to the twelve treatments described above. Subjects in each group were not statistically different in terms of age, gender, major and computer experience. A $20 prize was promised to the top dyads (for the intellective task) or individuals (for the negotiation task) participating under the same experimental conditions, based on their effectiveness scores. A total of 320 students participated in this experiment. Among them, four subjects' data were discarded because of incompleteness; the remaining 316 subjects' data were analyzed.

4.2 Procedures

A few days before the laboratory session, subjects completed a background-information questionnaire and were randomly assigned to a dyad in one of the twelve treatment conditions. At the laboratory session, subjects assigned to the intellective task were given the inheritance-tax calculation case and required to solve the problem by exchanging the necessary information in one of the communication modes. Subjects using the electronic mail and video conferencing system had a five-minute practice session before the experiment to make themselves acquainted with the medium.

Both subjects in a negotiation dyad were required to read the case before the negotiation began, but only the person assigned to the consonant group was allowed to rank the importance for each facility after reading the case. The ranking exactly inversely ordered was then given to the partner (a non-consonant subject). This type of negotiation is classified as a conflict-involving negotiation (McGrath 1984) in which the goals (agreeing on three facilities to cut the budget) of opposing negotiators are in complete conflict. The joint task was to agree on which three facilities from the list of eight would receive budget cuts. Each individual was given the objective of maximizing his individual payoff from the agreement on the facilities.

After a dyad solved the tax problem or reached a consensus on three facilities, they filled out a debriefing questionnaire. For both tasks, there was no time limit, but they were encouraged to finish as soon as possible because, other things being equal, the one with the faster time would win.

4.3 Independent Variables

This study focused on two task types: intellective and negotiation tasks. The intellective task, an inheritance-tax calculation problem, was developed based on a real but simplified case with the help of a certified public accountant (CPA). Each subject received only about half of the necessary information to calculate the right tax amount, and the partner had the remainder. Thus, they had to coordinate and communicate effectively to convey the information that was not available to the other subject. This problem consisted of four procedures (divided into twenty detailed steps) and five tables. Typical graduate students majoring in Business Administration took 20 to 25 minutes to solve the problem by themselves when complete information was provided. Most subjects were familiar with this type of task because they had taken at least two accounting courses.

The negotiation task, a two-person bargaining game, was adapted from Short and modified using topics familiar to the subjects. The experimental task involved a hypothetical situation for a particular university. It was hypothesized that this particular university was constructing a new building for its Business School. Due to an unexpected reduction in their construction budget, a cut was required for three of the building's eight facilities. The negotiation goal of this task was to agree on which three facilities would suffer the budget cut.

Dyads involved in the negotiation task were significantly different in terms of their consonancy with the case. One subject (say "A") was required to rank the eight areas in order of dispensability and argue for the choice which reflected his personal views. Numerical payoff was assigned to each facility in accordance with his ranking. For example, the facility which he had ranked as most valuable was, for him, associated with the highest payoff. Thus, he was allowed to create his own logic, actually believing in what he was negotiating for (i.e., consonant type). Meanwhile, the payoff values assigned to his partner (say "B") for each facility were inversely ordered to those of "A." In other words, the most valuable facility for "A" was the least

valuable facility for "B." Thus, "B" was required to argue a case that bore no necessary relationship to his personal views or his own logic (i.e., non-consonant type).

This study employed four communication media: computer-mediated text, audio, video, and face-to-face. Subjects in the computer-mediated text mode were connected through synchronous electronic mail, subjects in the audio condition were connected via telephone, and subjects in the voice treatment communicated through video conferencing systems. The electronic mail software provided subjects with a split screen for simultaneous communication. The video conferencing system used in this experiment was Intel ProShare Video System 150. It provided a color screen with transmission speed of fifteen frames per second and headphone for audio transmission. Partners in these three media environments were placed in separate rooms. Dyads in the face-to-face condition were placed in a room, sitting approximately six feet apart across a small desk.

4.4 Dependent Variables

Task performance was measured using two different constructs: efficiency and effectiveness. Efficiency is related to the subject's time and effort in completing the given task. In this study, efficiency is measured by the number of minutes required for the dyad to agree on the decision for both intellective and negotiation tasks.

Effectiveness is related to the subject's final quality of decision. For the intellective task, there was one correct answer. Each dyad's step-by-step procedures to obtain their answer were reviewed and their correctness was determined based on the approximation to the right answer. The completely correct answer received 15 points and each member of a dyad got the same points.

For the negotiation task, decision quality was measured by the negotiation payoff. Negotiation payoff represents the total points received by each subject during the experimental negotiation game. Different values of points were assigned to each of the eight facilities according to the ranking of consonant subjects. These points ranged from 10 to 80. When the subjects agreed on three facilities that would suffer the required budget cut, the points assigned to each of the three facilities were added accordingly for each negotiator. These added points were the total payoff points gained by each subject. The score attained by each subject during the experiment ranged from 60 points (when a subject agreed on cutting the three most valuable facilities for him) to 210 points (when a subject agreed on cutting the three least valuable facilities for him). For the negotiation task, each member of a dyad received a different payoff, and the sum of two members' payoff always became 270.

5. DATA ANALYSIS

Dependent variables were measured at the dyadic level. Correctness for the intellective task and decision time for both tasks, were measured at the dyadic level. Payoff for the negotiation task was measured at the individual level, but the payoff of a subject was completely contingent upon the payoff of his partner (i.e., the sum of both sides' payoffs was always 270). If members' scores in a group are not experimentally independent such as in this case, group scores must be used as the unit of analysis (Anderson and Ager 1978). Thus, only the data from one side (the consonant subject) were used for the analysis. Data analysis was performed using SPSS/PC v5.0 package (Norusis 1992).

5.1 Manipulation Checks

Media richness was measured with an eight-item instrument which was previously used by Valacich et al. (1994). Subjects reported their media perceptions by using a seven-point Likert scale after the experiment session. The reliability (Cronbach's alpha) of this measure was 0.86. The ANOVA tests showed that subjects clearly distinguished the media in terms of their richness ($p<.01$). As a normative media richness perspective, face-to-face communication (4.71) was perceived as the richest medium, followed by video (4.36), audio (3.95), and text (3.46). Duncan's multiple range test at the .05 significance level found that all four media groups were significantly different in terms of perceived media richness from each other.

To check consonancy manipulation, the payoff of the consonant and non-consonant subjects were compared. If the consonancy manipulation was correctly controlled, the reasonableness of the consonant subjects would be greater than that of the non-consonant subjects. Other things being equal, greater reasonableness should produce higher payoff. The consonant subjects (148.08) were more successful than the non-consonant subjects (121.92), and this difference was significant ($p<.001$).

5.2 Effectiveness Hypotheses: H1 and H3

Since no significant correlation was found between decision time and effectiveness measure (i.e., correctness for the intellective task and payoff for the negotiation task), ANOVA was employed to test hypotheses on task performance. Because the two tasks were completely different, it is not meaningful to compare task performances with each other. Thus, raw data were transformed to z-scores for each task separately.

The means of effectiveness measure and decision time (z-scores in brackets) in various groups and ANOVA results are shown in Table 2. Because there were no medium main effect ($p=.71$) nor medium-by-task interaction effects ($p=.89$) on effectiveness measure, both hypotheses H1 and H3 were not supported. There was no significant difference among medium groups in terms of correctness for the intellective task. Subjects assigned in four media groups showed almost the same level of correctness for the inheritance-tax calculation problem. For the negotiation task, no significant difference among medium groups in terms of payoff was detected either. The consonant subjects (148.08) were more successful than the non-consonant subjects (121.92) regardless of media. Thus both hypotheses were not supported. The result is somewhat surprising since the negotiation task of this experiment was replicated from a previous experiment (Short 1974) which showed a significant ($p<.05$) media effect with an even smaller sample size (i.e., sixteen dyads).

Table 2. Mean Scores of Effectiveness and Decision Time

D.V.	Task	Media				Total	Main Effect		Inter.
		Text	Audio	Video	F-to-F		Media	Task	M x T
Effective.	Intel.	12.75 [-0.15]	13.25 [0.10]	12.75 [-0.15]	13.45 [0.20]	13.05 [0.00]	$p=.71$	n.a.	$p=.89$
	Nego.	148.95 [0.03]	148.50 [0.01]	145.26 [-0.09]	149.50 [0.04]	148.08 [0.00]			
Decision	Intel.	61.37 [1.00]	32.60 [-0.70]	42.10 [-0.14]	42.35 [-0.12]	44.39 [0.00]	$p<.001$	n.a.	$p=.42$
Time	Nego.	56.95 [0.62]	32.00 [-0.44]	41.05 [-0.05]	39.90 [-0.10]	42.31 [0.00]			

n.a: not applicable

5.3 Decision Time Hypotheses: H2 and H4

As seen in Table 2, the media main effect was significant ($p<.001$), but there was no medium-by-task interaction. In other words, decision times were significantly different among medium groups, and the effect of the media was the same across the tasks. Further analysis was performed to determine which particular means were significantly different from one another.

For the intellective task, as expected, the computer-mediated text groups (61.37 minutes) took significantly longer than other groups, and the face-to-face groups followed the text groups. However, the video groups (42.10 minutes) took more time than expected, and the time was closer to face-to-face (42.35) rather than audio groups (32.60). The video groups and face-to-face

groups were not statistically different from each other. It might be concluded that the video mode seems to be as rich as the face-to-face mode and too rich for the intellective task. Overall, hypothesis H2 was supported except that the video mode took as much time as the face-to-face mode.

The pattern was almost the same for the negotiation task, so hypothesis H4 was not supported. Again, the text groups (56.95) took significantly more time than other groups, and the decision time of the face-to-face (39.90) and video groups (41.05) were close to each other. The audio groups were expected to use more time than the video and face-to-face groups because of their limited channel, but the result showed that the audio groups (32.00) took the least time.

6. DISCUSSION AND CONCLUSIONS

The results from three previous studies employing similar treatments and dependent measures were compared with this study's findings in Table 3. All the studies agree that the face-to-face medium is the richest and the text medium is the leanest. With one exception, the video medium is perceived as richer than the audio medium. This ordering is consistent with normative views of media richness.

Table 3. Results Comparison of Four Studies

Study \ Dep. Var.	Kinney and Watson (1992)	Kinney and Dennis (1994)	Valacich et al. (1994)	This study (1996)
Media Richness	not measured	F>V>T	I: F>V>A>T C: F>A>V>T	F>V>A>T
Decision Quality	not measured	F=V=T	I: V>A=F>T	F=V=A=T
Decision Time	T>F=A	T>F=V	I: A>F=V>T C: V>F=A>T	T>V=F>A

Note: F=Face-to-face; V=Video; A=Audio; T=Text
       I=Intellective task; C=Cognitive conflict task

According to the findings of this study, there was no difference in terms of decision quality across media regardless of tasks, which supported the results of Kinney and Dennis. Including the study by Valacich et al. (1994), all the studies agree that matching media richness to task requirements did not improve decision quality as the MRT suggests. This study introduced a social psychology factor for the negotiation task to examine its interaction effect with media. The treatment was exactly replicated from a prior study (Short 1974) which showed a significant effect, but this study failed to find the effect. The reason might be difference in samples, culture (western versus oriental), generations (1974 versus 1996), or unknown facts.

This study and the studies by Kinney and Watson and Kinney and Dennis agree that the text medium took the most time; Valacich et al. (1994) did not. The remaining three media's effects on decision time were mixed, and it was difficult to find one clear pattern. In this study, the audio subjects finished both tasks in the shortest time, and the video and face-to-face subjects took almost the same amount of time.

The media/task fit hypotheses (refer to Figure 1) proposed by McGrath and Hollingshead suggest that the effect of video systems will be more similar to that of audio systems rather than face-to-face communications for the intellective task. According to this study's result, however, the video medium was much closer to the face-to-face medium than the audio medium in terms of decision time and communication satisfaction, regardless of tasks. Thus the media/task fit hypotheses might need a change.

In conclusion, this study did not support the MRT for the intellective and negotiation task except that the audio was the most efficient medium for the intellective task. This study also failed to support the combined theory of media richness and social psychology for the negotiation task.

This study contributed to the information systems area both theoretically and practically. From the theoretical side, the findings did not support the MRT in general. Definitely more studies are necessary to discard MRT, but the result of this study might "drive another nail into the media richness coffin" as a previous study (Kinney and Dennis 1994) mentioned. The concept in the theory might be too high or too simple to predict managers' media choices or individual effectiveness. It needs to accommodate situational and social psychological variables. An introduction of social psychology factors into MRT is another contribution of this study, and further research should be undertaken.

In terms of practical contributions, this research found that the video conferencing mode was more similar to the face-to-face mode. It implies that a video conferencing system can be a good substitution for a face-to-face communication for most of the tasks performed by the remote work groups.

6.1 Limitations

Limitations of this research need to be kept in mind when interpreting the results. First, the research findings were based on the first use of the video conferencing systems for the video subjects and relatively less experienced use of the synchronous electronic mail for the text subjects. Potential novelty effects were not controlled. Second, the use of zero history groups for brief periods could be another limitation. Since many tasks in organization entail larger groups working for long periods, it can reduce the external validity of this study. Third, the communication media employed reflect today's technology. As Wheeler, Valacich and Alavi (1995) pointed out, the results might not directly relate to previous research because of the continuing evolution of technology. Finally, as with any laboratory experiment, the controlled nature of the setting, the use of student subjects, and the narrow focus of tasks reduce the external validity.

6.2 Suggestions for Future Research

The vast amount of previous research has dealt with only one side of the coin, "one-dimension" characteristics of the task — equivocality. This study dealt with the other side of the coin, the social psychological factors of a task. However, this study failed to find a significant interaction effect of media and psychological factors. Future research needs more qualitative analysis, such as protocol and content analysis, to scrutinize the impact of psychological factors which were not revealed in the quantitative analysis.

Another direction for future research requires more elaborate manipulation of media characteristics. As Wheeler, Valacich and Alavi mentioned, the continuing evolution of technology makes it difficult to define certain communication media. Thus, future studies need to examine the effects of the underlying dimensions of communication technology (e.g., the number of channels, speed of feedback, etc.) rather than the communication medium itself.

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