Varieties of Social Influence: The Role of Utility and Norms in the Success of a New Communication Medium

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This is an empirically sophisticated study of the impacts of multimedia communication systems. It is rare to find a study that compares competing theoretical models, includes both quantitative and qualitative data analysis, examines leading edge technology impacts, and is longitudinal in design. Here we have such a study. I believe that we need more studies of organization communications that are as methodologically rich as this one.

Gerardine DeSanctis

Abstract

This natural experiment investigates the introduction and use of a pair of competing video telephone systems in a company over a period of 18 months. Both quantitative, time-series analyses and in-depth interviews demonstrate that employees adopted and used the video systems for both utility and normative reasons. Consistent with utility explanations, people in the most communication-intensive jobs were the most likely to use video telephony. Consistent with social influence explanations, people used a particular system more when more people in general were using it and when more people in their work group were using it. There were two conceptually distinct, but empirically entangled, types of social influence. First, use by other people changed the objective benefits and costs associated with using the systems, and thus their utility. Second, use by others changed the normative environment surrounding the new technology. Both utility and normative influences were stronger in one's primary work group. Implementers, users, and researchers should consider both utility and normative factors influencing both the success and failure of new organizational communication systems.

(*Interpersonal Communication*; *Social Networks*; *Diffusion of Innovations*; *New Communication Media*; *Social Influences*; *Critical Mass*; *Network Externalities*)

Introduction

Organizations spend considerable effort, time, and money buying, introducing, and using new communication systems. These efforts tend to focus on technical and cost issues at the expense of individual, group, and organizational social issues (Johnson and Rice 1987). Many systems fail, or are under-utilized, and implementers and users alike tend not to fully understand the social reasons that distinguish the failures from the successes. Research on the implementation, adoption, and diffusion of new media can improve this condition (Rogers 1983; Williams et al. 1988). But there are still many concepts that need clarification, and research that needs to uncover subtle, over-time influences on system diffusion or rejection.

One intriguing example of this situation is the visual telephone, sometimes known as desktop videoconferencing. AT&T first demonstrated a visual telephone in 1929 and introduced the PicturePhone™, its first commercial product, in the 1960s. Visual telecommunication has long been emblematic of a high-tech future in settings ranging from the 1964 World's Fair to Flintstone cartoons and

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Star Trek movies. Yet despite relentless research and development on the underlying video technologies, substantial improvements in the costs and quality of the systems, and repeated attempts by large corporations to sell video telephone products, commercial video telephony systems have generally failed (see Noll 1992 and Kraut and Fish 1996, for recent reviews).

The natural experiment reported here investigates the introduction and use of a pair of similar, but competing, video telephone systems in one division of a company over an 18-month period. Video telephony succeeded in this company in the sense that use grew steadily during the course of the trial and was being used routinely by the end of the study period. Yet, even though both systems were used equally during the first months of the trial, ultimately only one of the systems flourished; the second died from lack of use. Because the two systems were offered to the same people and had very similar features and capabilities, their differential success cannot be explained by characteristics of the individual adopters, features of the technologies, or their interaction.

This study examines the growth of the two video systems, and the death of one of them, in some detail. Our primary intention is to differentiate among several mechanisms that are often lumped under the rubric of "social influence." We use this natural experiment as a lens through which to examine the manner in which the behavior of other people influenced individuals' adoption and use of a new communication medium, and the way in which these influences changed with time. Our goal is to examine how use of these systems was driven both by their value for communication, i.e., their *utility,* and by social definitions of how they should be used, i.e., *normative influences.*

Theoretical Framework

The sections below compare utility theories about the diffusion and use of innovations with normative ones. Utility theories emphasize how use is driven by the relatively objective value that people derive from the technology. However, we distinguish between two variants of utility theory. Contingencies approaches, which emphasize the fit of stable features of technology with the tasks it needs to support, are not inherently social theories. In contrast, externality approaches are social theories, in that they emphasize the way in which the number of users of a technology changes its utility. In contrast, normative theories emphasize the role of socially communicated, but relatively arbitrary beliefs in shaping the use of technology. Using both time-series analyses and interviews, we then illustrate how both types of social influence—socially generated utility and socially communicated norms—shaped the use (and nonuse) of the video systems.

Utility Models

Contingency Approaches. According to individual utility models of the diffusion of innovations, people adopt new technologies when the benefits from adoption and use exceed the costs (Rogers 1983, Tornatzky and Klein 1982). Some of the value of a new communication medium is intrinsic. It derives from stable features of the medium and their fit to particular communication tasks. When explaining the success or failure of new communication media in general, most commentators have stressed the unique attributes of a particular medium compared to its competitors. Communication media, for example, differ on whether they are text-oriented or support richer communication, whether they are interactive or asynchronous, whether messages are stored or are ephemeral, whether they support one-to-many communication or are limited to one-to-one communication, and a number of other factors (Rice 1987).

Applied researchers contrasting video telephony with other synchronous media, including face-to-face communication and the conventional telephone, generally ask whether the visual channel adds value (e.g., Short et al. 1976, Noll 1992). For example, Noll (1992) argued that AT&T failed to create a market for video telephony because people had no use for the video. ". . . [I]t seems very clear that AT&T's PicturePhone service failed . . . for the simple reason that most customers had no applications for it." According to Noll's analysis and others that have preceded it (e.g., Williams 1976), being able to see a communication partner adds little to communication effectiveness, and customers will refuse to pay a premium for a communication feature that adds little value.

Theoretical approaches to the study of new media also focus on more or less objective features of the media. Daft and Lengel's well-known media richness theory (1986), for example, emphasizes differences among media in how interactive and expressive they are. According to Daft and Lengel's taxonomy, video telephony is a rich medium; that is, it is both highly interactive and capable of subtleties in communication, such as expressing facial expressions. Media richness theory is primarily about communication. Its central thesis is that communication effectiveness will improve if the medium matches the information processing requirements of the task. However, one can also derive predictions about media choice from it and from the structural contingency theory out of which it grew (e.g., Tushman 1978). According to this perspective, video telephony should appeal most to people who have equivocal or ambiguous work to perform. For example, all else being equal, managers, and others with

complex and nonroutine tasks to handle, such as personnel issues, will use video telephony more.

Externalities. The personal costs and benefits of innovations also have a social component—one that is likely to change over time. The most important social component is the number of other people using an innovation. Across many kinds of innovations, costs are reduced and benefits increase as more people use them. For example, the cost of manufacture for most consumer products typically declines with production, while the availability of accessories, spare parts, repair services, and advice all typically increase with the number of users (Mahajan et al. 1990). Economists term this phenomenon *positive externalities,* while researchers in the communication field often use the concept of critical mass.

Positive externalities are especially important for communication technologies because the ability to communicate with others is intrinsic to their value.[1] Markus (1990), among others, has theorized that the value of a communication system rises as a "critical mass" of individuals begins to use it. Conversely, as people stop using a system, its value drops for the remaining users. Thus, according to an externalities account, the most important determinant of using a communication system is the total number of people whom potential adopters can reach through it. This factor can change with time and is likely to be self-reinforcing.

Because communication systems gain value as they connect more people, systems that are equivalent to each other in terms of features (e.g., their richness or user interface) are likely to compete on the basis of the number of users they connect. Indeed, Markus takes an extreme view: "[T]he diffusion of an interactive medium in a community may be an 'all or nothing' affair. Either usage will spread to all members of the community . . . or no one will use the medium (for communication inside the community), because no one started using it or because early users defected" (Markus 1990, p. 199). In the case of competing systems, one system is likely to drive out the other as each additional user increases the value of the one and each defection decreases the value of the other. While economists have observed the existence of "tipping points" associated with network externalities, there currently is no widely accepted theory to predict when they will occur (Katz and Shapiro 1994).

This view—that the value of a communication system depends on the number of people it connects—also implies that organizational structures and a potential adopter's location within them are crucial factors in explaining the initial adoption as well as the ongoing use of communication systems. In particular, people will gain more benefit from a communication system if others who are *important* to them also use the system than if the same number of others who are less important to them use it. These others constitute the "community" in the quote from Markus, and Rice (1990) refers to these reference groups as "the relevant critical mass." A study by Rice et al. (1990) shows that adoption of an electronic mail system is strongly determined by the others with whom one communicates before implementation of the system. The relevant reference group may be defined by formal organizational membership (e.g., members of one's work group) or through patterns of behavior (e.g., the people with whom one communicates most frequently). In the study described here, we use organizational structure—an individual's relationship to others on the organizational chart—as the basis for identifying the sources of relevant critical mass.

Normative Models

Explanations emphasizing social norms focus less on the objective value of an innovation and more on the communication contexts and processes through which potential adopters learn about and develop attitudes toward it. These can be processes of direct persuasion (you adopt an innovation because your boss or coworkers recommend it to you) or indirect persuasion (others speak of it or behave toward it in such a way as to shape your perception of the innovation's costs or benefits). For example, social learning models would predict that observing or hearing about others using a system with positive results would encourage people to use the innovation (Bandura 1977).

Social influence is likely to be highly dependent on one's position in a social structure, because position shapes exposure to influence attempts and their effects (Rice and Aydin 1991). Diffusion models of the spread of innovations have long focused on the interpersonal communication that leads people to adopt a new behavior, attitude, or technology and the role that a person's place in a social network plays in moderating the influence of communication (e.g., Burt 1987, Coleman et al. 1957, Rogers 1983).

In addition to influencing adoption and the amount people use a communication system, normative processes may also shape the manner in which they use it. The video telephone is an anomalous/ambiguous technology; it is similar in some ways to face-to-face and telephone communication, but it is different from both. In the early stages of adopting video telephony, norms surrounding this new form of communication are unlikely to exist and may be in flux or under negotiation. As a result, more general norms regulating social interactions are likely to be applied (Cool et al. 1992). During this early period,

users can attempt to apply more general rules about face-to-face or telephone interaction to guide their uses of the new technology, but their application is uncertain and may lead to gaffes. For example, initially users will not have a convention for introducing other people who are present physically when they receive a video call. People often make these introductions in face-to-face conversations, but rarely in telephone ones. Over time, however, these general rules of social interaction themselves may become redefined or replaced as people develop new norms for using the new technology. These changes in norms are likely to be developed collectively among users who share some reference group membership, such as an organizational work group.

While the normative approach to innovations emphasizes common patterns of adoption and use within a group, it does not propose that individuals are unthinking followers of anything that salient others do or say. Some people, after all, are early adopters, while others may never adopt. Further, the group may present a distribution of attitudes and a set of possible usage norms that are available for negotiation and evaluation. Also, some individuals may have stable traits or positions within a group that encourage them to be innovation opinion leaders, while others may remain followers (Rogers 1983). Finally, even though social influence processes may be highly influential in general, they can play out in different ways in different social groups (see Rice et al. 1990). Thus norms are not deterministic; rather they represent a changing, socially negotiated order that both constrains individual behavior and is influenced by it.

The Intertwined Nature of Utility and Norms

Some commentators (e.g., Fulk 1993, Fulk and Steinfield 1990, Soe and Markus 1993) have attempted to pit utility theories and normative theories about the use of new technology against each other. They argue that the objective utility of technology is far less important in determining how it is used and the degree to which it is successful than are the relatively arbitrary views of the technology that social groups impose upon it. In contrast, we attempt to show in this paper that the two models are complementary, compatible, and reinforcing. It is very likely that the fit of a communication medium with a task will influence people's adoption decision and usage patterns. But in addition, the numbers of people using a medium and their implicit and expressed attitudes toward it are also likely to influence adoption and use.

Although utility and social norms are conceptually separable, in many settings the same social behaviors that change the utility of an innovation for potential users also provide them evidence about others' attitudes toward it. Thus, in many real-world settings, utility and norms are inseparable. This is because another's use of a communication system can be interpreted both as a resource that increases the objective value of the system (i.e., a utility variable) and as a symbolic act of endorsement (i.e., a normative variable). That is, in the externality account, each additional user of a communication system adds one other person that all can communicate with directly, as well as exponentially enlarging the communication possibilities within the social network supported by the system. On the other hand, in the normative account, each additional user or remaining nonuser is a potential model whose behavior can be imitated or taken as a basis for evaluation.

A study by Fulk (1993) demonstrates the difficulty of distinguishing between individual utility and social norms as influences on a focal individual's use of a new communication medium. Fulk presented data to show that a work group's use of an electronic mail system was the best predictor of a focal individual's use of the system, and that this effect increased with an individual's attachment to the work group. She interpreted her findings as evidence for social norms: "[W]ork group members' technology use behavior [predicted] individuals' technology use . . . because of compliance effects" (1993, p. 939). According to her interpretation, work groups used direct persuasion and example to shape the attitudes and meanings about the new technology that their members internalized, and these normative influences increased when members were highly attracted to their work groups. From a utility perspective, however, her data are also interpretable as evidence that the use of communication technology by members of a highly interdependent group increased the value of the technology for all group members and thereby increased their use of the technology. Indeed, recent studies argue, and show, that *both* factors are significant influences on new media use and evaluation (Rice et al. 1990, Rice and Aydin 1991, Sitkin et al. 1992, Trevino et al. 1990, Trevino and Webster 1992).

Hypotheses and Approach

We thus hypothesize that both utility and norms—especially within one's work group—can influence use of a communication technology, and that utility can be influenced both by static characteristics of the technology and by the behavior of others. However, the relative importance of these influences and the way that these processes affect the adoption and use of a technology over time remain open questions. Over time, costs and benefits change, interpretations that groups apply to a system

change, the number of system users changes, and even the technology itself changes as new features and applications are added or discovered. The major goal of this study is to investigate the influence of these processes on the use of video communication systems over time.

Quantitative Analyses: Time Series

We use two complementary methods to investigate the social influences on utility and norms. First, we conduct time-series analysis to examine how the behavior of others changes a focal individual's use of two video telephony systems across time. Both the utility and normative models predict that as more others are connected to one video system, a focal individual will also use it more and will use a competitive system less. The models' common predictions, however, have different rationales. According to the utility model derived from externality and critical mass theories, each additional user increases that system's objective value and decreases the value of its competitors. According to the normative model, each additional user (or defector) provides a positive (or negative) endorsement of that system with the potential to change a focal individual's attitudes toward the system.

Finally, both theories predict that use of a system by the focal individual's work group will have an additional impact on the individual's use, over and above the aggregate use in the general population. Because much of the productive work in an organization is done within the work group, members of a work group are especially important communication partners. Therefore, use by one of them increases the value of the system more than use by other, arbitrarily selected organizational members. Similarly, because the work group often acts as a reference group, its members may provide especially potent sources of meaning and norms for individuals trying to interpret the value of innovations (Festinger 1954). Observations of members of the work group and the receipt of explicit persuasive attempts by them are more likely to influence the focal individual's beliefs about the system than would the behavior of other arbitrarily selected organizational members. We expect that both of these effects of work groups should be greater for individuals who are more committed to their work groups.

We tested these hypotheses by examining with time series analysis the extent to which others' use of a video telephony system at one time period increased people's use of that system and decreased their use of a competitive system during the next time period. We operationalized "others' use" to include both the total number of others using the system as well as the proportion of a focal individual's work group using the system. We tested whether the influence of work group members was greater for people who were more integrated into their work groups.

These quantitative analyses tested and controlled for individual differences that may be associated with overall use of video telephony. These include demographic variables that may be associated with adoption of any innovation (e.g., age, gender, and organizational level). Second, the analyses also included variables to represent the communication intensity of an individual's work, to test the thesis from contingency theory that people who need to communicate more will be more likely to adopt any new communication medium. These variables include a measure of the interdependence of an individual's job within the organization and a system-collected measure of the amount of electronic mail the individual actually exchanged with others. Third, the analyses included variables to indicate whether an individual's work was more equivocal (using a measure of task analyzability and a measure of the extent to which the job involves difficult emotional and managerial tasks), because media richness theory hypothesizes that video telephony makes a better fit to more equivocal jobs. Finally, the analyses included a measure of whether participants' jobs involved writing and working with numbers, computer-oriented functions that were not supported at all by the video telephony systems, indicating work contexts for which the new systems would provide low utility. In summary, we predicted that people whose jobs were (1) more communication-intensive, (2) less analyzable, (3) more involved with personnel management, and (4) less document-oriented would use the video systems more.

None of these individual difference variables, however, can predict which of the two video telephony systems participants would prefer. From the standpoint of contingency theory, the two systems are equivalent. Neither should the individual differences predict changes in use of the video telephony systems over time, since individuals' basic tasks and the basic capabilities of the systems were relatively stable. In contract, both network externalities and normative influences are dynamic processes, and we expect changes with time. Early use by some people should influence later use by others, and norms about use take time to develop.

Qualitative Analyses: Semistructured Interviews

The second method we use to investigate social influence consists of exploratory, semistructured interviews with trial participants. In the quantitative analysis, we treat the number of others who used video telephony as a proxy for utility generated by communication exchanged through the systems and for the normative influences derived from others' behavior and persuasive messages

about the systems. But the participants can directly describe their motivations for using the systems and can report on the emerging beliefs about these systems. Participants engaged in extensive discussion about the technology, both early in the trial when they were first understanding what the technology was, how it was used, and what value it had, and later in the trial when use was more routinized. Our interviewing and qualitative analysis provide some insight into the content of this communication and the social norms it shaped. We conducted two sets of interviews during the trial, early and then later in the trial, to capture participants' beliefs during these two periods.

Methods

The Video Telephony Systems

This study is part of an approximately 18-month behavioral and technical trial of two desktop video telephone systems, one called the Cruiser™ System and the other called MTS (an acronym for Multimedia Telephone System). The systems were made available to and used by members of a large R&D technical company located on two campus-like sites separated by about 50 miles. At the start of the trial the systems connected about 20 users, and by the end the systems connected about 80 people; during the course of the trial, over 120 people had used at least one of the two video systems.

Both systems included a camera, a small television-style monitor, and software to allow users to place audio-only or audio/video calls to each other. The software ran on computer workstations and personal computers that members of this organization used routinely at their desks. The two video systems used the same hardware; that is, once potential adopters acquired the necessary camera, microphone, and monitor, they could make calls on either or both video telephony systems. As was the case with other communication services in this corporation, equipment and operational expenses were paid for by users' departments, rather than by the employees themselves, so that explicit financial costs are not part of any innovation utility assessment.

The two systems provided essentially identical capabilities, including (1) easy-to-use graphical user interfaces that let users place calls to each other by simply clicking on another person's name; (2) hands-free, full duplex audio; (3) wide-angle video views of each other's offices; (4) the ability to have conference calls with up to three other parties at once; and (5) access and privacy controls that let users regulate the degree to which others could gain access to them at a given time. Depending on the way in which they set their access controls, subscribers could exclude all video calls, operate in a video telephone mode (where they were notified of each call and could selectively answer or ignore it), or operate in video intercom mode (where calls were completed without explicit acceptance on their part). The two systems were developed by parallel departments in the R&D division and had slightly different user interfaces. In addition, the MTS system was provided to its first users about two months earlier than the Cruiser system. The MTS system allowed users to exchange brief text-based messages independently of electronic mail, while the Cruiser system did not.

People could simultaneously subscribe to both systems simply by running the software associated with them. However, the systems did not interoperate; that is, a call placed from one system could not connect with a person who was using only the other one. Hence, subscribers who wanted to place a call had to choose the system to place it on. The research groups developing the two systems treated them as rivals, with the group developing Cruiser investing more effort in advertising, recruiting new subscribers, and training and supporting them. For the purposes of the following analyses, we can treat the two telecommunication systems as equivalent but competing services available to a single population of potential adopters.

Participants

Over the course of the study, 135 people were given accounts on each system. During this period, there was organizational turnover of about 20%. New users were added to replace old users who left. In addition, over the course of the trial there was an absolute growth in the number of users, limited only by the budget for the trial rather than by potential customer demand. The users comprised a mixture of technical and administrative personnel, ranging from secretaries and technical assistants to corporate vice presidents. The modal user was a male, technical employee, aged 35 with a master's degree in engineering or computer science. About 20 users were involved in some way in building and maintaining the two systems; the rest used them exclusively for other corporate work and for supporting social relationships.

Sources of Data

Data were collected through four sources: (1) computer-monitored usage for each system began in November 1991 and continued for 82 weeks; (2) a baseline questionnaire was provided to people before they received their video telephony accounts[2] (the response rate was 93%); (3) organizational records were consulted to identify participants' work groups (a work group in this study is defined to be a focal individual's supervisor, all other

employees reporting to the same supervisor, and any employees reporting to the focal individual); (4) 43 in-person interviews with users were conducted during weeks 10 to 50, when new users were being added to the system, and 20 telephone interviews during weeks 70 to 81. Only two people declined to be interviewed. The interviews lasted between one half-hour and one hour and covered such topics as typical uses of the video telephony systems, positive and negative aspects of using the systems, and norms for politeness and privacy. The interviewer elicited this information by asking the interviewees to describe typical incidents involving Cruiser (e.g., "Describe the last call you made.") and to answer some diagnostic questions about their experiences with the Cruiser system (e.g., "Did you ever interrupt someone when placing a call?").[3]

Measures

Demographic Characteristics. Respondents reported their age and gender (male = 0/female = 1) on the questionnaire. We determined respondents' organizational level—from technician (1) to vice president (5)—from organizational records.

Task Characteristics. To examine whether fit between typical job tasks and features of the video systems would lead to greater use, we measured several aspects of participants' jobs.

(1) *Working with others.* This scale consisted of three items measuring the extent to which one worked alone (reversed), had a one-person job (reversed), or worked closely with others (Cronbach's alpha = 0.69).

(2) *Electronic mail use.* From computer generated records, we counted the number of electronic mail messages the participants received in a two-month period during the middle of the trial.[4] Since the distribution of calls had a long tail, we took the log of this count.

(3) *Task analyzability.* This scale, adapted from Withey et al. (1983), consisted of four items measuring the extent to which a job involved a clearly defined sequence of steps, a clearly known way of doing one's job, established procedures, and a well-defined subject (Cronbach's alpha = 0.75).

(4) *Personnel management tasks.* This scale, based on research by Bikson and her colleagues (1987) and refined through our principal components analysis of 11 items used in Bikson's research, consisted of 6 items measuring the extent to which one's job involved bargaining and negotiating, persuading and selling, managing people, handling difficult emotional situations, assembling and distributing documents, and scheduling (Cronbach's alpha = 0.84).

(5) *Document tasks.* This scale, also based on research by Bikson and her colleagues (1987), consisted of five items measuring the extent to which the respondent's job involved writing and reading documents, searching for information, handling numbers, and handling charts (Cronbach's alpha = 0.75).

(6) *Work group integration.* This scale consisted of four items drawn from the Cammann et al. (1983) scale of work group satisfaction and Van de Ven's coordination scale (1976). It measures the extent to which respondents felt themselves part of a work group, the ease of maintaining working relationships with their work group members, the ease of coordinating with them, and the smoothness of joint projects (Cronbach's alpha = 0.69).

Video Telephony Use. Computerized accounting records listed each call a participant placed or received during the 18-month field trial separately for each of the two video telephony systems. To conduct time series analyses, we broke the trial into 41 biweekly time periods to increase the stability of the data. Unlike the case of a conventional telephone, individuals in this sample subscribed to each video telephony system by running a computer program, and they had to activate the program each time they restarted their personal computers or workstations. They could subscribe to both systems simultaneously or to either one separately. Because of limitations in the accounting records, we define a subscriber as an individual who placed at least one call on a system during a biweekly period.

These accounting records were the basis for the following use measures for each time period. The use measures were calculated separately for each video telephony system.

(1) *Individual system usage.* The number of calls that each individual placed or received on each system during the time period. These are the dependent measures in our analyses. Since the distribution of calls had a long tail, we took the log.[5]

(2) *Subscribers to a system.* The total number of other people placing at least one call on the system during the time period.

(3) *Subscribers within the work group.* The number of *other* people in the subject's work group placing at least one call the system during the time period, divided by the total number (less one) in the work group.

Time-Based Controls. Time period is simply the biweekly time period indexed from 1 to 41. Including it in regression models controls for the linear effects of time (e.g., increasing or waning popularity of the systems).

Video availability is a dummy variable that was zero before the video systems were made available to a subject and one thereafter. It controls for the earliest date the subject could have used either system.

Analysis Strategy

Our goal in data analysis was to explain the variance in the amount that individuals used the Cruiser and MTS systems, using theoretically justified predictors. Significant predictors then provide evidence for the validity of the underlying theoretical model, or aspects of that model. Using panel data, we conducted two time-series regressions, predicting the total number of Cruiser and MTS calls each individual made during each time period. The dependent variables for these analyses were the number of Cruiser calls and the number of MTS calls (both in the log scale) per time period for each participant. To test whether the independent variables differentially influenced the use of the two systems, we conducted a supplementary analysis, in which the dependent measure was the difference (in the log scale) between the number of Cruiser calls in a time period and the number of MTS calls. The coefficient for an independent variable on this derived dependent measure is the interaction between the independent variable and system type, testing the null hypothesis that the independent variable had the same effect on each video system.[6]

The independent variables for the time series analyses include both static, individual differences and variables that change with time. The primary analysis, then, is a random effects, one-way panel model (Greene 1995) with 131 participants and 41 time periods. It uses generalized least squares regression (GLS) to estimate coefficients and to adjust standard errors, thereby accounting for the nonindependence of error terms in panel designs. To reduce ambiguity about causal direction, the relevant time series independent variables were lagged one time period (i.e., number of Cruiser subscribers at Time_{t-1} was used to predict Cruiser calls at Time_t).

For ease of exposition, independent variables were introduced into the analysis in five hierarchical models. The time-based control variables (the availability of video and time period) were entered first, in Model 1. Their introduction controls for methodological artifacts associated with people receiving access to the systems at different times. It also controls for the linear effects of time (including a possible novelty effect).

Model 2 adds the static, individual differences, including both the set of control variables of gender, age, and organizational level and the task variables that contingency theory suggests will be associated with use of the video telephony systems, including the total volume of communication (working with others and electronic mail usage) and task analyzability, personnel management tasks, and document tasks. This analysis tests whether an individual's average level of use of each system varied with these demographic and task differences. The analysis is equivalent to a conventional regression predicting media use from cross-sectional data, and the coefficients and significance levels are identical to those from OLS regression, controlling for the number of weeks they had access to a video system. The increase in R-squared from Model 1 to Model 2 shows the net effect of adding the measured individual differences.

Model 3 introduces the number of Cruiser and MTS subscribers in the previous time period. Both the utility and normative models predict that individuals will use a communication system more as more people are connected to it and will use it less as more people use its rival. The increase in R-squared from Model 2 to Model 3 shows the net effect of adding aggregate use in the general population.

Model 4 introduces the number of Cruiser and MTS subscribers in the focal individual's work group from the previous time period. Both the utility and normative models predict that individuals will use a communication system more as a higher proportion of the people they work closely with also use the system and will use it less if more of their close colleagues use a rival system. The increase in R-squared from Model 3 to Model 4 shows the effect of use within the work group, net of the effects of community-wide behavior.

Finally, Model 5 includes all the independent variables and adds the interaction between subscribers within the group level and participants' integration with their work group. Both the utility and normative models predict that individuals will be more influenced by the behavior of people in their work groups the more they are integrated in their work groups.

Quantitative Results: Explaining the Amount of Video Use Over Time

Bivariate Correlations and Usage Trends

Table 1 treats the individual as the unit of analysis and shows the correlations among individual difference measures and use measures averaged across time periods. It also summarizes descriptive statistics for these variables.

People who used one video telephony system also used the other ($r = 0.39$, $p < 0.01$). These correlations also show that people who worked with other people and who sent more email used both systems more. On the other hand, people with analyzable jobs and those who had

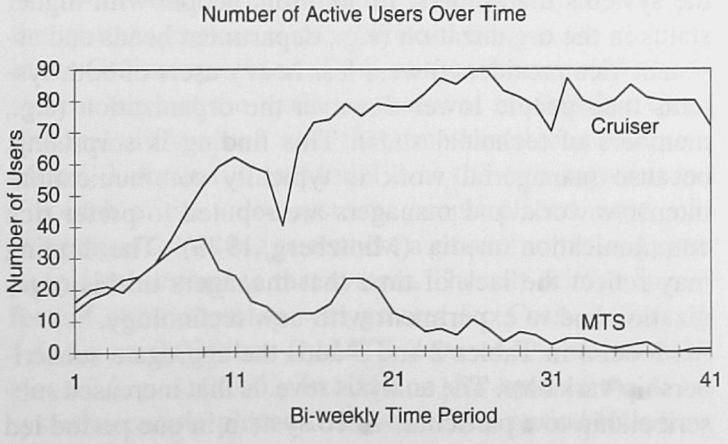
Table 1 Correlations Among Individual Difference Variables

Variable	Mean	Std	1	2	3	4	5	6	7	8	9	10	11	12	13
Video availability	0.71	0.26													
Gender	0.19	0.39	0.09												
Age	36.29	8.10	−0.22	−0.19											
Organizational level	2.29	0.63	−0.01	−0.10	0.49										
Working with others	3.31	0.80	0.14	−0.05	0.19	0.45									
Electronic mail usage	4.11	1.42	0.35	0.09	0.09	0.22	0.15								
Personnel management task	2.30	0.89	0.05	−0.17	0.31	0.52	0.51	0.19							
Document tasks	3.48	0.73	−0.27	−0.15	0.25	0.19	0.08	−0.11	0.41						
Task analyzability	2.62	0.69	−0.17	0.11	−0.18	−0.15	−0.14	−0.05	−0.14	0.07					
Work group integration	3.58	0.53	−0.01	0.10	0.00	−0.05	0.11	−0.03	−0.02	0.05	0.21				
Cruiser subscribers in work group	0.49	0.18	0.44	0.06	−0.18	−0.07	0.01	0.03	−0.09	−0.10	0.00	0.16			
MTS subscribers in work group	0.09	0.12	0.37	0.22	−0.17	−0.08	−0.01	−0.01	−0.04	−0.17	0.06	0.01	0.55		
Cruiser use (log)	1.22	0.94	0.66	0.10	−0.20	−0.13	0.16	0.41	0.00	−0.30	−0.16	0.08	0.24	0.24	
MTS use (log)	0.17	0.37	0.44	0.22	−0.13	−0.08	0.21	0.22	0.00	−0.22	−0.08	0.05	0.31	0.61	0.39

document-oriented tasks tended not to use either system. These findings demonstrate the existence of individual differences in use of video telephony systems that generalize across implementations, associations that are explored in more detail in the multivariate analyses below.

Figure 1 shows the number of subscribers (i.e., those who made at least one call) for each system during each biweekly period. As can be seen, each system starts with about 18 subscribers. These were primarily the developers of the systems and others in their work groups. The number of subscribers grows steadily during the first 20 weeks. Thereafter, the number of Cruiser subscribers continues to grow and eventually stabilizes at about 80 active subscribers per period, while the number of MTS subscribers declines and reaches zero by the end of the trial. Overall, 107 different people used Cruiser during the trial, but only 41 used MTS at any time during the trial. In terms of numbers of calls made, the number of Cruiser calls per subscriber showed a slight decline over time, while by the end of the trial, everyone had stopped making any MTS calls.

Figure 1 Number of Cruiser and MTS Subscribers per Time Period



Time-Series Analyses and Comparison of Models

Tables 2 and 3 show the results of the time-series analyses predicting Cruiser use and MTS use, respectively. Model 1 in these tables shows the effects of the time-based control variables. The negative coefficients for time period shows that use of both systems fell with time. The decline in use was reliably stronger for the MTS system (by means of a t-test of slope coefficients), which ultimately failed, than for the Cruiser system. By necessity, video availability itself was a strong predictor of the use of both systems. However, availability was reliably a weaker predictor for use of the MTS system ($p < 0.001$). Having the technology available was a necessary, but not sufficient, condition for using it. In the later stages of the trial, all participants had both the Cruiser and MTS systems available, but many participants never tried the MTS system, even though they used the Cruiser system to varying degrees. The failure of many later trial participants to use MTS was therefore not influenced by their direct experience with it.

Model 2 in these tables shows effects of individual differences on the usage of the two systems. The individual differences measured in this study explained 7% of the variance in use of the Cruiser system and 3% of the variance in use of the MTS system (that is, the difference in the R-squared value between Model 1 and Model 2 in the two regressions). With some exceptions, these data are

Table 2 Predicting the Use of Cruiser Over Time Periods

Cruiser Use Independent Variable	Model 1 Time-Based Controls		Model 2 Time-Based Controls + Individual Differences		Model 3 Time-Based Controls + Individual Differences + Aggregate Usage		Model 4 Time-Based Controls + Individual Differences + Aggregate Usage + group Usage		Model 5 Time-Based Controls + Individual Differences + Aggregate Usage + Group Usage + Group Usage Interactions	
	b	p	b	p	b	p	b	p	b	p
Intercept	0.27	0.00	1.79	0.07	1.50	0.00	1.61	0.00	1.61	0.00
Video availability	1.51	0.00	1.49	0.00	0.91	0.00	0.89	0.00	0.89	0.00
Time period	−0.01	0.00	−0.01	0.30	−0.01	0.00	−0.01	0.00	0.01	0.00
Gender			0.00	0.98	0.05	0.62	0.07	0.53	0.07	0.52
Age			−0.01	0.49	−0.01	0.38	0.00	0.42	0.00	0.44
Organizational level			−0.33	0.01	−0.28	0.00	−0.28	0.00	−0.28	0.00
Working with others			0.16	0.07	0.13	0.05	0.12	0.05	0.12	0.06
Electronic mail usage			0.18	0.00	0.12	0.00	0.12	0.00	0.13	0.00
Personnel management tasks			0.03	0.74	0.04	0.49	0.05	0.41	0.05	0.43
Document tasks			−0.16	0.07	−0.14	0.03	−0.15	0.03	−0.15	0.02
Task analyzability			−0.14	0.10	−0.09	0.17	−0.08	0.20	−0.09	0.16
Work group integration			0.09	0.15	0.06	0.18	0.05	0.26	0.04	0.32
Cruiser subscribers					1.08	0.00	1.05	0.00	1.03	0.00
MTS subscribers					−0.19	0.00	−0.11	0.05	−0.12	0.03
Cruiser subscribers in work group							0.09	0.00	0.09	0.00
MTS subscribers in work group							−0.07	0.00	−0.07	0.00
Integration X Cruiser subscribers in work group									0.05	0.00
Integration X MTS subscribers in work group									−0.06	0.00
R-squared	0.30		0.37		0.51		0.51		0.51	

generally consistent with the thesis that the new communication medium was used most when it fit people's characteristic work tasks. First, people who had more communication-intensive jobs used both video systems more. The beta coefficients show that across both systems, people who sent more electronic mail messages and those who worked more closely with others were heavier users. The association with electronic mail messages, however, was reliably higher for the Cruiser system than for the MTS one ($p < 0.01$).

Second, consistent with media richness theory, people who had less analyzable jobs were more likely to use video telephony ($p < 0.10$); the size of the coefficients was not reliably different for the two systems, although it reached statistical significance only for the Cruiser system. Also consistent with the general contingency-theory thesis, people who worked more heavily with documents, which neither system supported, were less heavy users of both systems ($p < 0.05$).

Surprisingly, people who performed more equivocal, personnel management tasks were not more likely to use the systems than others. In addition, people with higher status in the organization (e.g., department heads and assistant vice presidents) were less heavy users of both systems than people lower down in the organization (e.g., members of technical staff). This finding is surprising, because managerial work is typically communication-intensive work, and managers are reputed to prefer rich communication media (Mintzberg 1973). The finding may reflect the lack of time that managers in this organization had to experiment with new technology.

Model 3 in Tables 2 and 3 adds the aggregate subscribership variables. The analysis reveals that increased subscribership to a particular video system in one period led

Table 3 Predicting the Use of MTS Over Time Periods

MTS Use Independent Variable	Model 1 Time-Based Controls		Model 2 Time-Based Controls + Individual Differences		Model 3 Time-Based Controls + Individual Differences + Aggregate Usage		Model 4 Time-Based Controls + Individual Differences + Aggregate Usage + group Usage		Model 5 Time-Based Controls + Individual Differences + Aggregate Usage + Group Usage + Group Usage Interactions	
	b	p	b	p	b	p	b	p	b	p
Intercept	0.82	0.00	0.65	0.00	0.56	0.00	0.46	0.00	0.05	0.31
Video availability	−0.02	0.00	−0.02	0.00	−0.01	0.00	−0.01	0.00	−0.01	0.00
Time period	0.51	0.00	0.51	0.00	0.37	0.00	0.36	0.00	0.36	0.00
Gender			0.16	0.04	0.08	0.03	0.06	0.16	0.05	0.17
Age			0.00	0.65	0.00	0.53	0.00	0.46	0.00	0.47
Organizational level			−0.11	0.08	−0.07	0.02	−0.07	0.02	−0.07	0.02
Working with others			0.11	0.01	0.08	0.00	0.09	0.00	0.09	0.00
Electronic mail usage			0.02	0.37	0.02	0.07	0.03	0.02	0.03	0.02
Personnel management task			−0.01	0.88	−0.01	0.54	−0.03	0.27	−0.03	0.27
Document tasks			−0.04	0.41	−0.03	0.26	−0.01	0.58	−0.01	0.59
Task analyzability			−0.01	0.86	−0.01	0.72	−0.02	0.43	−0.02	0.42
Work group integration			0.00	0.95	0.01	0.72	0.01	0.44	0.01	0.41
Cruiser subscribers					−0.15	0.00	−0.13	0.00	−0.13	0.00
MTS subscribers					0.92	0.00	0.78	0.00	0.77	0.00
Cruiser subscribers in work group							−0.05	0.00	−0.05	0.00
MTS subscribers in work group							0.13	0.00	0.13	0.00
Integration X Cruiser subscribers in work group									0.00	0.73
Integration X MTS subscribers in work group									0.00	0.70
R-squared	0.17		0.20		0.45		0.47		0.47	

to greater use of that system *and* reduced use of a rival system in a subsequent period. Aggregate use by the communication community as a whole was the strongest of the theoretically interesting predictors of video use. Week-to-week variation in the number of people using the systems explained an additional 14% of the variance in the Cruiser system and 25% of the variance in the MTS system beyond the variance that was attributable to individual differences and the time-based controls (i.e., Model 3 compared to Model 2 in the two regressions). For each of the video systems, people placed more calls in a period following one where a greater number of other people subscribed to that system. The self-reinforcing effect of subscribership was greater for Cruiser (*beta* = 1.1, s.e. = 0.03) than for MTS (*beta* = 0.9, s.e. = 0.03; $t = 17.2$, $p < 0.001$). In addition, for each of the video systems, people placed fewer calls in a period following one where more subscribers used a rival system. This effect of rivalry did not differ between the two systems.

Model 4 in Tables 2 and 3 adds work-group-level subscribership variables. The analysis reveals that increased percentage of subscribership to a particular video system within the work group led to greater use of that system *and* reduced used of a rival system in the next period. For each of the video systems, people placed more calls in the period following one where a larger proportion of their work group used the system. In addition, for each of the video systems, people placed fewer calls in the period following one where a larger proportion of their work group used the rival system. The effects of social influence within the work group revealed in Model 4 is over and above the effects of aggregate social influence revealed in Model 3.

Finally, Model 5 in Tables 2 and 3 adds the interactions

of work group integration with the work-group-level subscribership variables. It shows that the effects of the work group on people's use of the video systems were greater for people who were more integrated into their work groups.

Qualitative Results: Social Influences on the Style of Video Use

Results from the interviews reinforce the quantitative results and provide more detail about the processes through which network externalities and normative influence have their effects.

Externalities

Consistent with the network externalities or critical mass account, participants reported that the number of other people connected to a system, especially those in their work group, was a very important determinant of their use of video telephony in general and of Cruiser in particular. With more subscribers, the systems simply became more useful for doing work. As one user described it,

> 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.

Some participants learned about the value of the systems through their direct experience with successfully placing and receiving video calls. Others learned about the value of the systems less directly. When Cruiser was first introduced, it became a topic of conversation in which new users shared their experiences, and people found out who else was using the systems. 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'." These types of comments provided potential users both normative evidence—that they should use the system—and utilitarian evidence—that if they used it, they would have someone to talk to.

The new medium became incorporated into standard work practices. As one person put it, "I almost always use Cruiser for talking to them [other people in their project]."

The positive network externalities to the Cruiser system that resulted from the growing base of users involved more than an increase in the number of potential communication partners. The large subscriber base encouraged the development of ancillary communication services, which in turn further increased the system's value and usage. For example, in the last quarter of the trial, when approximately 60 people subscribed to the Cruiser system per week, the developers started to routinely broadcast corporate presentations and technical seminars over the Cruiser system. These seminars were not broadcast on the MTS system. Evaluations showed that participants found this new service valuable, and other people sought to subscribe to receive these broadcasts.

Development of Usage Norms

The growing subscriber base did not merely change the value of the video systems; it also influenced how people used the systems. By interacting with others and observing them, participants developed social norms about whether they should be using the new technology, how they could use it, whom they could legitimately call and for what purposes, and how to handle privacy and interruption. The work group was an especially important source of social norms because interaction within the group was frequent, because group members were credible and powerful sources of influence, and because the group provided a low-risk environment for trying out the new systems.

Example: Access, Intrusion, and Privacy. We illustrate these points through a discussion of how participants learned to regulate access and to handle problems of intrusion when placing and receiving video calls. With some features of face-to-face communication, some features of the telephone, and some totally new capabilities, the video systems were an ambiguous technology. At least initially, users were uncertain about the communication protocols to follow when placing calls. For example, people occasionally called others who were in the midst of face-to-face meetings in their offices. As with the telephone, callers did not know the state of the called party before placing a call. But as in face-to-face communication, once communication was established, callers could immediately see all of the people whom they had interrupted with their call and, in turn, could be seen by them, and could converse with them. Early on, when they found themselves interrupting a informal conversation among people they knew, callers did not know whether they should announce their presence, silently disconnect, or simply join the ongoing conversation. These uncertainties meant that using the video systems carried an element of social risk.

Among new users, concerns about intrusiveness often resulted in hesitancy to use the systems in other than "safe" situations. Over time and with sufficient exposure to the experiences of others, though, people developed shared understandings about acceptable behavior, which increased their comfort. These norms differentiated calls to regular communication partners from calls to relative strangers, as indicated by these two respondents:

> 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. . . . They see me peep in but they don't mind if I just hang out while they are busy because I won't say anything . . . With people I don't call a lot, it's always interrupting them.

> I use it to talk to people in my group . . . very rarely for people outside the group. . . . Whereas people outside the group, you are not sure if you are interrupting something that they are doing and you are going to talk to them about something that is completely different than what they are doing now.

While the net effect of having more Cruiser users on the network was generally self-reinforcing, the increased communication enabled by the video telephony systems also generated more interruptions. New users had to learn acceptable methods for managing intrusiveness, both for themselves and for others, while at the same time honoring the pre-existing norm in this organization that employees should be easily accessible to one another. Interviewees reported that they felt an obligation to be continuously accessible to others; the norm was expressed in organizational practices such as shared offices and employees typically keeping their office doors open during the day.

Both video systems had features that allowed the recipients of calls to control the ease with which others could have access to them. Within work groups, where interaction was more frequent, people developed norms about reciprocity and about accessibility. Their use of the accessibility controls was both instrumental (subscribers would limit interruptions by selectively accepting calls) and symbolic (by occasionally changing their accessibility settings, subscribers gave callers a way to gauge the social significance of their intrusions). People in the organization accepted their responsibility to protect their own privacy. For example, when discussing personnel matters, managers would typically set their access controls to accept no video calls or would even disassemble cameras and microphones to ensure that no one would overhear their discussions.

However, people overwhelmingly set their accessibility controls to an "auto acceptance" mode, so calls could be completed without the recipient having to explicitly accept them. Averaging over all time periods and all subscribers to the Cruiser system, system records showed that participants used the auto accept mode 92% of the time. People developed a sense of how to use Cruiser by observing the "normal" uses made by others, especially in their work group:

> I keep it on auto accept. As far as I know nobody uses them [the privacy controls]. Everybody I call tends to accept automatically.

Developing New Norms and Techniques. Because of this normative use, people were able develop new techniques for social interaction via video telephony. For example, users developed a technique where they would call an office to see if the occupant was available and maintained the connection until an absent occupant returned, while at the same time continuing their own desk work.

Other new techniques for social interaction did not rely upon the norm of automatically accepting calls. For example, people developed a technique for virtually shared offices. Some types of collaborative work, such as jointly writing a paper or preparing a presentation, require frequent exchanges of information alternating with periods of individual work. When subscribers were conducting sustained collaboration, they would sometimes connect their video phones for hours or days, foregoing the overhead of starting a new video phone connection each time. However, these long-duration calls interfered with conventional calls; other callers received a busy signal instead of a connection. To accommodate the practice of virtual shared offices (and the use of the video phones to connect to televisions and other long duration video sources), the developers created a method allowing users to prioritize connections. Subscribers could designate their virtual office as a low-priority connection, which could be automatically interrupted to accept a higher priority, incoming call.

As the volume of communication increased, people were more likely to engage the access settings that allowed them to control the flow of communication, thereby signalling to others that the call volume they were receiving was excessive; this in turn affected subsequent callers' behaviors:

> Initially I had it on 'auto accept'. Then I was getting far too many calls, getting interrupted far too often. Then I set it back on 'select [to accept or not] every call', and I guess people saw that and started to call me less frequently, and now I have it back on 'auto accept'.

Because it took less effort to communicate over the video systems than required for face-to-face communication, subscribers who resided in groups with many active users were more likely to receive calls of little value to them. As a result, when people made decisions about which calls to accept, they somewhat paradoxically tended to place a premium on calls from outside the group. As one subscriber explained this rule,

> I would accept the call from somebody I never got a call from before. Also, someone who called me very rarely, I would accept their calls, but I would ignore calls from most other people. That would include members of my group.

Summary of Qualitative Analysis

In summary, by observing others and interacting with them, users and potential users discovered who was using the video systems, formed opinions about their value, and developed communal norms about how to adapt the systems to the ongoing social practices of the organization and to their own needs to balance communication with solitude. They developed new techniques for using the systems (e.g., hanging out in an empty office until its owner returned) and appropriated features of the systems (e.g., the access controls) based on these norms. The development of norms around these topics increased the net utility of using the systems as well as directly shaping the manner of use. Once norms became established, the social costs of using the systems from sources such as embarrassment decreased and the fit of the technology to their work needs increased. The work group was an incubator for the formation of the norms.

Discussion

We found support for both utility and normative explanations for how people adopt and use video telephony. People who used one video telephony system tended to use the other system as well. Consistent with contingency theory, people in the most communication-intensive jobs were the most likely to use video telephony. In addition, people who worked primarily with documents were least likely to use it. Consistent with media richness theory, people with less analyzable jobs used video telephony more. However, inconsistent with media richness theory, managers and people who had people-management jobs did not use it more.

While a contingency model can partially explain individual differences in use of video telephony in this setting, it cannot explain the two most interesting outcomes of this study: (1) use of video telephony varied over time, and (2) among two virtually identical video telephony systems, one eventually dominated the other. Here social influence was vital. People used a particular system more when more people in general were using it and when more people in their own work groups were using it. In contrast, they used a particular system less when more people in general were using a rival system and when more people in their work groups were using the rival system. Further, the effects of social influence in the work group was strongest among the people most integrated with them.

Other people and their use of the systems influenced a focal individual's behavior in two conceptually distinct, but empirically entangled, ways. First, they changed the benefits and costs associated with using the systems and thus their utility. Increased subscription overall and within one's work group increased the number of people with whom one could communicate and the volume of communication one could have over the systems. A large subscribership also provided the incentive for third parties to offer ancillary services, such as the seminar broadcast or the call prioritizing services. Concentrated use within one's work group provided a safe environment in which to experiment with the new media and to work out new social protocols. These factors all increased the media's net utility. But as the interviews suggest, increased subscribership had some negative effects as well, such as increased exposure to interruption, thus decreasing the system's utility.

The self-reinforcing nature of positive network externalities frequently leads to the amplification of early advantages and, as happened in this organization, can lead to a "tipping point," so that one communication system ultimately dominates (Katz and Shapiro 1994). Critical mass theory predicts the "all or nothing" phenomenon observed in this study, but it provides only loose guidance about the factors that influence which of multiple systems will dominate, when one does. Economists note that small perturbations early in a system's history may have large effects later on, and that accidents and unique events can play an important role. In other cases of tipping, factors that seemed to predict the outcome included which system was introduced first, which had the more powerful sponsor, and which offered the most early benefits. In the case of the video telephony systems in this trial, the advertising and training offered by the supporters of one system may have recruited enough early users to have tipped the balance between the rival systems, thus overcoming the otherwise fairly equivalent utilities offered by each system, and increasing positive social influences on use of Cruiser. More systematic research on the determinants of tipping among competing communication systems is needed.

Tipping, however, is not a necessary outcome of an early advantage, since competitive systems may be different enough that they can appeal to different resources and derived benefits of potential users (Markus 1990). Thus, for example, electronic mail and fax are, in many ways, functionally equivalent messaging systems, but both of them have had rapid growth, and neither shows signs of dominating the other (see Straub 1994 for some ways they differ).

While the account so far has emphasized the manner in which increased numbers of users change the objective value of a communication medium, subscribership also influences use by changing the normative environment surrounding the new technology. Each subscriber to a

system or defector from it is a potential source of influence, changing the legitimacy of its use, as well as sources of usage norms. Observations of people using the new medium, and discussion with them, helped potential users in this setting develop a set of socially shared beliefs about the value of the systems and about how they should be used. These norms about how to use the video systems were especially important, as users struggled to figure out how to maintain their open work environments, how to limit interruptions that others imposed on them, and how to handle the social gaffes that occurred when their video call interrupted an ongoing meeting. Experimentation within work groups was influential in helping early users to define the meaning of the new technology, to experiment with the system in a safe environment, to develop norms for polite use, and even to invent new rituals involving it.

Use of a communication system by members of one's primary group is an especially important determinant of a potential adopter's behavior. Use in the work group encourages adoption through *multiple* routes. Use by work group members increases the system's value through local positive network externalities. But primary groups also encourage or discourage adoption by displaying norms legitimizing or devaluing its use. Increasing numbers of calls made by members of a work group seem to stimulate other members' own calls. Interviews suggest that work groups were also influential in helping early users to define the meaning of the new technology, to experiment with the system in a safe environment, to develop norms for polite use, and even to invent new applications.

Organizational implementers and users might use such results to help identify where and how to introduce such systems. For example, given the importance of the size of the communications community that new technology supports, implementers might want to offer subsidies (perhaps in the form of training or free software) to early adopters. Given the importance of the work group, as a site with pre-existing shared utilities and shared social norms, implementers might try to saturate particular workgroups before offering the new technology more broadly in an organization. Finally, implementation efforts, as well as the systems themselves, should provide opportunities for veteran users to discuss relevant usage norms with potential new ones, thus avoiding ambiguous risks that stifle adoption.

Clearly there are limitations to this research. The reliabilities of some of our measures were low (less than 0.80), which means that we might have understated actual relationships among latent variables. Our research is fundamentally a case study, where unique characteristics of the organization, participants, or technology may limit the generalizability of the findings. The research was conducted in an R&D company, and most of the participants were technically adept, which may have lowered adoption thresholds and increased perceived utilities. Because two virtually identical technological systems were introduced into a single organization simultaneously, system features probably had less influence on the adoption decisions in this organization than in others where the diffusion of innovations has been studied.

On the other hand, it is precisely because of the unique features of this setting that we can see the effects of social influence with such clarity. By combining multiple methods and observing the unfolding of the introduction of technology over time, the study explicated several typically confounded concepts.

In conclusion, this case study shows that *both utility and normative theories* are necessary to explain how new communication technology diffuses through an organization. The rivalry between these theories of media adoption suggested by some writers is, we believe, a straw argument. Both routes to the adoption of a new technology coexist and are often reinforcing; both are deeply interwined in organizational life, and both can "make or break" the adoption of a new communication system. Our research demonstrated that other people's behavior, both in the aggregate and as members of a potential adopter's work group, influences adoption and use through two conceptually distinct mechanisms: by changing the objective value of a communication system and by generating norms defining appropriate use. We hope our analyses provide some conceptual clarity about the utility and normative mechanisms that are both social influences on the use of new media and suggest some issues to explicitly consider in implementing new organizational communication systems.

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Endnotes

[1]Externalities may be negative: as more people use a communication system, it may become congested, response times may degrade, and information overload or privacy violations, in which others intrude upon one's solitude, may increase.

[2]The 20 employees who were involved in building and maintaining the systems received the questionnaires after they had been using the systems.

[3]Interviews primarily involved experiences with the Cruiser system,

since after the early states of the trial, use of MTS declined and eventually dropped to zero.

[4]The system provided information only about email messages received.

[5]To handle computational problems, 1 was added to the number of calls before computing the log, i.e., Log2(#Calls) = Log2(#Calls + 1).

[6]Note that this is not a "difference" score sometimes used in regressions where a variable's value at time 1 is subtracted from the variable's value at time 2, and the difference is the dependent variable regressed upon predictor variables. For such analyses, using the residual is the preferred statistical approach. Rather, this is the difference between an individual's use of one system and the individual's use of the other system. We are simply analyzing the differential usage of the two systems at particular time periods.

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