

December 2001

Development and Validation of Media Property Perception Measures

Alan Carswell

University of Maryland, College Park

Ritu Agarwal

University of Maryland, College Park

V. Sambamurthy

University of Maryland, College Park

Follow this and additional works at: <http://aisel.aisnet.org/amcis2001>

Recommended Citation

Carswell, Alan; Agarwal, Ritu; and Sambamurthy, V., "Development and Validation of Media Property Perception Measures" (2001). *AMCIS 2001 Proceedings*. 36.

<http://aisel.aisnet.org/amcis2001/36>

This material is brought to you by the Americas Conference on Information Systems (AMCIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in AMCIS 2001 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

DEVELOPMENT AND VALIDATION OF MEDIA PROPERTY PERCEPTION MEASURES

Alan D. Carswell
University of Maryland,
University College
acarswell@umuc.edu

Ritu Agarwal
University of Maryland,
College Park
ragarwal@rhsmith.umd.edu

V. Sambamurthy
University of Maryland,
College Park
smurthy@rhsmith.umd.edu

Abstract

Recent research has conceptualized media properties not as fixed or objective, but perceptual, emergent and socially constructed. Thus, an instrument to measure user perceptions of media properties is needed. As part of our research into student outcomes in a technology-mediated, asynchronous distance learning environment, we have developed and validated an instrument to measure selected perceptions of media properties. Information gathered from a pilot test and a survey of students enrolled in distance education courses was subjected to exploratory and confirmatory factor analysis to develop the instrument.

Keywords: Distance learning; media richness; measurement; methodology; evaluation

Introduction

In the spirit of forwarding the cumulative tradition of MIS research, the purpose of this research is to propose an instrument to measure user perceptions of selected media properties. Recent theoretical work has modeled media perceptions as perceptual, emergent and socially constructed. As part of our research into student outcomes in a technology-mediated, asynchronous distance learning environment, we have developed and validated an instrument to measure perception of selected media properties.

Media Richness Theory

Media richness theory (Daft and Lengel, 1986), also known as information richness theory, was developed as an explanation for how managers choose communications media. Various communication media can be classified along a spectrum according to their richness, or capacity to convey the social presence of the communicator. The media range in richness from face-to-face, through phone calls, letters, personal documents such as letters or memos, impersonal written documents, and numerical reports. The criteria used in classifying media include capacity for immediate feedback, the number of cues and channels utilized, personalization, and language variety (Daft and Lengel, 1986).

MRT hypothesizes that media with low richness would be chosen where the desire is to reduce uncertainty, and media with higher richness would be chosen where the desire is to reduce equivocality. Media of low richness are efficient and effective for processing well understood messages and standard data. In situations of high equivocality, however, managers have to overcome different frames of reference to develop a shared understanding of complex, subjective messages. Face-to-face, the richest medium, offers multiple channels of communication, such as facial expressions, body language, and voice quality to communicate. It also offers the potential for immediate feedback, an efficient way to undertake a trial-and-error method of examining alternate meanings.

Empirical support for media richness theory has been mixed, with findings of support as well as disconfirmations. For instance, Lengel and Daft (1986) found that managers requested rich information sources for non-routine tasks. Russ, Daft and Lengel (1990), in a survey of managers from one large petrochemical company, found results that supported the hypothesis that managers select rich media to send equivocal messages and lean media to send messages lower in equivocality. Daft and Lengel (1986), found that middle and upper level managers were prompted by equivocality to rely on face-to-face communications. Donabedian

and McKinnon (1998), in surveying 68 managers in 12 manufacturing organizations in North America, found support for hypotheses relating rich media choices to high levels of task variety and low levels of task analyzability.

The increasing availability of new types of electronic media in organizations, particularly electronic mail, has prompted researchers to study how managers perceive, choose and use such media. For instance, MRT would propose that electronic mail, being primarily text-based, is a relatively “lean” medium, and would be used mainly for uncertainty-reducing tasks (Daft and Lengel, 1986). However, studies of the use of email have found usage patterns not in keeping with the predictions of MRT. For instance, Markus (1994), found that managers’ perceptions of various media to be in keeping with the predictions of MRT, but that effective senior managers use email heavily and even for equivocal communications tasks. Lee (1994) found that email was often used for rich communications.

Where the hypotheses are not confirmed, explanations found in the literature tend to be along three lines (Carlson and Davis, 1998): 1) new electronic media have capabilities like synchronous computer conferencing, storage and retrieval of information, and ways of addressing communication, that are not taken into account when assessing their richness, resulting in incorrect positioning on a richness scale; 2) the idea of differences in the importance of some criteria in different situations; and 3) evolving understanding about how to use the media.

One of the more fundamental criticisms of MRT is that it conceptualizes media as having fixed, objective qualities, and that the communicator makes a rational choice of media that are best suited to the task at hand. As used to explain media choice, MRT makes two assumptions. First, that different media have unchangeable objective characteristics. Second, that managers make choices of media based on a rational decision making process. Thus, based on the objective, fixed characteristics of the media at hand and the requirements of the situation, managers will decide which medium to use. Alternative explanations of media choice contend that media qualities are perceptual, emergent and socially constructed (Fulk and Schmitz, 1995; Poole and DeSanctis, 1990; Schmitz and Fulk, 1991).

An alternative explanation of media choice contends that communications technologies are themselves equivocal because they can be interpreted in multiple and potentially conflicting ways. This is especially true of modern technologies such as electronic mail, videoconferencing and computer conferencing, which can change their nature according to how they are configured and used. The social influence model (Fulk, 1993; Schmitz and Fulk, 1991) argues that social and symbolic processes produce patterns of shared cognitions and behavior. Thus, the choice of communications medium will depend on social psychological factors such as observational learning and behavioral patterning of group norms. Adaptive structuration theory (AST) (Poole and DeSanctis, 1990), while in agreement with the social construction of media perceptions, does not employ media richness as central construct in shaping individual's perceptions of media use. AST argues that groups appropriate structures embedded in procedures and technologies and adapt them to their own purposes in the course of accomplishing their tasks (Nagasundaram and Bostrom, 1994). It should be noted that most of the empirical studies take MRT as a *descriptive* theory of choice of communications media. The tested hypotheses seek to predict managerial choices or perceptions of media, relating them to task characteristics. MRT, however, may also be described as a *prescriptive* theory of media fit, rather than an explanation of how managers actually choose media (Dennis and Valacich, 1999; Donabedian and McKinnon, 1998). Empirical studies of MRT as a prescriptive theory tend to take as the dependent variable not choices made by subjects, but effectiveness or performance measures in a situation where the media used are fixed. There are relatively few empirical studies of MRT as a prescription of media choice. Such studies would evaluate how effectiveness or performance outcomes relate to tasks and media already chosen. Valacich and Paranka (1993) found that groups using computer mediation outperformed groups using verbal communication in generating unique and high-quality ideas. Dennis and Kinney (1998), studying decision making in two-person teams using computer-mediated and video communication, found no support for the hypothesis that matching media richness to task equivocality would improve performance.

Media Synchronicity Theory

On the issue of effectiveness of already-chosen media, a recent alternative to MRT is media synchronicity theory (MST) (Dennis, Valacich, Speier, and Morris, 1998; Valacich and Paranka, 1993). MST proposes that media differ in their ability not only to convey the social presence of the communicators, but also in their information processing capabilities. Both social presence and information processing affect the “richness” of a medium. Five media characteristics can affect communication, according to MST:

- Immediacy of feedback - The ability of the medium to support rapid feedback on the communications received;
- Symbol variety – The number of ways in which information can be communicated using the medium;
- Parallelism – The ability of the medium to support multiple simultaneous conversations. For instance, face-to-face would be low on parallelism, but computer conferencing would be ranked high.
- Rehearsability – The extent to which the medium enables the sender to rehearse or fine-tune the message before sending it, and;

- **Reprocessibility** – The extent to which a message can be reexamined or processed again within the context of the communication event.

No one medium can be classified as the richest in all respects; it is possible for one medium to possess different levels of a communication capability, depending on how it is configured and used. For instance, email can be totally text-based or it can include text, graphics, animation and video.

Currently, no measures exist for these characteristics (Dennis, personal communication, 1999). As part of our research into student outcomes in a technology-mediated, asynchronous distance learning environment, we developed measures of student perceptions of the media characteristics of immediacy of feedback, parallelism, and reprocessibility.

Development of a Measure

Based on a review of the media richness and media synchronicity literature, an initial list of 25 items was generated (10 each for feedback and parallelism, 5 for reprocessibility). These items were submitted to a group of expert judges, seeking suggestions for revisions to better fit the theoretical constructs. The refined items were included in a web-based pilot survey administered to graduate students registered in online courses at a university oriented towards the part-time learner. Ultimately, 56 students provided usable data.

Pairwise factor analyses with varimax rotations were performed on the items comprising each possible pair of the constructs. A review of the results of the factor analysis suggested items that cross-loaded on other than their intended factors, and these items were deleted. Other items were added, resulting in a final set of four items measuring immediacy of feedback, six items measuring parallelism, and five items measuring reprocessibility perceptions. These items were included in the final survey.

The final web-based survey was administered to a similar group of students in both undergraduate and graduate courses at the university in question. A solicitation email was sent to a selection of 1685 students in 62 sections of 11 different undergraduate and graduate courses. They were given the URL to the survey, which could be completed by clicking on the student's responses. Ultimately, 304 usable responses were received, for a response rate of 18%. The average age of the respondents was 36, and 44% of the respondents were male.

Exploratory factor analysis was performed on the 15 items by means of principal components analysis with varimax rotation. A minimum factor loading of .4 was used, and factors with eigenvalues greater than 1 were chosen. Table 1 shows the results.

Table 1. Rotated Component Matrix

	Component		
	FBACK	REPROC	PARALLELISM
FBACK4	.892		
FBACK2	.881		
FBACK1R	.879		
FBACK3R	.851		
REP5		.806	
REP1		.761	
PAR6		.754	
REP3		.630	
REP2R		.573	
PAR5		.486	.426
PAR1		.463	.434
REP4		.440	
PAR4			.868
PAR3			.844
PAR2			.827

Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.
 Rotation converged in 4 iterations.
 See Appendix A for items

As Table 1 illustrates, few items (PAR6, REP2R, PAR5, PAR1) loaded onto factors other than or in addition to their intended factors. These items were dropped from further consideration.

As a further step, confirmatory factor analysis was conducted using LISREL (Joreskog and Sorbom, 1997) to verify the relationship between observable variables and latent constructs. Confirmatory factor analysis is a more rigorous method to assess validity, in that a model is built assumed to describe, explain, or account for the empirical data in terms of relatively few parameters. This model is based on *a priori* information about the data structure in the form of a specified theory (Joreskog and Sorbom, 1997). The theory specifies the correlations between variables and factors, and between factors and other factors. A confirmatory factor analysis seeks to optimally match the observed and theory factor structures for a given set of data in order to determine the goodness-of-fit of the factor model.

To conduct the confirmatory factor analysis, structural equation modeling with LISREL (Joreskog and Sorbom, 1997) was employed. While SEM is typically used to model causal relationships among latent variables, it can also be used to explore CFA measurement models. This is accomplished by examining only the paths from the latent variables (factors) to their respective indicators. The resultant item loadings provided by the SEM analysis are analogous to a factor analysis where each factor is effectively a latent variable (Gefen, Straub, and Boudreau, 2000).

Using accepted heuristics in the MIS literature for evaluating model characteristics (Gefen et al., 2000), one feedback item and one reprocessibility item were dropped to obtain a final set of items that exhibited an acceptable factor structure, as shown in Table 2.

Table 2. Measurement Model Goodness-of-fit Measures

Measure	Target (Gefen et al., 2000)	Actual Value
Ratio of chi-square to degrees of freedom	< 3:1	2.86:1
Goodness-of-fit Index (GFI)	> 0.90	0.95
Adjusted Goodness-of-fit Index (AGFI)	> 0.80	0.91
Root Mean Square Residual (RMR)	< 0.05	0.039

Finally, to assess the reliability of the constructs, Cronbach's alpha was calculated for them, and the results are shown in Table 3. All constructs exhibited reliabilities above 0.7, which is deemed the minimum threshold for confirmatory research in the social sciences (Nunnally, 1978). The final list of items can be found in Appendix A.

Table 3: Cronbach Alpha Reliabilities

Construct	Reliability
Perception of Immediacy of Feedback	.89
Perception of Media Parallelism	.84
Perception of Media Reprocessibility	.73

This research did not develop measures for the other media characteristics as described in media synchronicity theory (symbol variety and rehearsability). Additional research to develop these measures would be useful to further our understanding of media properties.

Applications

The measures developed in this research have a wide range of potential applications. If one accepts that perceived media characteristics are perceptual, emergent and socially constructed, a reliable and valid tool to measure media perceptions will be useful. Given the rapid growth of computer-mediated communications in the workplace and society, there is a great need to further our understanding of how media perceptions evolve.

References

- Carlson, P. J., and Davis, G. B. (1998). "An investigation of media selection among directors and managers: From 'self' to 'other' orientation," *MIS Quarterly*, 22(3), 335-362.
- Daft, R., and Lengel, R. (1986). "Organizational information requirements, media richness and structural design," *Management Science*, 32(5), 554-571.
- Dennis, A. R., and Kinney, S. T. (1998). "Testing media richness theory in the new media: The effects of cues, feedback, and task equivocality," *Information Systems Research*, 9(3), 256-274.
- Dennis, A. R., and Valacich, J. S. (1999). "Rethinking media richness: Towards a theory of media synchronicity," Paper presented at the HICSS, Hawaii.
- Dennis, A. R., Valacich, J. S., Speier, C., and Morris, M. G. (1998). "Beyond media richness: An empirical test of media synchronicity theory," Paper presented at the HICSS, Hawaii.
- Donabedian, B., and McKinnon, S. M. (1998). "Task characteristics, managerial socialization, and media," *Management Communication Quarterly*, 11(3), 372-391.
- Fulk, J. (1993). "Social construction of communication technology," *Academy of Management Journal*, 36(5), 921.
- Fulk, J., and Schmitz, J. (1995). "Cognitive elements in the social construction of communication technology," *Management Communication Quarterly*, 8(3), 259-288.
- Gefen, D., Straub, D. W., and Boudreau, M.-C. (2000). "Structural equation modeling and regression: Guidelines for research practice," *Communications of the Association for Information Systems*, 4(7).
- Joreskog, K., and Sorbom, D. (1997). *LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language*. Chicago, IL: Scientific Software International.
- Lee, A. S. (1994). "Electronic mail as a medium for rich communication: An empirical investigation using hermeneutic interpretation," *MIS Quarterly*, 18(2), 143-157.
- Lengel, R., and Daft, R. L. (1988). "The selection of communication media as an executive skill," *The Academy of Management Executive*, 2, 225-232.
- Markus, M. L. (1994). "Electronic mail as the medium of managerial choice," *Organization Science*, 5(4), 502-527.
- Nagasundaram, M., and Bostrom, R. P. (1994). "The structuring of creative processes using GSS: A framework for research," *Journal of Management Information Systems*, 11(3), 87.
- Nunnally, J. C. (1978). *Psychometric Theory (2nd Edition)*. New York, NY: McGraw-Hill.
- Poole, M. S., and DeSanctis, G. (1990). "Understanding the use of group decision support systems: The theory of adaptive structuration," In C. Steinfield and J. Fulk (Eds.), *Organizations and Communication Technology* (pp. 175-195). Newbury Park, CA: Sage.
- Russ, G. S., Daft, R., and Lengel, R. (1990). "Media selection and managerial characteristics in organizational communications," *Management Communication Quarterly*, 4, 151-175.
- Schmitz, J., and Fulk, J. (1991). "Organizational colleagues, media richness, and electronic mail: A test of the social influence model of technology use," *Communication Research*, 18(4), 487-523.
- Valacich, J. S., and Paranka, D. (1993). "Communication currency and the new media: A new dimension for media richness," *Communication Research*, 20(2), 249-276.

Appendix A: Items

Construct	Item ID (R suffix denotes reverse-scaled item)	Item text
Immediacy of Feedback	FBACK1R	It is difficult to know how my contributions to the class are being received, because I don't get timely feedback.
	FBACK3R	The responses I receive to my class contributions are not received quickly enough to be helpful.
	FBACK4	I receive responses to my class contributions in a timely manner.
Parallelism	PAR2	In our online discussions, there are several threads of conversation that are occurring simultaneously.
	PAR3	In this course, discussions are occurring about several issues at the same time.
	PAR4	In our online discussions, there are several parallel "conversations" going on at any given point in time.
Reprocessibility	REP1	The online learning environment permits me to review messages from my instructor and classmates over and over again.
	REP2R	After I've read the instructor's or fellow student's message for the first time, I find it difficult to go back to that message and review it.
	REP3	I am able to repeatedly review the course materials.
	REP5	The online learning environment allows me to re-examine messages repeatedly until I understand them.