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Computer-mediated communication and media preference: an investigation of the dimensionality of perceived task equivocality and media richness

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Abstract. Computer-mediated communication is the foundation of networking and electronic communities. As the use of new communication technologies continues to proliferate throughout organizations, new modes of interaction between individuals and groups emerge, presenting alternative media choices. How individuals choose between these modes has stimulated much research into theoretical perspectives of media choice within networked and electronic communities. Media Richness Theory is one of these theoretical perspectives. The research presented in this paper investigates the underlying factors of Media Richness Theory, task equivocality and media richness. The results obtained provide evidence to suggest that equivocality may not be unidimensional, and that the richness of media is perceived multidimensionally in terms of the information carrying capacity of media. The findings on dimensionality of equivocality raise doubts as to the basic assumptions of this concept and media richness theory.

1. Introduction

To be successful organizations must perform specific tasks related to corporate objectives. For these tasks to be executed successfully information needs to be gathered and processed to reduce uncertainty (Galbraith 1977, Daft and Lengel 1986, Weick 1979). Communication between individual members of organizations is part of the process of reducing uncertainty. Studies have shown that mangers spend a large proportion of their time communicating, the most frequent medium used by managers being face-to-face (Panko 1992, Rice and Shook 1990).

Communication media used to support this critical role of communication within organizations has been and continues to be changed by information technology. Much of the communication within organizations is now mediated by computers. Computer-mediated communication (CMC) systems use computers to structure and process information and use communication networks to facilitate its exchange (Rice 1987). The implementation of CMC systems within organizations continues to grow. CMC systems include electronic mail, voice mail, computer conferencing, computer bulletin boards, and group decision support systems. The advances in multi-media technology now make it possible for messages to include fully integrated individual functions of the technology listed above, i.e. text, sound/voice, and image with full user interactivity. One distinct advantage of these computer mediated channels is that they remove the constraints of geographical proximity and temporal differences from communication partners as well other issues related to communicating: accessibility, distribution, storage and reprocessing. It is through these new communication technologies that virtual electronic communities are formed. Individual members within organizations now have a choice of alternative media to support their communication behaviour.

Decisions on how to communicate in organizational settings are complex and not understood. In response to the need to understand this critical behaviour within organizations, several general theories have emerged speculating on decision models for individual choice of media to facilitate communication. This paper reports on the validity of one of these theories which attempts to explain media choice, Media Richness Theory. This investigation is carried out within an organization implementing a new medium, voice mail.

Media Richness Theory has stimulated much empirical research on media selection. However the two basic assumptions of the theory, equivocality and media richness, have not been tested. The main objective of

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the research reported in this paper is to empirically measure equivocality and media richness and thereby investigate these two underlying assumptions and the applicability of Media Richness Theory to individual media choice. These investigations included measuring the underlying factors that determine equivocality and media richness and then testing the relationship between these two concepts. The research methodology employed was to investigate media preference in one organization over three time periods. Realistic tasks were used to survey employees of one division that was in the process of introducing voice mail. The prime analysis methodology centred on an investigation of employee media preference for tasks that varied in their characteristics. In the process of such analysis, the dimensionality and reliability of the main constructs of Media Richness Theory were established. The results obtained provide evidence to suggest that equivocality may not be unidimensional, and that the richness of media is perceived multidimensionally in terms of the information carrying capacity of media. The findings on the dimensionality of equivocality raise doubts as to the basic assumptions of this concept and Media Richness Theory. The testing of the relationship between equivocality and media richness showed that managers did have a preference for media high in richness for those tasks high in perceived equivocality. However, this relationship is not linear, although preference for leaner media increased as equivocality declined, face-to-face was the media of choice over the range of equivocality for this sample of managers. Thus, perceived media richness may not be a reliable predictor of media choice.

2. Theoretical background

This section outlines the literature on task complexity, tracing early work dealing with variety and analysability to the recent notion of equivocality.

The work on task analysis has its origins within the concepts of contingency theory. As discussed earlier in this chapter, organizations are information-processing systems. Many aspects of structure and process that have been observed within organizations may reflect information processing requirements (Daft and Macintosh 1981).

Equivocality is a salient concept derived by Daft and Macintosh (1981) through their analysis of information processing and identification of two types of information tasks: co-ordination and equivocality reduction. There are several definitions of equivocality offered. However Daft and Macintosh's definition is the one of most use to this research as it has a broader approach to equivocality. The definition below stresses ambiguity in the interpretation of the message:

> 'Information that is clear and specific and that generally leads to a single, uniform interpretation by users is considered unequivocal. Information that lends itself to different and perhaps conflicting interpretations about the work context is considered equivocal information' (Daft and Macintosh 1981, page 211).

Equivocality was further defined by Daft and Lengel (1986) where they distinguished between uncertainty and equivocality: uncertainty can be reduced by additional information whereas equivocal or unanalysable tasks are not resolvable simply by acquiring additional information:

> Equivocality seems similar to uncertainty, but with a twist. Equivocality presumes a messy, unclear field. An information cue may have several interpretations. New information may be confusing and even increase uncertainty. New data may not resolve anything when equivocality is high. Managers will talk things over, and ultimately enact a solution. Managers reduce equivocality by redefining or creating an answer rather than by learning the answer from the collection of additional data' (Daft and Lengel 1986, page 554).

The notion of equivocality has been expanded by the work of Daft *et al.* (1987) where they explore the relationship between task equivocality and media and media choice as the foundations for the concept of Media Richness Theory. In this work, Daft *et al.* refine the concept of equivocality in terms of the types of information processing undertaken by managers. Within the context of management, equivocality often means confusion, disagreement and lack of understanding. Managers are not certain what questions to ask, and if questions are posed there is no store of objective data to provide an answer. Equivocality is differentiated from uncertainty in the information processing response from managers. Uncertainty leads to the acquisition of data. Equivocality leads to the exchange of subjective views among managers to define the problem and dissolve disagreements. Equivocality also differs from uncertainty in that uncertainty can be reduced by information whereas equivocal situations cannot be reduced by information because frames of reference differ. Daft *et al.* propose that equivocality is the barrier confronting computer-mediated communication media.

Media Richness Theory (Daft and Lengel 1984, 1986, Trevino *et al.* 1990, 1987) has its sources within the concept of contingency theory in that it hypothesizes on the relationship between task equivocality and media choice. Media Richness Theory suggests that organiza-

tional communication is necessary to reduce two fundamental task demands: uncertainty and equivocality. Daft and Macintosh (1981) propose that two task characteristics, analysability and variety, generate two types of information requirements: equivocality and amount. Media Richness Theory addresses the question of identifying media most appropriate in reducing these two aspects of information. Media Richness Theory is a subset of contingency theory, in that it makes propositions about how the fit between information processing requirements (such as equivocality) and use of organizational media (such as voice mail) affect performance. Use of any communication channel involves both costs as well as information processing capacities, so a medium that is not well matched to task requirements will degrade communication performance. For example, Lind and Zmud (1991) found that use of information rich channels contributed to agreement between information systems and non-information systems personnel on the importance of information technology to support those activities, and this convergence was associated with information technology innovativeness.

As part of their theoretical development of Media Richness Theory, Daft and colleagues discuss and develop a four-item scale of general task equivocality (Withey *et al.* 1983). However, their initial empirical study (Daft *et al.* 1987) took a different approach to measuring the equivocality of tasks that managers would assess when choosing media. They first asked 11 managers to identify critical incidents in their ongoing work. This generated 220 incidents, though we do not know the distribution of incidents across managers. The researchers then categorized these incidents into 60 generic tasks, but we do not have a measure of that coding reliability. The researchers then provided a written explanation of equivocality to a panel of 30 judges and asked them to rate each task's equivocality on a single item ranging from 1 to 5, although neither the unidimensionality or the reliability of these ratings have ever been assessed. Russ *et al.* (1990) used these same incidents but reworded them to represent, firstly, the sender's point of view and then the receiver's point of view, and expanded the media to include 18 common workplace situations which were then rated on a single-item equivocality measure by a panel of judges. Trevino *et al.* (1987) found that face-to-face communication was ranked by 100 managers as more likely to be chosen for communication tasks involving equivocality than telephone, written and electronic mail, while electronic mail was more likely to be chosen for tasks involving temporal or geographic constraints.

Subsequent studies have taken similar approaches to either generating hypothetical tasks with varying amounts of equivocality, or rating the richness of different media. That is, respondents are provided a short written definition of task equivocality (or media richness, including the medium's capacity for immediate feedback, the number of cues and senses involved, personalization, and language variety) and then asked to choose a value on a single-item scale for each task (or medium) (Schmitz and Fulk 1991, Fulk *et al.* 1995).

Indeed, there are several ongoing questions about the reliability and validity of these assessments of task equivocality and media richness. For example, the use of the mean of a single item response to a four-part description as a measure of media richness will mask any inherent scale multidimensionality or respondent confusion as to the nature of specific tasks or media. Further, both the strengths of prior results (such as about relations between media awareness and managerial performance) and unstated assumptions underlying that research (such as about symmetry and non-monotonicity of the task-medium fit) have received considerable critique (Rice *et al.* 1992). For example, managerial media awareness in Daft *et al.* (1987) explained only 10% of the variance in managerial performance, and that was due almost entirely to selections of rich media. Empirical support for media richness propositions is often mixed at best, especially when new media such as voice and electronic mail are concerned. (Markus 1994, Markus *et al.* 1992, Rice and Shook 1990). Part of these inconsistent results may be due to inherent problems with judges' ratings of task equivocality or user ratings of task equivocality or of media's richness. Other reasons, admittedly, may be due to as yet poorly understood individual, positional and organizational differences in media choice (Rice *et al.* 1992, Rice and Shook, 1988, 1990, Russ *et al.* 1990, Trevino *et al.* 1990).

The issue of both the perceptions of CMC and reliability in the underlying concepts of task equivocality (that is, based on generated common incidents) and media richness stemming from the work of Daft and Lengel raises doubts about the findings of media richness work to date. As far as we know, no reliability or dimensionality tests for either have been reported. This research explores methods for deriving reliable scales for measuring task equivocality and media richness.

3. Method

The research reported in this paper is part of a longitudinal study (consisting of three data collection points, t1, t2, and t3) of media preference in an organization implementing a new communication technology, voice mail. The issues on which this paper focus,

measuring equivocality and media richness and testing the relationship between these two concepts were largely derived from the third data collection point of the longitudinal study.

A large insurance company was the source of the data for this research. The company was undertaking a phased implementation of voice mail. An interesting issue of this organization's implementation that is significant to this research is that, as the organization has a culture based in customer service, the management decided that voice mail was not to be used in telephone answering mode (all incoming calls were to be answered by staff). Voice mail was to be used only for messaging.

3.1. *Deriving the communication tasks*

The communication tasks used in the media preference survey were derived from the work environment of the respondents/subjects of the sample, who also completed the surveys. Consequently the tasks used in the research were ecologically valid tasks. They were not hypothetical. They were real tasks directly related to the work environment of the respondents. The phases undertaken in deriving the communication tasks were as follows.

In the first phase, a Critical Success Factor technique was used to focus participants on their communication behaviour in terms of their areas of responsibility and performance. The output from the focus groups was 192 communication tasks; these tasks were generalized to 16 tasks using content analysis. These 16 tasks were then rated in terms of their perceived equivocality. The subjects for the focus groups included 25 managers of sections, branches or regional zones within the retail division of the company. As part of the implementation of voice mail, each of these managers was brought to headquarters to attend one of six voice mail training sessions. The voice mail account for each manager was activated after completing the training session. One of the authors attended three of these training sessions, and before these training sessions, asked the attending managers to participate in focus groups. Krueger (1988) points to three advantages of focus groups: the technique is a socially oriented research method capturing real-life data in a social environment; it has flexibility and it has high face validity. Typically more than one focus group is convened in a given study, since there is a serious danger that a single group of 7 to 12 people would be too atypical to offer any general insights (Babbie 1992).

Within the three focus groups the critical success factor technique (CSF) (Daft *et al.* 1987, Rockart 1979, 1982) was used to help managers identify their key areas of responsibility and performance. As in Daft *et al.* (1987) the critical success factors provided a concrete reference in the managers experience which identified information needs and the communication activities around the managers business goals. These CSFs were then used as a reference point for managers to identify:

- critical tasks related to key areas of responsibility;
- all media potentially used for these tasks; and
- communication components of those critical tasks.

The output of the focus groups constituted 192 managerial incidents of communication generated by the 25 managers in these three focus groups.

As these tasks were derived from organizational members within the same work groups, the perceptions of and experiences within tasks should be reasonably homogenous in terms of the types of tasks. Content analysis was also undertaken to validate the coding of the tasks and the subsequent reduction from 192 to 16 tasks.

The 192 communication tasks derived from the focus groups were coded and categorized into 16 types of common, critical tasks involving communication. To measure the reliability of the application of the coding scheme the same 192 tasks were coded using the same set of codes by a research assistant. The Cohen's kappa (Cohen 1960) was calculated to determine the level of non-chance agreement. Cohen's kappa measures agreement between the ratings of two observers for the same group of objects. In order to partially validate the coding of the 192 communication tasks the agreement between one of the authors and the research assistant in the application of the codes to the tasks correcting for amount of agreement expected by chance needs to be determined. The proportion of cases for which the two raters agreed was 56% with a Cohen's kappa of 0.379.

The coding was further validated by two other approaches:

- of the 26 managers who responded to the t1 questionnaire, 10 of them were asked to comment on the representativeness of this final 16-task categorization. All indicated that these well captured the nature of their critical tasks that required communication activities;
- to further add to the validation of the tasks in the t3 questionnaire the respondents were asked to rank the tasks in terms of their representativeness of their day-to-day communication tasks on the following scale: 1 — a very great extent ; 2 — a great extent; 3 — some extent; 4 — a little extent; and 5 — a very little extent.

The mean ranking for the response to the question on representativeness was 2.33 with a standard deviation of 0.75, a very high rating. On observation of the results of the three validation methods inferences regarding the strength of the reliability in terms of whether the raters were internal or external to the organization may be made. The first method, the inter-rater reliability, was conducted by raters who are external to the organization. For the other two methods the raters were internal to the organization and the reliability of their ratings is high. So then the internal validity of the content analysis and consequent reduction of the 192 tasks to 16 is (arguably) reasonably high.

3.2. *Sampling procedure*

The main sampling procedure, a media preference survey was composed of three parts, each part operationalizing the three basic issues underlying this research:

- The equivocality scale developed by Withey *et al.* (1983) was used to determine the equivocality of the of the 16 tasks. Withey *et al.* demonstrated that this scale was unidimensional. As this study has been undertaken under high ecologically valid conditions, the dimensionality of this scale will be measured employing factor analysis.
- A scale developed by the authors to measure the respondents' perception of the richness of selected media. The scale was developed by considering Daft and Lengel's (1984) identification of how media differ in their capability to (a) provide feedback, (b) support multiple cues, (c) allow for variety in language used, and (d) support personal focus, the extent to which a medium allows for participants to show their feelings.

The following four item media richness scale was derived indicating the above four characteristics of media richness:

1. If communicators are unclear about something or do not understand it, the medium allows them to ask questions and obtain answers as they arise. This aspect investigated the way the medium facilitated feedback.
2. The medium allows communicators to add meaning to what they want to say by using as many cues (body language, voice, tone, etc.) as possible. This aspect investigated the way the medium supports multiple cues.
3. The medium allows communicators to be flexible with the way words are used in order to increase understanding. This aspect investigated the way the medium allows for variety in language usage.
4. If communicators feel very strongly about something (positively or negatively), the medium allows them to show their feelings. This aspect investigated the way the medium supports a personal focus.

The above constructs were used for each of five media of face-to-face, telephone, electronic mail, voice mail and memo.

In the media preference component of the survey, the respondents indicated their first three preferences for media choice for each of the 16 tasks. For each task, for each medium, these rankings were converted into 0 — not chosen, 1 — chosen third, 2 — chosen second, and 3 — chosen first. Media included: electronic mail, face-to-face/meeting, telephone, voice-mail, fax, formal memo, note, letter, secretary, single purpose report, standard report and secretary. At t3 sixty questionnaires were distributed with 42 responses received, a response rate of 70%.

4. Results

One of the objectives of this research is to investigate the dimensionality of task equivocality. Equivocality is a complex concept that is difficult to measure. It may not be a single measurable entity but a construct that is derived from measurement of other, directly observable variables. Any investigation of the concept of equivocality should attempt to determine how equivocality is actually perceived within the environment from where the measurement of equivocality is drawn. Such an investigation should also provide some insight into the components of equivocality. The identification of such underlying dimensions or factors greatly simplifies the description and understanding of complex phenomena (Norusis 1994). Factor analysis helps identify these underlying, not-directly-observable constructs.

To investigate the perceived dimensionality of equivocality, the 16 equivocality measures were entered into a principal components analysis with varimax rotation. Table 1 shows the mean equivocality ratings and the factor loadings for the 16 tasks. Based on the principal components analysis two situational equivocality dimensions emerge. Two factors are being considered here as they explain 48% of the variance. The scree plot suggests a three factor solution for this set of data. However, as only two of the tasks (you wish to request funding for a non-routine expenditure in your region/

branch/department, you need approval for allocation of resources in your region/branch/department) loaded on the third factor explaining only 8% of the variance, and considering that these two factors also loaded on the second factor, it was decided that more meaningful inference could be made by using the first two factors only.

The first factor (explaining 37% of the variance) is indicated by the six higher equivocality ratings and the task ranked with the tenth highest equivocality. All of these, but the first, third and fourth, related to equivocality across upward lines of authority and all but the third related to zone/branch/departmental issues. Another aspect that is common to all the tasks that load on the first dimension is that they all deal with unstructured problem solving.

The second factor (explaining 12% of the variance) is indicated by five of the ten lower equivocality tasks. Three of these six tasks are related to intra-boundary crossing and all but one are representative of zone/branch/department management evaluation. Further, no other items loaded highly on these two dimensions.

Thus the principal components analysis reinforces the discriminant validity of these tasks to salient differences in equivocality. That is, the lowest equivocality tasks load on one dimension (with one exception), explaining the most variance, and the highest equivocality tasks load on a second, less encompassing, dimension.

Table 1. Mean task equivocality: rank, and factor loadings for t3.

Task (rank from high to low equivalent)	Mean equivalent Max. value = 5	S.D.	Reliability	Factors loadings	
				Factor 1 *vertical*	Factor 2 *horizontal*
You wish to organize the support of your colleagues for an idea that you have for a new development in your region/branch/dept.	3.55	0.91	0.86	0.79	
You need to discuss a problem in your region/branch/dept. with your manager	3.5	0.79	0.81	0.75	
You need to respond to a colleague's urgent request for advice on a problem	3.39	0.86	0.87	0.61	
You need clarification from a superior on a critical issue affecting your region/branch/dept.	3.35	1.02	0.88	0.84	
You wish to discuss a region/branch/dept. performance issue with a staff member	3.25	1.1	0.86	0.83	
You wish to clarify a procedural matter with your staff	3.23	1.0	0.88	0.83	
You want to advise your manager on the progress of a project in your region/branch/dept.	3.14	0.95	0.69		0.64
You need some important figures for a monthly report from an other dept.	3.13	1.08	0.79		0.79
You need approval for allocation of resources in your region/branch/dept.	3.13	1.05	0.91		0.64
You need to respond to a formal memo from your manager	3.11	0.94	0.88	0.80	
You wish to request funding for a non-routine expenditure in your region/branch/dept.	3.04	1.15	0.90		0.63
You need to respond to a colleague's enquiry on your budget-vs-actual expenses.	2.96	1.04	0.76		
You need to respond to an urgent request by a superior for some performance statistics on your region/branch/dept.	2.95	0.97	0.70		0.61
You need to respond to a query by a superior concerning a variation in a budgeted-vs-actual expenses report.	2.92	0.88	0.64		
You wish to organize a salary review with a staff member.	2.73	1.03	0.44		
You want to schedule a meeting for two weeks from today.	2.55	1.14	0.71		
Eigenvalue				5.70	2.05
pc variance				35.6	12.08

The data presented in table 1 show that the perception of equivocality is not unidimensional. Two primary dimensions of task equivocality derived from the initial 16 tasks concerned equivocality of communication tasks across lines of authority, and equivocality of evaluation within and across lines of unit authority respectively. Central (to these tasks) is an underlying issue of equivocality induced by communication across or about boundaries of authority and evaluation. So, two possible sub-dimensions of organizational equivocality have been detected: vertical boundaries (authority; apparently the more encompassing of the two) and horizontal boundaries. This is not an aspect of equivocality discussed by prior analyses of media richness or equivocality.

These findings are parallel to the findings of Zmud *et al.* (1990) who found that the direction of communication did have an influence on managers' perceptions of the attributes of communication channels. The findings of this work may add understanding to how this differentiation arises as the work of Zmud *et al.* only examined the attributes of communication channels not communication tasks.

To allow for new and more extensive analysis of the relationship between media richness and task equivocality, this paper reports on the measurement of the perception of media richness of specific media by operationalizing a scale developed by the authors. Table 2 shows the means and reliabilities for the media richness scale for the five media of face-to-face, telephone, voice mail, electronic mail and memo.

The rankings are as expected by Media Richness Theory. Face-to-face and telephone are placed at the top of the media richness continuum while voice mail, a new medium that combines the oral tones and cues of face-to-face and the telephone, is ranked third. Email and formal memo, both text-based media, are ranked forth and fifth respectively.

As the telephone and voice mail are two media that use the same interface, the telephone handset, and where voice mail may just be perceived as a telephone answering system it is important to discount the possibility that these two media may be perceived as the same, i.e. that the use of voice mail is perceived the same as the use of the telephone. To explore this possibility a paired-samples t-test for the perception of media richness of telephone and voice mail was computed. Results of this test reveal there is a significant difference in the perceived media richness of voice mail and the telephone ($t_{[40]} = -6.51$, $p < 0.001$).

To alleviate any alternative explanation of a media's perceived richness a correlation between perceived richness and total months usage was calculated. Neither voice mail's or electronic mail's perceived richness was significantly correlated with the total number of months that the respondents had been using electronic mail or voice mail. To further validate the media richness scale and explore its dimensionality factor analysis was used on the media richness measures.

To evaluate the dimensionality of the media richness scale, the five media richness measures (reported in table 2) were entered into a principal components analysis with varimax rotation. The scree plot output by this analysis shows that a three factor solution is the most suitable for this set of data. Table 3 shows the loadings of the media, with loadings above 0.5 in bold text, on three factors.

Formal memo and electronic mail both load on the first factor, accounting for 40% of the variance. Both memo and electronic mail are the only two text based media which were measured by the scale. Face-to-face loads highly on the second factor while voice mail also loads, but negatively, on the second factor. Both face-to-face and voice mail are media that make use of oral tones and cues, however voice mail lacks the physical presence of face-to-face and related physical and social cues. Thus it is appropriate that voice mail should load negatively to face-to-face on the same factor. Voice mail and the telephone both load positively on the third factor. Both voice mail and the telephone are, of course, mediated by the use of a telephone handset and are oral media. So it may be said, for these five media, that the three primary dimensions of media richness derived from the media richness scale are text based, physical proximity and oral based.

Table 2. Media richness ratings and scale reliabilities.

Medium	Mean	S.D.	Scale reliability
Face-to-face	4.62	0.65	0.86
Telephone	4.03	0.74	0.80
Voice mail	3.14	0.98	0.75
Email	2.42	0.96	0.60
Memo	2.30	0.92	0.54

Table 3. Rotated factor loadings of media richness scale based on rankings of respondents.

	Factor 1 text	Factor 2 physical	Factor 3 oral
Face-to-face	0.09	**0.90**	0.23
Memo	**0.95**	0.01	−0.02
Email	**0.92**	−0.07	−0.18
Voice mail	0.32	**−0.68**	**0.51**
Telephone	−0.22	0.11	**0.90**
Eigenvalue	2.02	1.27	1.07
Variance	40.4	25.5	21.5

As the variance of the third factor in table 3 is explained by an eigenvalue of 1.07 (only factors with eigenvalues greater than 1 are considered significant as factors less than 1 are no better than a single variable loading on 1 factor), it may be worthwhile to compute a factor analysis with a two factor solution instead of three.

In the two factor solution, provided in table 4, memo and electronic mail load on the first factor with telephone, accounting for 40% of the variance. Memo and electronic mail are the only text based media in the scale and both load highly on the first factor. Telephone, a synchronous, oral based medium loads with a negative value, so then telephone is perceived oppositely to memo and email. Voice mail and face-to-face load on the second factor explaining 25% of the variance. Both voice mail and face-to-face are oral based media, of course face-to-face has more richness attributes than voice mail, suggesting that voice mail is perceived as a richer medium than text based media. The two dimensions in this case are text based, lean in richness, and voice based, higher in richness. Thus, the two factor solution confirms the three factor solution with voice mail loading on the same factor as richer media rather than leaner media.

The finding that media richness is not unidimensional is supported by the factor analysis (both the three factor and two factor solutions) of the media richness measures. In the three factor solution voice mail did load on the same factor as the telephone, but the value was a marginal 0.51, while the value for telephone was high, 0.90. So the two factor solution may be more suitable where voice mail loads highly, 0.87, opposite to face-to-face (−0.72). What is of interest is that voice mail loads on those factors associated with media that are richer rather than less rich.

Multidimensional Scaling (MDS) (Kruskal and Wish 1978, Norusis 1994, Rice 1993) can contribute to identifying perceived media similarities and thus is a valuable technique that can be used to confirm the findings based on the factor analysis. One of the problems of comparing new media to old media is that new media may include new capabilities. Consequently it is difficult to compare new and old media unidimensionally. In combination with factor analysis, as summarized above, multidimensional scaling can contribute to identifying perceived similarities of old and new media. While factor analysis groups variables together allowing inferences to be made on their similarities, MDS creates distances between variables in terms of their dissimilarities and plots them together in multi-dimensional space while keeping the relations among the data objects as similar as possible (as indicated by low values of 'stress'). These distance values calculated by MDS are used as co-ordinates to plot the variables on a multi-dimensional plot. Those variables that are similar will be clustered closely in the multi-dimensional space, while those variables that are dissimilar will be distant from each other in the multi-dimensional space. So, MDS can be used to confirm factor analysis in that variables that load on one factor in factor analysis should appear close together in the multi-dimensional space drawn by MDS.

Given that one of the objectives of this research is to investigate the operationalization of a media richness scale it is desirable to uncover the schema applied by respondents in differentiating, in this case, the five media. Factor analysis allows us to identify underlying factors that help explain an abstract concept through identifying variables that are similar (i.e. the factors that emerged from the factor analysis of the sixteen tasks that were used to measure equivocality). MDS is a similar technique to factor analysis however it differs in that MDS uses dissimilarities in data to show how variables are different.

Table 4. Rotated factor loadings of media richness scale based on rankings of respondents—two factor solution.

	Factor 1 text	Factor 2 mediated/oral
Face-to-face	0.03	**−0.72**
Memo	**0.89**	0.14
Email	**0.92**	0.15
Voice mail	0.10	**0.87**
Telephone	**−0.52**	0.19
Eigenvalue	2.0	1.3
Variance	40.4	25.5

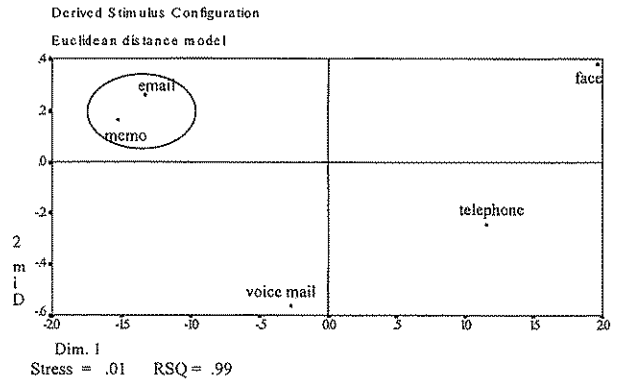

Figure 1. Multidimensional scaling plot of media richness based on ranking by respondents.

The MDS solution for the media richness scale shown in figure 1 portrays the factor analysis solutions. The overall stress was 0.01 and the r^2 was 0.99, indicating that the two-dimensional scaling almost exactly reproduces the relations among the five richness means. The media that load positively on the first factor (two factor solution) electronic mail and memo, are clustered together. While telephone (loading negatively on the first factor) is mapped at the opposite side to electronic mail and memo. On the second factor face-to-face loaded negatively to voice mail (positive). This is well reflected in the two dimensional MDS plot.

The factor analysis and the MDS plot provide sufficient analysis to support the finding that media richness is multi-dimensional. This scale now makes available a new variable, an interval measure of perceived media richness, which will enable further analysis of media richness theory.

Table 5 shows the mean preference ranking for the five media used in the media richness scale (face-to-face, telephone, electronic mail, formal memo, and voice mail) as well as the rankings of those media from the media richness scale and correlations of tasks equivocality and media preference. Table 5 combines these three variables demonstrating the relationship between the measurements of media preference, media richness and the correlations between mean task equivocality ratings with mean media preference. Table 5 suggests a relationship then between the perceived richness of media and the respondents preference for rich media. The preferences are almost in a linear relationship, except for formal memo being preferred over voice mail, with voice mail having a higher richness ranking than formal memo. Table 5 lends strong support then to media richness theory for face-to-face and voice mail.

Table 5. Media preference variable (average across task) and media richness.

Variable	Mean preference	Media richness	Correlations of task equivalent and mean media preference
Face	1.46	4.62	0.65
Telephone	1.39	4.03	0.22
Email	0.80	2.42	−0.16
Formal memo	0.74	2.30	−0.02
Voice mail	0.47	3.14	−0.57

Taking into account experience with the new media, and considering that traditional media such as formal memo and the telephone may not be ranked as a top three medium because of situational constraints or access to the other party, electronic mail may rise to the most preferred medium of the mediated communication channels.

A regression between media preference and the rankings of the perceptions of media richness will add to the understanding of the relationship of media richness and media preference. Five regressions were computed for each medium included in the media richness scale, with preference of the medium as the dependent variable and media richness of the medium plus a relevant control as the independent variables. Table 6 provides the results of these five regressions.

For telephone, voice mail and electronic mail there is a linear relationship between media preference and media richness. For electronic mail, accessibility of the medium appears to be an additional factor. There is no linearity between the preference of face-to-face and media richness although location is an influence in the preference for this medium. This lack of linearity for face-to-face, the richest of all media, may be explained for this group of mangers bias towards face-to-face communication across tasks. There is no linearity between media preference and memo with the control of management level having no effect. However, it is fair

Table 6. Regressions of media preference on media richness measures.

Independent variables	SE B	*t*	Sig. *t*	*F* (*df*)	Sig. *F*	Adjusted r^2
MR of face-to-face	0.07	0.06	0.10	7.5 (2,39)	0.00	0.24
location	0.04	−0.39	0.00			
MR of telephone	0.36	2.35	0.03	2.8 (2,39)	0.07	0.08
location	0.05	−0.30	0.80			
MR of voice mail	0.10	2.18	0.04	3.6 (2,38)	0.03	0.16
location	0.04	1.00	0.32			
MR of email	0.16	2.25	0.03	6.0 (2,37)	0.00	0.20
accessibility	0.04	2.9	0.00			
MR of memo	0.10	1.66	0.10	1.7 (2,39)	0.19	0.04
management level	0.12	0.64	0.52			

to assume that there are other mediating factors for the use of memo i.e. organization policies and control standards.

5. Discussion

The loading of the tasks on the equivocality scale dealing with cross-authority communication indicates that supervisor–subordinate relations and unit relations are a major factor in media choice. Zmud *et al.* (1990) identified that for similar communication tasks, different communication media were chosen by senior management depending upon the direction of the communication. Rice and Shook (1990) suggested that as an individual moved from one job position to another, or across organizations, different patterns of media choice might be relevant, although promotion and relocation training rarely considers such issues. Further work needs to be done in examining the nature of the authority and boundary relationships and media choice.

The media richness scale was an attempt to the fill the vacuum in the current research concerning the reliability and dimensionality of media richness. The scale developed and used at t3 was shown to have a satisfactory level of reliability, especially at the higher levels of media richness. Both the factor analysis and multidimensional scaling confirmed the dimensionality of the scale and its capability to measure and identify factors of media richness which led to fundamental ranking of media on a media richness continuum.

The issue of both dimensionality and reliability of the underlying concepts of task equivocality (based on generated common incidents) and media richness stemming from the work of Daft and Lengel adds to the research to date that demonstrate that Media Richness Theory does note fully explain media choice in an organization setting. Even though the measurement of perceived media richness was as expected by Media Richness Theory it was not a predictor of media choice for tasks varying in equivocality. This supports the findings of Markus (1994a), Rice (1992), and El-Shinnawy and Markus (1992).

In attempting to generalize media richness more completely than has been done in the past, this study approached the measurement of media richness by considering three factors: media preference, task equivocality and media richness. The Withey *et al.* (1983) scale needs further investigation into its suitability in identifying equivocality in tasks. Its reliability and validity need to be confirmed. Similarly the media richness scale developed and tested as part of the dissection of media richness theory also requires further testing to confirm its reliability and validity.

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