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INDIVIDUAL, STRUCTURAL AND SOCIAL INFLUENCES ON USE OF A NEW COMMUNICATION MEDIUM

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ABSTRACT

This study investigates influences on use of a new desktop telephony system. Media richness implications are supported only for a few early time periods. Critical mass has strong initial influences but few long-term influences. Norms about how to use the system develop through social processes.

INTRODUCTION

The study of the reasons why people reject, adopt or continue to use new technology has produced two classes of explanations. According to cost-benefit explanations, people adopt new technology when the benefits from adoption exceed the costs. Structural/social explanations focus on the communication contexts and processes through which potential adopters learn about and develop attitudes towards an innovation (Fulk & Steinfield, 1990; Markus, 1990; Rice & Aydin, 1991).

FOUNDATIONS

Task Characteristics

The general cost-benefit approach to adoption of innovations is congruent with media richness theory, which extends contingency theory by proposing effects of the fit between tasks and media (Daft, Lengel & Trevino, 1987). Thus people are more likely to use information rich media (e.g., face-to-face communication) for unanalyzable or equivocal tasks because related cues such as another person's credibility, expertise, or status are more available, there is a greater chance of accomplishing the task for a given search effort, and feedback is quicker. Generally, the evidence for the influence of task analyzability on media use is supportive, if weak (Rice, et al., 1990, 1992). In the present case, since real-time audio and video supports nonverbal cues and interactivity well, lower task analyzability should lead to greater use of the medium.

As video telephony does not support sharing of online documents or collaborative programming, and currently only supports a few users in a single screen, we would expect that greater extent of textual information work and greater extent of managerial orientation should both be

negatively related to system use. Finally, the extent to which one works with different others might make using such a new medium difficult because norms for use would not be well-established, but also stimulate such use because it would help to overcome communication constraints.

Critical Mass

The benefits of any particular communication system network rises, and thus the relative cost of adoption decreases, as a "critical mass" of individuals begins to use the system (Markus, 1990; Rice, 1990). One's location in organizational structures may be a crucial factor in explaining initial adoption as well as ongoing use of innovative communication systems because such structure represents sources of both resources and benefits to potential adopters, as well sources of local users (Rice, Grant, Schmitz, & Torobin, 1990).

METHOD

The Study

This study is part of a year-long trial of a desktop video conferencing system called Cruisersm built to explore how informal communication could be supported in distributed organizations (Fish, Kraut, Root, & Rice, 1993). The system connected members of a large R&D technical organization within two campus-like sites. The software ran on familiar desktop workstations and personal computers, but the system also included a small desktop video camera. Features included: (1) a directory-based graphical user interface that let users place calls to each other by simply selecting another user's name, (2) a series of access and privacy controls that let users control the degree to which others could gain access to them, and (3) the ability to have conference calls with more than two parties at once.

In addition, at about the same time, another similar desktop communication application, called MTS, was also available to all potential users. It was, however, the product of a different group of designers, and was built to serve as a demonstration platform for novel software features. Cruiser and MTS did not interoperate, so for any particular call, people had to choose which application to use.

Over the course of the study, about 160 people were given

Cruiser accounts, and an average of 100 people were able to use the system. The users ranged from secretaries and technical assistants to organizational vice presidents.

Sources of Data

Data were collected through six sources during 42 bi-weekly periods beginning in November 1991: (1) system-monitored Cruiser usage for each period; (2) system-monitored MTS usage for each period; (3) system-monitored email usage for most of these periods; (4) a baseline questionnaire administered primarily during periods 8 through 12 to those who were given Cruiser accounts, with a response rate of 93%; (5) organizational records; and (6) 63 hour-long personal interviews.

Measures

Task analyzability was measured by Withey, Daft, & Cooper's (1983) four-item scale (factor variance 58%, reliability .75). **Information handling and people management** was measured by two task scales from 11 items developed by Bikson (1987) (18%, .75; 36%, .84 respectively). **Working with different others** consisted of the mean of the extent to which one's job involved working as an individual, and in a group, with different others (reliability .67).

Self-reported usage was measured by the estimated average number of Cruiser messages sent per day. **Individual monitored usage** was measured by system-monitored number of messages sent, aggregated into 42 two-week periods for each system (Cruiser and MTS). **Aggregated monitored usage** was indicated by two sets of more aggregated usage: the mean of Cruiser messages sent during time periods 5 through 16, and for time periods 27 through 38. **Prior network communication** was measured by summing the extent of work-related communication the respondent reported having (from 0=never to 7=several times per day), through any communication channel, with a proportional sample stratified by work unit of 136 other employees in the organization. **Relative organizational communication of Cruiser usage** was created by dividing the number of Cruiser messages each person received during periods 12 through 24, by the number of email messages received during that same time period. **Perceived critical mass/accessibility** was measured by the reported percent of co-workers who were accessible through Cruiser, and extent to which others were easy to get hold of through the system. **Work unit usage** was based on the code for the work unit of each person in the division. For each participant, various critical mass measures (such as total number of messages sent by others in the work unit, or percent of others who were assigned a Cruiser account) were computed relative to (1) the person's the work group, (2) overall, (3) for each time period, (4)

aggregated over the two long time periods, and (5) aggregated at the work unit.

RESULTS

Usage

The mean number of Cruiser messages sent per active user ranged from 36 at period 2 to 14 by period 41; for MTS, this dropped from 38 to 0. The initial and maximum number of monthly active users, and the total who had ever used the system, for Cruiser were 13, 89 and 135, and for MTS were 16, 36 and 65, respectively.

Task Influences

Three aggregated regressions were run that focussed on possible task influences. The first attempted to predict the mean Cruiser usage over the first aggregated time period (5-16), based on task analyzability, the extent to which one worked with different people, extent of information-oriented tasks and management-oriented tasks, and the first week one started using Cruiser. Only earlier adoption predicted greater later usage, with a beta coefficient of $-.35$ ($p < .001$), and an adjusted $R^2 = .11$, $F_{1,80} = 11$ ($p < .001$). The second regression attempted to predict the mean Cruiser usage for the second aggregated time period (27-38). Here, greater extent of information work was the only significant predictor, and had a negative influence (beta = $-.25$, $p < .01$), with an adjusted $R^2 = .06$, $F_{1,125} = 8.3$, $p < .01$. The third regression attempted to predict the mean Cruiser usage for the second aggregated time period with the same variables but added in one's own mean Cruiser usage over the prior aggregated time period. The equation's adjusted R^2 was $.16$, $F_{3,80} = 6.1$ ($p < .001$), with one's prior use (beta = $.30$, $p < .01$), information work ($-.20$, $p < .05$) and working with different others ($-.18$, $p < .08$) as significant influences.

Thus, initially, using the task and adoption variables, it appears that early adoption is the only influence on near-term usage, and early adoption does not influence later usage. The media richness argument – that lower task analyzability should predict the use of a medium that supports real-time video and audio – gained no support. Working with different others had a slight negative effect, and information-oriented tasks had a significant negative effect, on later usage.

In this setting, where face-to-face communication was available and many project tasks involved the sharing of graphic and mathematical material, the essentially dyadic video communication medium added little to existing ways of communicating about technical and managerial issues among more than two users, and did not support shared applications. As one user put it, "There's very little information that the Cruiser can give. Occasionally I will

pick up my camera and aim it at the screen and say 'look at this new demo I have'."

Critical Mass

Influence of perceived critical mass. Perceived percent of co-workers who are accessible had an average correlation with Cruiser usage of $r=.12$ across the 42 time periods. Extent to which others are easy to get hold of through the system had an average correlation of $r=.09$. Neither measure was a significant predictor when added to aggregate regressions predicting usage in periods 21, 42, or the second aggregated usage period.

Influence by others in one's work group. The number of other members of a person's work group who use the video system at any one time is a moderately strong predictor of that person's use of the communication system at the next period. This phenomenon occurs, however, only early in the adoption process, and declines later on. There are several indicators of this change.

First, mean prior usage by others was weakly correlated with one's usage at the two selected time periods (period 21, $r=.32$, $p<.005$; period 42, $r=.33$, $p<.001$). The number of others in the work group who held an account (but did not necessarily use the system) was not correlated with usage at period 21 ($r=.13$, ns.), but was for period 42 ($r=.25$, $p<.005$).

Second, in separate regressions for each time period at the individual level, use of Cruiser by others in one's work unit is a significant predictor primarily in the early periods, and afterwards only intermittently, while the influence of one's own usage in the prior time period quickly becomes a larger and stable influence of one's own usage. Indeed, the correlation between the standardized betas of others' usage or one's own usage for each of the periods (taken from the above regressions), and the number of that time period, are: for others' usage, $r=-.40$, $p<.05$, and for own usage, $r=.39$, $p<.05$.

Third, we ran two sets of regressions predicting mean usage at different summary time periods. The first attempted to predict the second aggregated mean usage (27-38) by prior aggregated own usage (both Cruiser and MTS), prior aggregated work group usage, task characteristics, and first use. 13% of the variance in use was predicted only by use by others in one's work group in the same aggregated period (beta=.25), and, as before, textual information work (beta=-.18). The second set of regressions included both the one-time questionnaire measures as well as aggregated own and work unit usage measures, predicting usage at the two selected time periods (21, with 51% of variance explained; and 42, with 40% explained). Significant predictors of the first aggregated period were

one's own use in the prior aggregated period (beta=.52), one's own use of MTS in the prior aggregated period (beta=.26), the time of the first period of use (beta=.23), and use by others in one's work group (beta=.26). Only one's own use in the prior aggregated time period was a significant predictor for use in time period 42.

Relation of cruiser usage to other communication. The total prior communication network sum was a predictor for only two periods. A somewhat related behavioral measure is the ratio of Cruiser messages received to total email messages received. This variable was initially negatively correlated with Cruiser usage through period 13 (an average across all the first 20 time periods of $r=-.19$), and then positively correlated (an average for the second 20 time periods of $r=.11$). Early usage did not complement other, more pervasive and familiar mediated communication, but later usage came to complement such communication.

Competing systems. When two comparable communication systems are available, there seems to be little significant influence of an individual's usage of one system on one's later usage of the other system. However, based on a lag-correlation analysis at the aggregate level of analysis, growth in the number of users of Cruiser is significantly associated with a decline in the number of users of the MTS system about five time periods later.

Social aspects of critical mass. Social influence processes can also account for increased use by those with access to a large proportion of potential communication partners. In particular, groups generated social norms (both directly and indirectly) about whether they would be using the new technology and about the style with which they would be using it (Cool, Kraut, Fish & Lowery, 1992).

When Cruiser was first introduced into the work environment, it became a topic of conversation as new users shared their experiences, and let others know who was using the system. As one person reported, "I've heard people say 'I cruised this person, I cruised that person', just as a way of saying 'I talked to this person'." Over time, people developed a sense of how to use Cruiser by observing the "normal" uses made by others in the work group. One of the first Cruiser norms to develop concerned the use of privacy settings. A typical response to the personal interview question "Do you use any of the privacy settings on Cruiser?" was: "I haven't. I keep it on auto accept. As far as I know nobody uses them. Everybody I call tends to accept automatically."

Three extension of critical mass theory helped us better understand Cruiser usage.

Relevant critical mass. Over time, group norms develop and Cruiser becomes less risky to use. Consequently, as the regression analyses show, use by others in one's work unit

comes to have no significant influence on one's later usage. The process through which these new norms develop involves critical mass in two ways. First, the original pool of users that a person communicates with must be a "relevant mass" (Rice, 1990) involving routine interaction partners, and shared intersubjectivity about boundaries of accessibility and communication styles. For example: "I use it for talking to my colleagues, people I work close to within the group and outside the group. People I know, or with whom I have frequent interaction. I don't use it to call people I don't know well. I prefer to walk to their office." Second, early users talked about their efforts to match specific system settings to correspond to those of their group: "The system is set on auto accept. I suppose as I get more used to using this and other people use it more, I might start to differentiate. [How do the others in your group keep their settings?] They all seem to keep it on auto accept."

Critical mass of experiences. Through frequent interaction with other members of the group there develop collective understandings about normative uses, which lessens the discomfort about Cruiser, and potentially increases use. "The people I call all the time are accustomed to me calling up and so if they are busy I just don't interrupt them and they don't mind having me there...With people I don't call a lot, it's always interrupting them." In addition, increased frequency of Cruiser use among the relevant group makes people aware of the variety of system uses, and sometimes leads to the development of new or novel ways to use the system (Fish, Kraut, Root, & Rice, 1993). One example is the "virtual office", where two users open their channels to each other for several hours or more, allowing a continuous stream of potential interaction, as well as extended periods where each person simply goes about his or her own work.

Negative influence of critical mass on usage. Over time, critical mass can reach a saturation point, where there are more potential online partners than a person wishes to, or feasibly can, interact with (Rice, 1982), creating problems of technical resources, interruptions and trust. As one person put it, there were "so many system users" that one couldn't become completely familiar with the integrity of all other users.

Ongoing Use

While early on in the adoption process, the tasks that people perform, and the numbers of other users in one's work unit, both influence participants' willingness to use the new medium, their influence wanes over time, replaced by a person's own use of the system in one (or an aggregated) time period as the best predictor of use in a later period (average $r = .39$; $p < .02$), for two reasons. First, methodologically, an individual's use of the system in a prior time period captures (and hides) many stable

reasons (such as initial task requirements) for using the system in a subsequent time period. Second, prior behavior is a real "cause" of subsequent behavior, as this behavior becomes integrated into routines, habits, and standard operations, as adaptive structuration theory argues (Poole & DeSanctis, 1990). For example, a person who had stopped using the telephone in favor of using Cruiser told us, "I don't know if there is anything better (about making telephone calls on Cruiser). I think it just evolves that way. Here that sort of thing just evolves."

DISCUSSION

Our analyses speak to several different theoretical issues. First, as McGrath (1988) and others argue, time matters. One of the reasons for contradictory or weak results of prior tests of media richness or critical mass might be that they have a greater role earlier on as individual influences, while structural factors become greater influences later on. Second, as found in other studies, social influence and critical mass effects seem to be local (work unit) rather than global (total network summary or usage relative to email messages received), and perceptions of critical mass do not well predict behavioral aspects of critical mass (Rice, 1990; Rice & Aydin, 1991). Third, the dichotomy between "rational" and "social" influences seems artificial and perhaps unnecessary. Critical mass includes both formal structural as well as informal influence components, and requires greater conceptual clarity (Rice et al., 1990). Finally, individual influences such as task requirements, and social-structural influences such as critical mass, may be some of the mechanisms whereby adaptive structuration takes place, based upon some individual cost-benefit assessment as well as peer influence. Over time, individual assessments and critical mass interact to institutionalize, through developing norms, patterns of usage of a new medium.

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