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PERSPECTIVES FOR THE DEVELOPMENT OF RESEARCH

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ABSTRACT

PERSPECTIVES FOR THE DEVELOPMENT OF RESEARCH ON MEDIA SYSTEMS

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This dissertation explores implications of new communication technologies for communication research.

The following propositions are derived for a new model of communication: 1) Information is always sought or selected, not merely sent; 2) Media systems require different levels of user activity; 3) Activity is a user trait as well as a medium trait; 4) Person-machine interactions are a special form of communication; 5)Continuous feedback is a special kind of feedback in which use behavior is measured on an ongoing basis by a source or gatekeeper, for all users; 6) The distinction between source and receiver is not present in all media systems; 7) Media systems may facilitate mass communication, interpersonal communication, or both.

Chapter 2 presents a model of information exchange which can be applied to intrapersonal, interpersonal and mass mediated and unmediated information exchange. The new model is consistent with the propositions identified above.

The following propositions for research are derived from technological proliferation issues: 1) Rather than confusing channel with medium, channel is distinct (the combination of senses by which information is perceived); 2) Telecommunication technology refers to a class of devices and techniques from which media systems can be created; 3) Media system rather than medium should be used to refer to a specific technological, social, and economic information service structure; 4) Research must look beyond the individual media systems to underlying factors which vary across media systems.

Chapter 3 quantifies media system attributes related to interactivity and channel and tests a taxonomy of media systems differentiated by function: Mediated intrapersonal, interpersonal and mass information exchange as well as integrated or multifunction systems. The classification system is statistically significant using discriminant analysis on a set of 53 hypothetical media systems.

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Chapter 1: Propositions for Change

This dissertation will explore implications of new communication technologies for mass communication research. Chapter 1 will review criticisms of traditional conceptualizations of communication in light of technological change. A series of propositions for change will be offered. Specifically, implications will be derived from two key facets of new technologies: 1) the numerous dimensions of interactivity now possible over media systems and 2) the technological proliferation of new media systems. Proposed changes in traditional models of communication will be integrated in Chapter 2 to create a model of information exchange consistent with the criticisms reviewed in Chapter 1. Chapter 3 will propose and define media system attributes and test a taxonomy consistent with the proposed research changes related to technological proliferation. Research implications will be discussed in Chapters 2 and 3.

INTRODUCTION

Communication scholars widely recognize a need to reconceptualize communication, in part because of changes brought about by new telecommunication technologies. Rogers and Chaffee (1983) argue that "scholars are going to have to

shift toward models that acommodate the interactivity of most of the new communication technologies. New paradigms are needed, based on new intellectual terminology."[1] Rice and Williams (1984) concur. "New media may, in fact, necessitate a considerable reassessment of communication research. Intellectual changes must occur to match the growing changes in communication behavior."[2]

Developments in telecommunication technologies continue to alter the ways in which we can communicate. Broadband cable, fiber optics and various other transmission media provide wider bandwidth to carry more (and more complex) signals simultaneously. Systems which combine telecommunication and computer technologies allow diverse configurations for user involvement and services. What has traditionally been considered mass communication is complicated with many new "media" and different kinds of "masses" than before. The ability to engage in mediated interpersonal communication becomes increasingly available in a variety of manners.

An inclusive perspective encompasses recent technological developments affecting the telecommunication and computer industries, such as teleconferencing, computer conferencing, VCRs, videotex, teletext, electronic mail, cable television and two-way cable, cellular radio, satellites, fiber optics, microcomputers, videodisc, audiodisc, design, facsimile, stereo TV and radio, call forwarding and so on. The list is an intentional mixture of

technologies, applications, and adaptations of old technologies. The point is not to attempt to differentiate whether or not a technology is "new" so much as to recognize that what is technologically possible in the realm of communication has changed dramatically in the last decade and will continue to do so.

These technological developments illuminate inadequacies in and issues relevant to traditional conceptualizations of communication, particularly mass communication. Few if any of the problems or solutions are unique to new telecommunication technologies; they have been raised by communication scholars in many areas. But for those studying new technologies, the need to address such issues is more immediate because many of the anomalies of the old models are physical realities as well as conceptual concerns. (For example, interpersonal scholars have suggested that receivers should be conceived of as playing a more active role in the communication process, whereas new technology researchers are studying computer-based electronic text news services such as videotex and teletext where "receivers" must play an active role, selecting each page of specific content they wish view.) This chapter will briefly review traditional conceptualizations of mass communication. Properties of new technologies which may necessitate changes in those traditional conceptualizations will be outlined and used to organize criticisms of existing models and propositions for a new model. Research implications of the proliferation of technological

development will be explored and clarifying definitions offered.

REVIEW OF TRADITIONAL CONCEPTUALIZATIONS

Mass communication has primarily been modeled as the one-way transmission of a message from source to receiver. Shannon and Weaver's (1949) mathematical theory of communication defines a communication system as an information source which produces messages to be communicated, a transmitter which operates on the message to produce a transmittable signal, a channel or medium to carry the signal to a receiver (the opposite of a transmitter), and a destination (the person or thing for whom the message is intended).[3] Noise on the channel interferes with accurate tranmission (see Figure 1). Although their model was developed to help engineers describe transmission of an electrical signal from one machine to another, it was widely adopted by communication researchers as a model for human communication. Osgood (1956) added the idea of human "encoding" and "decoding" of messages, referring to the translation of thought into expression, or the interpretation of expression as thought.[4] The mechanics of encoding and decoding were not articulated in Osgood's model; he merely noted that the processes occurred.

Shannon and Weaver (1949) outlined three levels of communication problems their model was designed to address: 1) technical problems: how accurately can communication symbols be transmitted; 2) semantic problems: how precisely

do the transmitted symbols convey the desired meaning; and 3) effectiveness problems: how effectively does the received meaning affect conduct in the desired way.[5] Their model is mechanistic, resembling a technical system. It also assumes that communication is purposive: that there is a desired impact. Early mass media research focused on purposive communication.

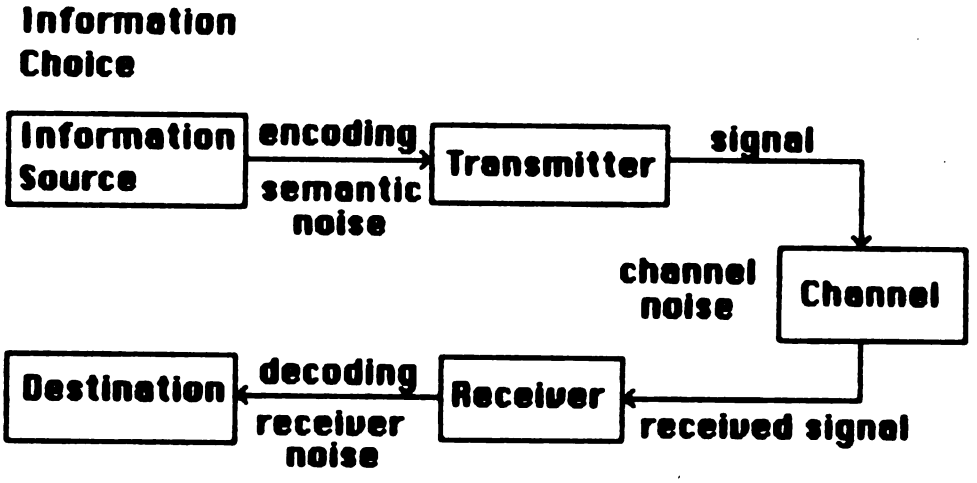

Figure 1. Shannon and Weaver's Model

In the aftermath of World War I, the "magic bullet" or "hypodermic needle" theory of mass media effects emerged: a belief that media propoganda had great power to influence public opinion (DeFleur and Ball-Rokeach, 1982).[6] Instinct psychology was at its peak, proposing uniformity of human nature and therefore uniformity of mass media effects. "The basic idea behind these [theories] is that media messages are received in a uniform way by every member of the

audience and that immediate and direct responses are triggered by such stimuli."[7]

Research findings failed to provide dramatic proof of uniform media effects and new perspectives emerged. The "two-step flow" model of media effects recognized that some people consume more mass media than others. Thus, information transmitted by the media may reach relatively well informed individuals (opinion leaders) who frequently attend to mass communication. The information is then passed on to those with less direct media exposure, through interpersonal communication. DeFleur and Ball-Rokeach (1982) label this the "social relations" perspective of media effects because it accounts for the influence of informal social relationships.[8] In this one-way flow of information, a media message is sent to opinion leader receivers who transmit it in person to low media users.

Alternatively, the "social categories" perspective assumes that people with similar locations in society will relate their orientation and behavior to "such phenomena as the mass media in a fairly uniform manner (DeFleur and Ball-Rokeach, 1982)."[9] Individuals may not respond uniformly to mass media, but members of the same social group do. Sex, age, and education remain among the best predictors of media use habits. They serve as the primary intervening variables in this adaptation of the magic bullet theory (mediating direct, uniform effects), as do opinion leaders in the social relations perspective.

A third major perspective is that of individual differences. "The logical structure of the individual differences view of media effects is also a "cause (intervening process)-effects" structure, just as was the magic bullet theory before it (DeFleur and Ball-Rokeach, 1982)."[10] Here however, the intervening processes are variations in personal-psychological orientation, due to both biological and learning experiences.

"The principal of selective attention and perception was formulated as a fundamental proposition regarding the way ordinary people confronted the content of the mass media."[11] Selective attention and perception suggest that individuals selectively attend to media messages, noticing some and ignoring others. Selective perception results in different impacts of the same message. An example of selective attention and perception (which presumably act together during media exposure) is the differential effects found for All in the Family, a television sitcom portraying a bigoted character in a humorous manner. Those viewers who were initially prejudiced perceived Archie Bunker to be credible, while those who reported low prejudice found him pathetic or laughable (Surlin and Tate, 1976).[12]

Westley and MacLean (1957) proposed a model which included features particularly pertinent to mass communication (see Figure 2).[13] They introduced the concept of a gatekeeper, "C," (for example, a newspaper editor or TV news editor) who selects messages about external stimuli to which a receiver, "B," is not otherwise exposed, and

transmits those messages to receivers. An original source, "A," may also exist (for example, a government official holding a press conference). The importance of gatekeepers is their role in selecting the information to which receivers can be exposed.

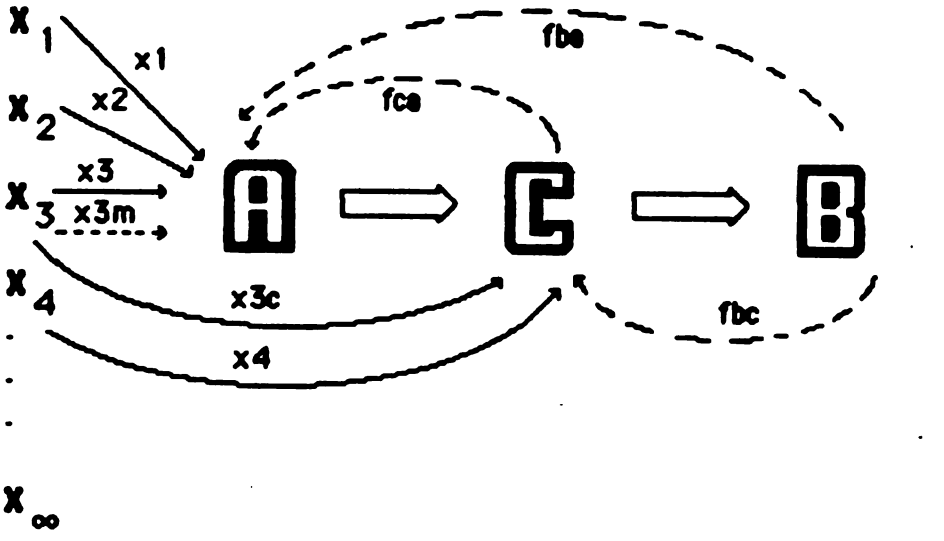

Figure 2. Westley and MacLean's Model

Westley and MacLean also introduced the concept of feedback: responses from the receiver to the source, in reaction to receiving a message. In traditional mass media, feedback takes such forms as letters to an editor or phone calls to a TV or radio station, or purchasing an advertised product. The majority of mass media receivers do not engage in feedback for the majority of messages.

Westley and MacLean's (1957) addition of the concept of feedback moved away from a one-way flow of information, but

not to the extent of considering the receiver as a full-fledged deliverer of messages.[14] Even in interpersonal communication, where in practice there has been a two-way flow of messages all along, all receiver responses to a source's messages are considered feedback, rather than messages in their own right. Responses to an original message were somehow given second class treatment, perhaps due to the orientation toward purposive communication.

All of these perspectives basically maintain a one-way flow view of mass media, as do other models of communication which have been developed. Lasswell's (1949) verbal model, "who says what to whom in what channels with what effects," further exemplifies an overall concern with media effects.[15] Berlo (1960) and Schramm and Roberts (1971) offer similar models differentiating source, message, channel and receiver.[16]

DIMENSIONS OF INTERACTIVITY

Most of the newer technologies feature increased interactivity. Rice (1984) defines new media as communication technologies "that allow or facilitate interactivity among users or between users and information."[17] Rafaeli (1985) suggests that "studying interactivity is the special intellectual niche for communication researchers" in the realm of computers.[18] Interactivity is often cited as a primary distinction of new technologies, but the term is rarely defined. When it is, a range of meanings emerge. This chapter proposes that

interactivity as it relates to communication technologies is a multi-dimensional concept. In this section, six dimensions of interactivity are defined.

Dimension 1: Complexity of Choice Available

Rice (1984) approached interactivity in terms of the amount of choice provided to users.[19] He selected this definition because more user choice makes it difficult to define a particular mass using a specified content of a given medium at a particular time. When more choice of content is available, the audience for any particular content at a given time is smaller. Broadcast television initially provided users almost exclusively with the three major network channels. Broadcast television is a mass medium in the traditional sense, reaching large mass audiences with the same program content at the same time. Cable television carries many channels, and the handful of subscribers choosing to use a public access program resembles a specialized audience fragment more than a mass audience. Even more disparate from the original concept of mass audience are media such as videotex. The group of subscribers accessing a particular page of videotex from the hundreds or millions of pages available at the same moment is minute. When users are provided with a choice, they must interact with a medium in the sense that they must make a choice. This dimension of interactivity concerns <u>the extent to which users are provided with a choice of available information.</u> (Information in this context

includes any sort of media content, be it entertaining, persuasive or educational.)

Dimension 2: Effort Users Must Exert

Researchers have also defined interactivity as the amount of effort a user of a media system must exert to access information. Paisley (1983), in his work with the videotex system Green Thumb, defined interactivity mathematically as "the ratio of user activity to system activity."[20] At one extreme is cabletext (alphanumeric cable channels which provide a repeating cycle of text information). Cabletext has a zero ratio of user to system activity. Once tuned to the cabletext channel, users exert no effort beyond watching and reading the text information which the cable operator provides on that channel. At the other extreme is The Source (an alphanumeric computer network which provides news retrieval and other interactive services to subscribers). Paisley considers The Source to be near parity (a one-to-one ratio of user and system activity). In accessing news stories on The Source, users select each page they view, sending a message to the central computer asking to display the requested page. Diverging from Paisley's mathematical ratio but maintaining the focus on user effort, this concept can be broadened. For example, videocassette recorder users must more exert effort traveling to a rental store to pick up a tape than broadcast viewers do sitting down to watch television. A second

dimension of interactivity is the amount of effort users must exert to access information.

Dimension 3: Responsiveness to the User

Rafaeli (1985) defines interactivity as a continuous variable measuring how "actively responsive" a medium is to users.[21] He focuses on interactivity from a user's perspective. Responsiveness is defined as conversationality, or the degree to which a communication exchange resembles human discourse. Some degree of "intelligence" is necessary in both the user and the medium being interacted with. Rafaeli does not define intelligence other than to clarify that it could be artificial or natural. Technologically, intelligence might reside in a computer processor, either micro- or mainframe which is capable of recognizing and responding to information. The sophistication with which a processor is capable of responding to information varies widely. The microprocessor in a microwave oven is programmed to store and react to input about time and temperature. The central processor in a mainframe computer can be programmed to run all manner of software, for a variety of tasks. Rafaeli considers the sophistication of a processor from a user's perspective. Human-like responsiveness as the highest level of sophistication. Thus, "ultimate interactivity is achieved when communication roles [of human and machine] are interchangeable and any third exchange in a series of communication transmissions is predicated on the bearings of

the second exchange on the first."[22] Rafaeli points out that ultimate interactivity is currently difficult or impossible for media systems to achieve. (Human communication also does not always achieve that ideal in conversationality.) However, media systems can begin to electronically approach human discourse standards of responsiveness. Artificial intelligence research is an attempt to do just that. Teletext and videotex programmers may achieve lesser levels of responsiveness by programming instructions, help pages and error messages. Teaching machines and computer aided instruction offer programmed interactive instruction which requires responses from and provides feedback to learners, to improve performance (Pressey, 1964).[23] The third dimension of interactivity is the degree to which a medium can react responsively to a user. (Media systems can also interpose a human who responds to user queries, for example, the telephone operator. Thus media systems can be technologically or humanly responsive to users.)

Dimension 4: Monitoring Information Use

New technologies are also changing the nature of feedback. With traditional media such as television, radio and newspapers feedback refers primarily to media users calling or writing to the station management or editors. Newspapers conduct occasional reader surveys. For commercial TV and radio, audience rating services provide station operators and advertisers with data on what programs

different types of people consume. A small sample of the audience is measured, usually by telephone survey, to generalize to overall viewing and listening habits. Stations drop programming which appeals to too small an audience and search for more popular content.

With some of the new technologies user selection of information can be monitored on a continuous basis, across the entire population of users. Videotex central computers can track every screen of information each user accesses. Similarly, videocassette rental outfits can monitor use of their film library. Two-way cable television systems can monitor viewership. The potential for continuous monitoring of system use has implications for billing and for programming system content to meet user interests. The fourth dimension of interactivity is the potential to monitor system use.

Dimension 5: Ease of Adding Information

With some new technologies, users actually act as an information source, providing information which is carried on a media system to other users. Broadcast television carries virtually no user-programmed content (with the occasional exception of an editorial comment). Electronic bulletin boards, on the other hand, are computer-based systems which link users by telephone to public message databases comprised almost entirely of user-generated content. Similarly, when cable television franchises provide public access channels, they offer a means for users

to act as information providers. Some videotex systems permit users to add pages of information directly to the system's central database information collection. When a user can act as a source of information which is communicated to a mass audience, the traditional user role is substantially changed. A fifth dimension of interactivity is the degree to which users can add information to the system that a mass, undifferentiated audience can access.

Dimension 6: Facilitation of Interpersonal Communication

The dimensions of interactivity articulated up to this point apply primarily to mass communication, in which information is provided to many users. But interpersonal communication (communication between two people or among a small group of people, in which each participant can send and receive messages with each other participant)[24] is also increasingly possible over technical systems. Media systems impose limitations on interpersonal communication which are not present in face to face interpersonal communication. Teleconferences can be configured to simulate face to face communication to varying degrees. Some teleconferences offer no possibility for interaction between source and receiver, involving merely the transmission of a television signal to a specific group or groups of receivers. Other configurations allow the receivers to ask questions of the teleconference originators by telephone. More fully interactive teleconferences provide full motion video

origination capability to all participants. The interpersonal communication possible is still limited by the choice of camera shots transmitted at any given time, and with the traditional channel limitations of video and audio resolution of television.

In computer conferencing, interpersonal communication can also exist, limited to an alphanumeric text channel for communication but varying in time limitations. Some computer conferences are asynchronous, with users responding to messages at different points in time during a day or week. Others are synchronous, with all conference participants participating concurrently. The computer conference most similar to face to face communication would allow any participant to communicate with any other participant, simultaneously. The time element of communication has rarely been discussed by communication scholars other than to say that communication by mail involves a delay. Technologies now permit machines to process faster than humans can, with data transfers occurring at fractions of a second. On the other extreme, during asynchronous computer conferences, the system may "wait" for a minute or a week for the user to finish typing a sentence. Time, channel and various other elements may facilitate or inhibit interpersonal communication. The final dimension of interactivity is the degree to which a media system facilitates interpersonal communication between specific users. Many technologies such as broadcast television allow for no interpersonal communication.

These six dimensions of interactivity will be used to focus a synthesis of conceptual communication issues raised by developing technologies.

IMPLICATIONS OF INTERACTIVITY

In this section propositions about mass communication related to the six dimensions of interactivity will be derived, for use in developing a new model of communication. In some cases implications relate to more than one dimension of interactivity and the dimensions are discussed together.

Complexity and Amount of User Choice

> "Broadcast television is like the passenger railroad, taking people to scheduled places at scheduled times. Cable television has the potential of becoming like a highway network, permitting people to use their television sets in the way they use their personal automobile; they may be able to select information, education and entertainment at times and places of their own choosing (Parker and Dunn, 1972)."25

New technologies frequently offer users more choice of content than traditional technologies. The minimal level of user choice might be the captive audience-- for example, a videotape being shown in a classroom (or for that matter, an in-person lecture). The student can ignore the message, but selectivity operates most often in selective attention, perception and retention. Somewhat more choice is offered to the home viewer in a community with a single broadcast television station. A watch-don't watch option is available in addition to the option of whether or not to pay attention once the set is on. Cable television provides users with

more choice: numerous watch-don't watch options at any given time. Rental of videocassettes for home use affords even more choice at any point in time, so much so that users must (rather than can) actively seek content. Unlike cable where the only effort needed is to turn on the set, the VCR rental user must go out, select a tape, bring it home, and choose a time to watch (and return it the next day). Many of the new technologies increase user choice as well as the amount of effort a user must exert to receive content. Some technologies (for example, videotex or VCRs) only provide information that is requested or sought. If the user seeks no information, none is transmitted. At this level, the physical process of communication is quite different from a one-way flow. The connection from source to receiver is activated by receiver actions. In other cases like cable television, engaging in active selection is an option available to the user.

Chen (1984) claims that "we begin to see that passivity and interactivity are qualities of individuals making use of media, not the media themselves."[26] That passivity is a user trait is most true for situations where user activity is optional. Active use characterizes both individuals and media systems. Chaffee points out that we are "already beginning to see theories in which the activation agent is the person, or a social system, in place of linear effects models that assume a message is the stimulus to action (Rogers and Chaffee, 1983)."[27] Chaffee's perspective moves

the research focus to the user as an activator-- a major departure from traditional models.

A move to consider receivers as active participants in the communication process is not unique to new technologies. Miller (1983), taking stock of the communication discipline, also observes a movement toward recognition of receivers as active participants. "Among communication researchers, a respect for the role of human volition has replaced the law-governed, deterministic paradigm of communication behavior."[28] Further, humans actively exercise influence over their environment, rather than passively reacting to it. "Humans can choose among alternative courses of action in the pursuit of their goals"[29] (emphasis Miller's).

White (1983) proposes a receiver-centered paradigm.

> "Initially communication was conceived in terms of a relatively simple paradigm as a direct transfer of a message from the source to the receiver. It was assumed that the completion of the transfer depends largely on the ability of the source to make the receiver accept and implement the message as the souce intends. The paradigm was tested largely by measuring particular effects on attitudes or behavior such as imitative violence, sexual deviance, and voting. Virtually every attempt to test some version of this paradigm revealed "anomalies" which suggested that the activity of the receiver and the sociocultural conditions of the receiver are far more important in the communication process than the initial paradigm would imply. The anomalies have accumulated to the point that a new "receiver-centered" paradigm, or a paradigm in which interacting individuals together create meaning, is proposed as more adequate than the original source-message-receiver model (emphasis mine)."[30]

Schramm (1983) objects now to a one-way flow model, arguing that communication is not a one-way relationship in which a communicator "does something" to a passive audience.

"Now the audience has as much to do with the effects as the communicator. Information flows both ways."[31]

Chaffee points out that the concept of a mass audience becomes archaic, even though mass production of messages does not (Rogers and Chaffee, 1983).[32] No longer is there a mass, undifferentiated audience receiving the same information at the same relative time, but instead audiences are characteristically specialized, often small and differentiated, with more in common with other consumers of the same content. Audience fragmentation-- away from simultaneous nationally shared information content-- and audience segmentation-- development of special-interest channels or content with relatively homogenous audience segments, though not necessarily large in size-- occur.

De Sola Pool (1983) suggests a change in research focus brought about by new technologies. The effects of mass media

> "is not the salient question to ask about an information retrieval system. If people have access to an enormous range of information and are able to choose what they want out of it, they may have all sorts of problems in skill and motivation in finding just what they want, but no one is telling them what ought to be heard or seen. This situation makes the user more interesting than the effects of the messages on that user."[33]

Selective exposure research is an example of a receiver-oriented perspective already developed. The focus of this research is on why and how individuals expose themselves to information, rather than how media affect them. Zillmann and Bryant's (1985) book reviews current

research directions.[34] The earliest selective exposure research applied Leon Festinger's (1957) theory of cognitive dissonance to predict that information is selected on the basis of its consistency with attitudes, beliefs and behaviors.[35] Information dissonant with such cognitions or behaviors is avoided (not selected) (Cotton, 1985).[36] A universal principle is used to try to explain exposure, as did the magic bullet theory of effects.

The uses and gratifications approach to selective exposure has also been an active research area. Media exposure is believed to be motivated by anticipation of intrinsic gratifications (transitory mental or emotional responses) and in part, by utilitarian considerations or uses, such as guidance-seeking or utility for conversation (Atkin, 1985).[37] Different individuals seek different uses and gratifications -- an individual differences approach to a receiver-oriented model. A related individual differences approach is selectivity as a receiver trait, already suggested by Chen and exemplified by Heeter and Greenberg's (1985) analysis of cable viewing styles. Here, a model of the choice process in selecting programs to watch was developed, and viewers were found to engage in selectivity (examining options and changing channels) at different rates.[38]

Increased user choice is only one element of technological change. The implications of this capability are summarized below as propositions for developing a new model of mass communication.

P1: Information is always sought or selected, not merely sent.

P2: Media systems require different levels of user activity. (Users are always active to some extent.)

P3: Activity is a user trait as well as a medium trait. (Some media are more interactive than others; some receivers are more active than others.)

Degree of Responsiveness to the User

The enhanced potential for people and machines to exchange information enabled by technological development raise the issue of whether that interaction should be considered communication.

An example of a simple person-machine interaction might be with videotex where users are frequently offered menus of choices (e.g., within news: 1=world, 2=nation, 3=local, 4=business, 5=people, 6=weather, 7=sports). The user selects a numbered option by pressing a key on the keypad. That selection is transmitted to a local or distributed intelligence which is programmed to receive and interpret the signal and to transmit or display the particular page of information the user requests. More sophisticated interactions can also occur. On Viewtron (a videotex service based in Miami and offered nationally) users can mark pages of interest to them and the system will automatically show them those marked pages in the marked order whenever they log on to the system. In Toronto, users of Teleguide can select restaurants by filling out multiple criteria electronic questionnaires which ask for desired

price range, location, type of food, and types of credit cards accepted. Educational psychologists built "teaching machines" before the introduction of personal computers, which provided the learner with programmed instruction and instant feedback about the correctness of responses.

At a more extreme level of person-machine interaction, users can write their own machine language computer programs, allowing them to control what the computer does, within the constraints of the language and the device (and the person). In some instances, the machines may exchange information with other machines, for example, a videotex mainframe may contact a restaurant's computer to log a reservation for a user. Eventually, the user's request would reach the people at the restaurant making seating arrangements. (Machine-to-machine exchanges are another area of philosophical interest to communication scholars, but those issues are beyond the scope of this dissertation which focuses on human communication.)

A major issue is whether these interactions should be defined as communication. Hewes (1983) suggests that when we use computers, we communicate with the original system designers and database indexers, programmers, and so on, even though the original programmers may be long gone or far removed from the user's time and place and intent of use.[39] Communication over traditional mass media is usually described as a message sent by a source to a receiver. Thus, when people read a book, they are communicating with the author who created those messages. Much use of new

technologies directly parallels this model. For example, videotex users read pages of news which have been supplied to the system by "sources."

However, computers introduce a form of person-machine exchange which does not necessarily parallel that model. When a person writes a computer program in machine language, they are likely to be doing so in order to use the computer as a tool, to produce some desired result. In a sense they may be considered to be communicating with the original creators of the machine or of machine language. But it is more the case that they are simply using the language that was created, much as we use spoken languages. Computer programers are not seeking to be receivers of mass communication messages. They are using programmed logic and functions as tools to interact with that structure to accomplish some result. It might be said that they are interacting with the computer, rather than with the original creators.

New technologies introduce a wide range of situations which fall somewhere between the two extreme models of computer programming and mass media consumption. Take the example of conducting a computerized bibliographic search. A large collection of bibliographic information exists in computer memory -- too large to be useful in its entirety. The system has been programmed to interact with a user to select specific pieces of information to display. When users respond to or send commands to the computer about what

particular information they desire, they are operating in a simplified computer programming situation, interacting with the computer to accomplish a goal. When they are reading the actual bibliographic information once it has been selected, they are consumers of content created by a source for mass use.

Having suggested that persons and machines do interact, it becomes necessary to integrate that interaction with the concept of communication. Rice and Williams (1984) argue that person-machine interactions should be considered communication, pointing to cognitive psychologists' development of "mental model" theories of person-technology interaction.[40] Rice and Williams cite a theory adapted by Borgman (1982) which posits that "humans, no matter their level of experience, develop images [of a technology] that lead to a conceptual representation of a device which is used in interacting with that device."[41] This mental model theory permits co-orientation models of communication to be applied to human-machine interactions. For example, Newcomb's (1953) co-orientation model of communication (see Figure 3) involves person "A" and person "B" and an external object, "X."[42] From person A's perspective, A holds an attitude toward B and an attitude toward X. A also perceives that B holds an attitude toward A and toward X. Newcomb's theory assumes that there is a "strain toward symmetry" such that there is balance across these relationships. If A likes B and B likes X, A is influenced to like X. If A doesn't like B and B likes X, A may be

influenced to dislike X. If B is a computer or videotex system (or TV channel) instead of a person, the mental model theory suggests that the strain toward symmetry would still apply. Thus, individuals approach machines in a manner similar to how they approach other humans. Perhaps they also approach person-machine interactions like they approach communication.

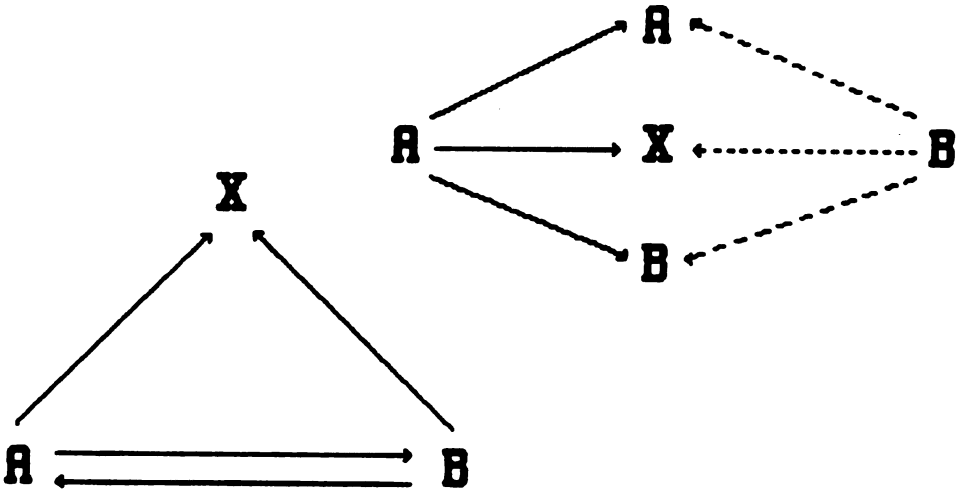

Figure 3. Newcomb's Coorientation Model of Communication

Fredin and Krendl (1984) apply the concept of schema (or script of expectations) to media, calling it a media frame. "A media frame can be defined as a structure of expectations individuals apply to organize and understand their experiences with a particular medium. It is evoked whenever the medium is being thought about or is present."[43] The frame establishes a general relationship between the individual and the medium, and the medium and society.

Fredin and Krendl demonstrated that eighth graders' media frames about computers changed after they used computers to access an electronic encyclopedia. Thus, a media frame evolves over time in response to experiences with a medium. Different people may have different media frames regarding the same media system, affecting their expectations about using the media system.

To say that person-machine interaction is not communication becomes increasingly difficult. Rice (1984) points out that even the legal distinction between communication and processing is blurring. He cites the AT&T divestiture as an example. "The distinctions between processing and communication are useful at the gross level: local distribution and long-haul transmission are officially communication" but not processing. Value-added carriers provide both processing and communication, while service bureaus provide processing but not communications."[44]

P4: Person-machine interactions are a special form of communication.

Degree of Monitoring System Use

The nature of feedback with some new technologies may need clarification and expansion. Arbitron and Nielsen rating companies have long provided estimates of audiences for TV and radio stations. Their measurement techniques include surveys (which are not as precise) and electronically monitored samples of households, used to estimate national audiences. These data are sold to the

stations and to advertisers considering purchase of commercial time. This situation is quite different from that of a two-way cable system or a videotex system in which the system operator has the capability of monitoring all usage with great precision. (And, they are able to prepare their own reports for potential advertisers.) In such situations, the system operators have the potential to intricately link use with content and format features by precisely tracking use behavior. Westley and MacLean's (1957) model of mass communication included the concept of "feedback."[45] Purposive feedback on the part of the receiver includes letters to the editor which give media institutions some idea of the impact of their messages. Nonpurposive feedback is feedback the user does not initiate intentionally. In face to face communication, some body language may provide nonpurposive feedback to another communicator. Purchase behavior is used by advertisers as feedback on the effectiveness of advertisements, as is audience research. Some technologies permit a special kind of nonpurposive feedback which is not optional and rare, but built into the system itself. Continuous feedback, then, is the ongoing measurement of use behavior of a media system. This type of feedback is not an optional user response, but a monitoring of use which users may not be aware of and probably could not avoid if they wanted to. Some media systems can monitor use at point of purchase (e.g., movie theaters). Continuous feedback provided by some

technologies is more extensive, including the ability to track behavior of particular users of time.

P5: Continuous feedback is a special form of feedback in which use behavior is measured on an ongoing basis by a source (e.g., videotex programmer) or gatekeeper (e.g., cable operator) of all users.

Ease of Adding Information by Users

Media systems increasingly permit users to add information to the collection of information available to others using the system. In effect, the user can be a source of mass communication messages received by other users. Electronic bulletin boards are designed to be accessed by various users who add messages to the system for general consumption. Thus, the user is an essential information source (or information provider) for that system. Similarly, in some videotex systems, users can create pages of information and add them to the system. On Viewtron, there is a series of "ask the expert" subroutines, where users "write in" questions and experts write in answers. The questions and the experts' answers are added to the system database, remaining there for a month or more. On Compuserve, users with valuable information are encouraged to formally become "information providers" as well as information users. A further challenge to the traditional one-way flow models of mass communication is this dissolution of the distinction between source and receiver.

P6: The distinction between source and receiver is not present in all media systems.

Facilitation of Interpersonal Communication

Particularly with the various technologies used for conferencing (computer, video and audio conferencing), users can exchange messages with other individuals in situations previously limited to face to face interactions. Telephony, for example, has long been a limited form of interpersonal communication, even though it is "mediated." "Because the new media are interactive and may be used in a variety of new situations-- flexible interpersonal communication (for example, through electronic mail), group communication (through video conferencing), and private use of public information (through videotex)-- the mediated communication is giving way to a continuum of communication behaviors (Rice and Williams, 1984)."[46] This continuum ranges from interpersonal to mass communication, all of which can occur using mediated or unmediated systems. Rogers (Rogers and Chaffee, 1983) claims that "interactive communication represents a historical turning point away from the one-way transmission" of television and other traditional media, because "source and receiver cannot be distinguished in an interactive communication system."[47] Conditions have already been identified under which a user can serve as an information provider to a system, offering messages for mass consumption. In the case of mediated interpersonal communication, all parties may communicate interpersonally with a specific other or others. Rogers asks: will

"participant" replace source and receiver? Will information exchange replace communication?[48]

"One barrier [to a more general theoretical understanding of communication] has been the major division in communication research based on the distinction between interpersonal versus mass media channels (Rogers and Chaffee, 1984)."[49] That arbitrary distinction is breaking down some, in part due to interactive communication technologies. "New communication technologies are no longer occurring just in mass media communication; they are now affecting interpersonal and small-group communication also. The miniaturization of computers is bound to affect the kind of research and theory that we produce, establishing entirely new communication situations (Rogers and Chaffee, 1984)."[50]

P7: Media systems may facilitate mass communication, interpersonal communication, or both.

IMPLICATIONS OF TECHNOLOGICAL PROLIFERATION

Perhaps even more striking than the elaborate capabilities of any particular new technology is the proliferation of technological developments itself -- the seemingly endless parade of new products, services and possibilities. Communication researchers will have to find a way to deal with constant introduction of new media, developing models and theories and methods which do not become outdated or fragmented each time a new technology is introduced.

Wartella and Reeves (1985) review historical research trends for children and media, contending that the emphasis on research topics was "influenced by public debate about changing media technologies."[51] As public concerns about film gave way to concern about radio and then television, academic research made corresponding shifts. They write: "...we are impressed by the overwhelming similarity in the research studies from epoch to epoch, with a new technology substituted as the object of concern."[52]

The range of new technologies which could now follow that same repetitive pattern of research is prohibitively vast. Are videotex and videodisc and computers and high resolution television (and so on) all candidates for their own intensive use and impact studies? The proliferation of technologies demands a rethinking of this approach.

Rice (1984) reviews research literature comparing the appropriateness of different channels of communication for various communication activities. He suggests that "the notion that the channel of communication might be as important a variable in the communication process as source, message, receiver and feedback, may have been overlooked."[53]

Researchers have begun to identify features of media systems which permit comparisons across media. Many of the features identified and media systems studied evidence confused terminology and non-parallel comparisons. For example, Short, Williams and Christie (1976) developed the

concept of social presence of a medium, which Rice (1984) describes as

> "at best a vague concept, never clearly defined by its proponents. Social presence is typically marked by such adjectives as sociable, sensitive, warm and personal, yet is never explicitly operationalized."[55]

Short et al. compared the social presence ratings of face-to-face communication, television, multi-speaker audio, telephone audio and business letters. (See Table 1.) Face-to-face communication was rated as offering the most social presence, and business letters the least.[56]

Table 1. Social Presence Ratings of Five Media

Face-to-Face	.81
TV	.24
Multi-speaker audio	-.18
Telephone audio	-.52
Business letter	-.85

(index ranges from +.9 to -.9)

Phillips (1983) continued this search for characteristic differences among media. She compares college students' perceptions of familiarity, importance and personalness of seven "media:" radio, broadcast television, cable television, newspapers, videocassette recorders, telephones and computers.[57] (See Table 2.)

Table 2. Comparison of Media

	Familiarity	Importance	Personalness
Radio	1.33	-.34	-.07
Broadcast TV	.57	-.55	-.47
Cable TV	-1.09	-.12	.07
Newspapers	1.98	.42	-.90
VCR	-1.66	-1.05	.27
Telephone	.97	.84	1.64
Computer	-2.08	1.95	-.49

(familiarity was comprised of inexpensive, old and common; importance combined importance, time-saving, and necessary; personalness grouped personal and private)

Lometti, Reeves and Bybee (1977) used multidimensional scaling to attempt to isolate differences in perceived uses and gratifications for different media.[58] Rice and Williams (1984) point out that "naturally, [emphasis mine] the authors could not answer whether the dimensions related to the content [emphasis theirs] typically associated with a given channel or to specific attributes of that channel."[59] Ideally, research could be designed which controlled for content, to compare use and gratification features associated with specific media attributes.

Distinctions between medium, channel and technology are often confused. The result is research which cannot differentiate across these elements. Channel was initially defined in communication models as the sense or combination of the five senses along which communication occurred. For example, Berlo's (1960) SMCR model of communication elaborated on channel as "sight, sound, smell, hearing, touch."[60] At some point, channel became synonymous with medium -- such that television was treated as one channel,

and radio and movies were other channels. Short et al.'s (1976) list of "media" for comparison evidences a lack of consideration of the original conceptualization of channel. They treat multi-speaker audio as a different channel from telephone audio, business letters or television.[61] Note that television uses audio-visual channels, letters are visual symbols, and telephone and multispeaker audio are variations of audio channels.

P8: Channel should be used as it was originally defined: the combination of senses with which a user perceives a message.

Rafaeli (1985) states that "recent developments point to the computer becoming a mass medium."[62] To discuss a "computer" as a medium in the same sense that broadcast television was considered a medium is absurd. Computers are components in microwave ovens, alarm clocks, typewriters, videodisk players, two-way cable systems, etc. Computers are also a broad class of technology around which a variety of social media systems have been and are being built. There is a need to differentiate technology from communication medium.

Many different media systems use the same technology. Technology refers to hardware, software, ways of configuring equipment while media systems are a combination of technology and social, legal and economic norms surrounding a particular application of that technology. For example, television is a class of technology which involves two-dimensional electronic representation of moving visual

images and synchronous sound. There are many variations of basic television technology currently available. A television image can be viewed on a screen which ranges in size from a wristwatch face to a movie theatre screen. There may be 525 or 612 lines of resolution per frame, or even high definition or high resolution displays, in black and white or color, with mono or stereo audio. The signal may reach the screen via traditional broadcast of VHF or UHF signals, or be delivered via coaxial cable, fiber optics, satellite or microwave to an entire community or selected locations. The signal can come from a home VCR or be linked directly from camera to monitor. Further, television can be used as a two-way technology for interpersonal communication (i.e., teleconferencing), where participants at different locations can each originate a signal. Television can also be used as a limited two-way mass communication technology (i.e., interactive cable television where users can respond to television content by interacting in a limited way with a central computer, using a response pad to send information to the cable headend). Despite the many variations possible, the most common experience with television technology is as a unidirectional national information and entertainment dissemination system. All of these diverse media systems are applications of television technology.

P9: Telecommunication technology refers to a class of devices and techniques from which media systems can be created.

When people talk about the medium of television, they are generally referring to the widespread media system of broadcast and cable television. When television first was adopted, the picture was less complex: there were three national advertiser-supported networks, and virtually all viewership was devoted to those networks. Cable and VCRs have complicated and fragmented that media system. Broadcast television is one type of television media system; cable television is another; home VCRs may be another.

P10: The term "media system" rather than medium should be used, to refer to a specific class (or classes) of technological configuration, plus the social and economic structures surrounding a specific application of that technological configuration.

Schramm and Roberts (1971) and DeFleur and Ball-Rokeach (1982) both offer detailed schema for detailing and specifying a media system (although they do not refer to it as such).[63]

With the new technologies (and with the old ones), there is a need to identify the essential elements that are common as well as distinct across different media systems. Studying media systems rather than media will require researchers to examine the context in which a media system operates. Chaffee (Rogers and Chaffee, 1983) suggests that one of the challenges to behavioral researchers is that we "now find ourselves studying structural factors and historical contexts."[64] Rogers (Rogers and Chaffee, 1983) now finds himself "disappointed with a research paper that doesn't tell us about the communication system being

investigated, even though the effects data may be handled very well."[65]

The goal in consideration of channel, technology and medium is to permit comparisons across the new media, rather than merely within them. Thus far, this paper has identified numerous complications and factors to consider in research new technologies. The point of identifying these complications is twofold: 1) it accurately reflects the complexities we as researchers are faced with as technology continues to change and 2) it will eventually permit a synthesis of research findings which are not limited to a single technology. This need is voiced by Chen (1984): "Future research on television, microcomputers, and other media can benefit by moving away from a view of these media as distinct packages of technology to a focus on the specific features of these media that are linked to specific child outcomes."[66] "Research that looks beyond the technology of each new medium to its underlying content and symbols will enable theoretical progress that does not stop at the borders of each machine (Chen, 1984)."[67]

P11: Research must look beyond the individual media system to underlying factors which vary across media systems.

In the next chapter, a model for specifying the interaction structure of media systems which addresses the research propositions raised here will be described. In the third chapter, media system features and a taxonomy for classifying media systems will be presented. The model,

media system features and taxonomy facilitate comparisons across media systems.

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Chapter 2: A Model of Information Exchange

This chapter will propose a model of information exchange consistent with the propositions developed in Chapter 1. First, information exchange will be defined. Then the model will be presented, beginning with its basic, most simple form and then increasing in model complexity from intrapersonal information exchange, to interpersonal information exchange, to mediated interpersonal information exchange, to mass mediated information exchange. Finally, the model will be discussed in terms of Chapter 1 propositions.

DEFINING INFORMATION EXCHANGE

Information has generally been defined by communication scholars as something unrelated to meaning. Shannon and Weaver (1949) developed a mathematical, entropy-based definition of information. In their theory, information is "a measure of one's freedom of choice in selecting a message."[1] For example, by their calculations, use of the English language is estimated to consist of about 50% free choice and the other 50% of words used are determined by the semantic rules of the language. The reason for equating information with entropy was to solve engineering problems such as the calculation of channel capacity. Weaver comments on their definition:

> "the concept of information developed in this theory at first seems disappointing and bizarre--disappointing because it has nothing to do with meaning, and bizarre because it deals not with a single message but rather with the statistical character of a whole ensemble of messages, bizarre also because in these statistical terms the two words information and uncertainty find themselves to be partners."2

For engineering, Shannon and Weaver were not concerned with meaning. Communication scholars adopted their approach. Newcomb (1953) treated information similarly. "Every communication act is viewed as a transmission of information, consisting of discriminative stimuli, from a source to a recipient."[3] He based his definition of information on Miller's earlier definition: "information is used to refer to the occurrence of one out of a set of alternative discriminative stimuli."

Krippendorf (1982) defines information mathematically as "a change in an observer's state of uncertainty caused by some event in his [sic] world."[4] In this case, the definition of information is receiver-based. Krippendorf acknowledges that with his definition, "one can speak of information only in conjunction with a physically identifiable source, a message or a situation as described by an observer and relative to what he already knows."[5] In this manner, information is still only vaguely related to meaning, but it is at least considered in relation to a receiver.

In my model of information exchange, I will attempt to reintegrate the concept of meaning into the definition of

information. Like Krippendorf, I believe that information must be defined relative to a source, message or receiver. Three distinct definitions of information will be offered: one for each relational perspective. Stage 1 is a source (or information provider) perspective, Stage 2 a message perspective and Stage 3 a receiver (or information user) perspective. The nature of information is different at each stage.

Stage 1 occurs when an information provider encodes a message. This includes traditional conceptions of encoding: speech, writing, television production, and so on. From a source perspective, the information content of a message is the meaning information providers intend to convey. Whether or not they succeed in conveying that meaning is not relevant. The intended meaning is the nature of information at Stage 1. An information provider perspective exists only for purposive communication, in the sense that there must be volitional encoding of information. Unconscious acts, such as some body language, would not qualify for Stage 1 information analysis because there is no intended meaning.

Stage 2 occurs when information has been encoded into or otherwise already exists in the form of perceivable stimuli. Examples of encoded stimuli include writing, speech after it has been uttered, television programs, telegraph signals, and so on. Tangible stimuli also exist naturally-- the objects, events and people around us. Information at Stage 2 may or may not have been generated purposively. Although body language may not qualify as

purposive information, it is part of the information available to be perceived in an interpersonal environment. At Stage 2, information is defined in terms of its potential to be perceived and interpreted. What is perceivable will vary from one perceiver to another. Therefore, what qualifies as information must be defined either in relation to a group or groups of potential perceivers, or it must be defined broadly to encompass the perceptual abilities of all possible perceivers. For example, now that the microscope has been invented, the group of individuals with access to a microscope can potentially perceive and interpret specialized, minute visual information. However, most people do not have access to microscopic information. The information content of that which can be perceived is every possible meaning that information users might assign to a given stimulus.

Stage 2 analysis requires certain assumptions about the interpretive tendencies of perceiving users. For example, young children have very different interpretive skills than sane adults, who have different interpretive skills from schizophrenic adults. The range of what meaning could be assigned to a stimulus would vary with the expected users. At this stage of analysis, the meaning or information content of stimuli is most ambiguous. It is unlikely that the full range of possible interpretations could be identified, but a subset of likely meaning can be compiled. Content analysis is often an analysis of Stage 2 meaning.

For example, analyzing the portrayal of women on television may be an attempt to identify and quantify specific potential meaning embedded in fictional television content.

Media systems tend to limit the scope of information available. If one were to analyze the Stage 2 information available over a typical person to person telephone call, the potential shared stimuli would be limited to whatever signals (limited to 3.5 KHz of bandwidth range) are carried over the phone line and amplified over the receiver. The meaning available in a book is limited to what is visually interpretable, with the trivial addition of how it feels and smells. Whereas, in the environment immediately surrounding an information user, all senses can be used to perceive information.

Stage 3 information content refers to the meaning which is assigned to a stimulus by an information user who perceives the stimulus. This meaning is a subset of the possible meanings at Stage 2. To some extent, it may overlap with the intended meaning from Stage 1.

To clarify these three stages of information, take the example of a 30 second radio commercial. The information provider is the individual or group of advertising employees and producers who created the spot. At Stage 1, one can analyze the messages or meanings this group intended the spot to convey. Once the spot has been produced, it exists in the form of encoded information with real, fixed properties. It has length, measurable sound patterns and is comprised of some combination of words and music and sounds.

At this stage, the meaning is disembodied from a particular information provider or information user. Stage 2 permits analysis of the full range of potential meanings of the information. When listeners hear the spot, a Stage 3 analysis of the meaning they assign to that spot can occur.

Given this three stage definition of information, information exchange refers simply to the processes wherein information providers encode information, encoded information is collected and distributed, and information users perceive and interpret information. Communication, in its traditional sense, usually refers to the intentional encoding and transmission and reception of information from a source to a receiver. Information exchange includes communication but is more encompassing. Information exchange is a better framework for describing situations such as cable television, where a cable operator selects programming for 36 or more cable channels hoping that cable subscribers will find something satisfying to watch from among those options. The cable operator is very different from a traditional source who designs a specific message for a specific audience. Yet the cable operator is a key participant in the information exchange process, selecting information to provide. Similarly, while some may not consider person-machine interactions to be communication because the machine lacks human intent to communicate, those interactions do fit as information exchange (the person and machine do exchange information). A machine (or processor)

assigns meaning to the information sent by a person attempting to interact with it, and may provide information in return. (An interaction is defined as the exchange of information with another entity-- person, machine or animal.)

COMPONENTS OF THE MODEL

Figure 4 presents the basic components used in modeling information exchange interpersonally and via media systems. There is a box enclosing the model which represents the physical constraints on information exchange. In the case of face to face information exchange, the box would represent the shared sensory field of the participants. In the case of mediated information exchange, the box would represent the media system which constrains information exchange. (For example, information exchange over a telephone media system is limited to 3.5 KHz bandwidth audio.)

Within the box is a collection of information (Stage 2 information) available to be perceived. There may be divisions in the information collection denoting information available only to a certain user or users.

There are also information users. In face to face information exchange they are located within the same general sensory field. In mediated information exchange they are in some way connected to the media system or a part thereof (e.g., by telephone or via a published book). There is information (Stage 3 information) located within each

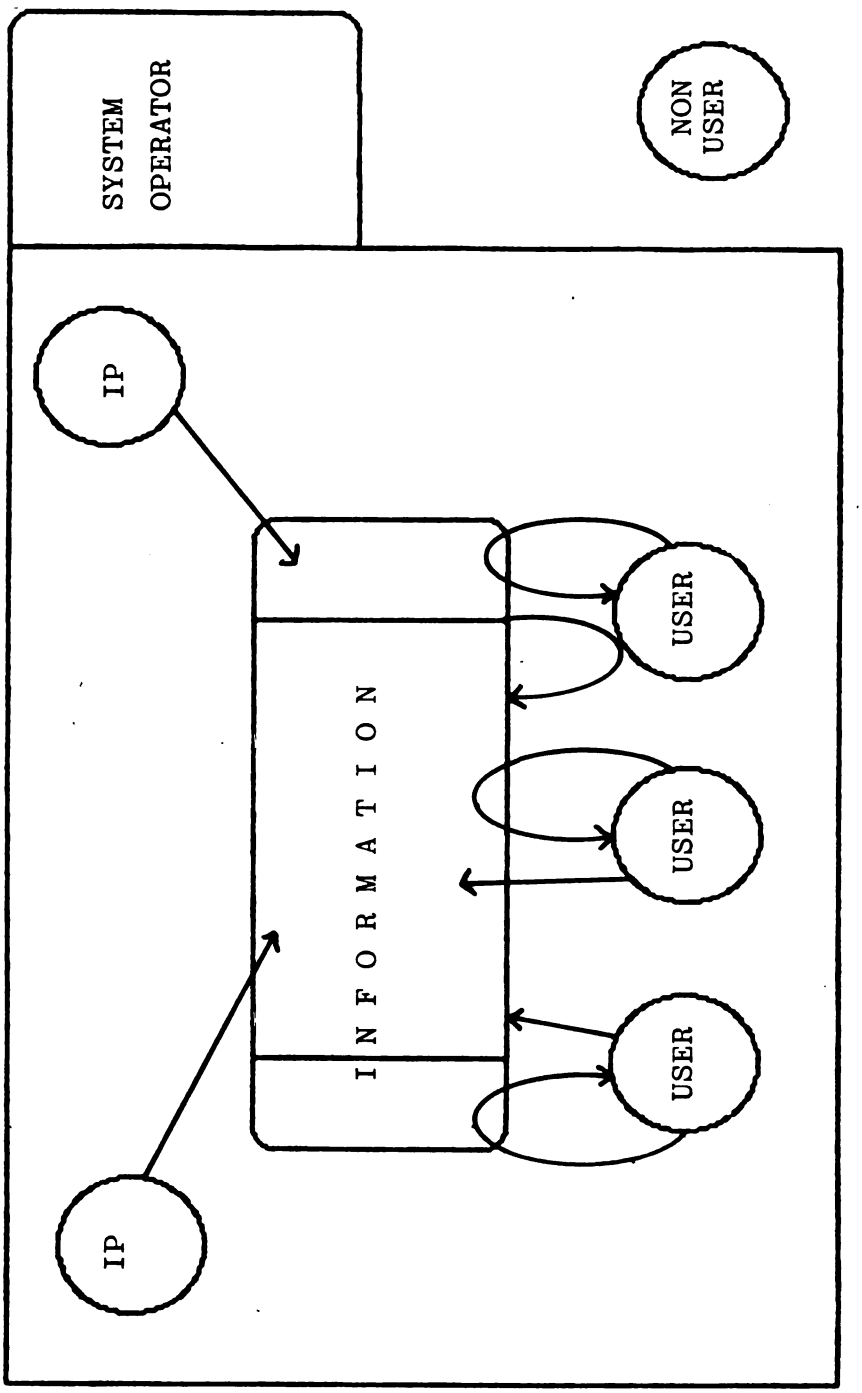

Figure 4: Components of the Model

user. This is the user's interpretation of the Stage 2 information they have selected. The looped arrow which starts at the user, reaches into the information collection, and returns to the user represents selection of information by the user. The straight arrow from user to the information collection, stopping at the edge of the information collection, represents the user sending information to the media system (Stage 1 information: for example, a videotex user requesting a particular page of information from the central computer). In contrast, the straight line from user into the information collection represents the user's potential to add information to the collection that others can access.

Note that these components are included in a particular model only when applicable to the information exchange situation being modeled. The looped arrow from the information collection, to the user, and back to the information collection represents the capacity for a media system to monitor user behavior or request information from a user. In addition to users, there are non-users: individuals who cannot or do not use a media system.

Some media systems (and some face to face communication) involve specialized users called information providers in this model, who primarily add information to the system rather than select or perceive it. Finally, there may be a system operator who controls or operates a media system.

These model components are used in modeling a variety of face to face and mediated information exchange situations in this chapter. They can be applied to any media system.

MODELING UNMEDIATED INFORMATION EXCHANGE

Intrapersonal Information Exchange

Westley and MacLean (1957), as a first step in describing their model of communication, diagram what they call intrapersonal communication, referring to information exchange between an individual and their environment. (See Figure 5.) "Objects of orientation (X1 . . . X0) in the

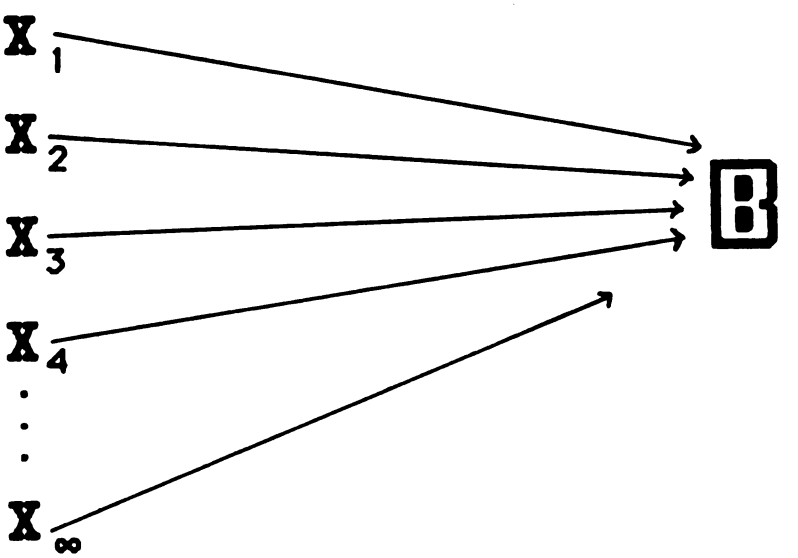

Figure 5. Westley and MacLean's Intrapersonal Communication

sensory field of the receiver (B) are transmitted directly to him in abstracted form (X1 . . . X3) after a process of selection from among all Xs, such selection being based at least in part on the needs and problems of B. Some or all

are transmitted in more than one sense (X3m, for example)."[6]

Westley and MacLean actually offer a receiver-oriented model of communication in that receivers select from among messages in their sensory field. The proposed model of information exchange will emphasize user activity even more and integrate the definitions of information explicated here. Figure 6 diagrams the model. The box denotes the boundaries of the sensory field of an individual: the limits of sight, sound, smell, touch and taste at any given time. Within that sensory field, there exists a body of information or stimuli which are available to be perceived. (This is Stage 2 information.) There exists a person, or information user who is capable of perceiving stimuli and assigning meaning to them. This user can select and perceive meaning (Stage 3 information) from the information available in the environment. The selection of information is represented by a looped arrow which starts with the user, reaches into the pool of information available, and returns selected stimuli to the user to interpret. The user can also add to the information within the system, for example by moving (to alter the visual stimuli) or talking (to alter auditory stimuli). User provided information is represented by the arrow directly from user to information.

For example, consider a person alone in the forest. Within their view if they chose to look, barring obstructions, is all that is physically present in the forest within about a 50-100 foot radius. Their auditory

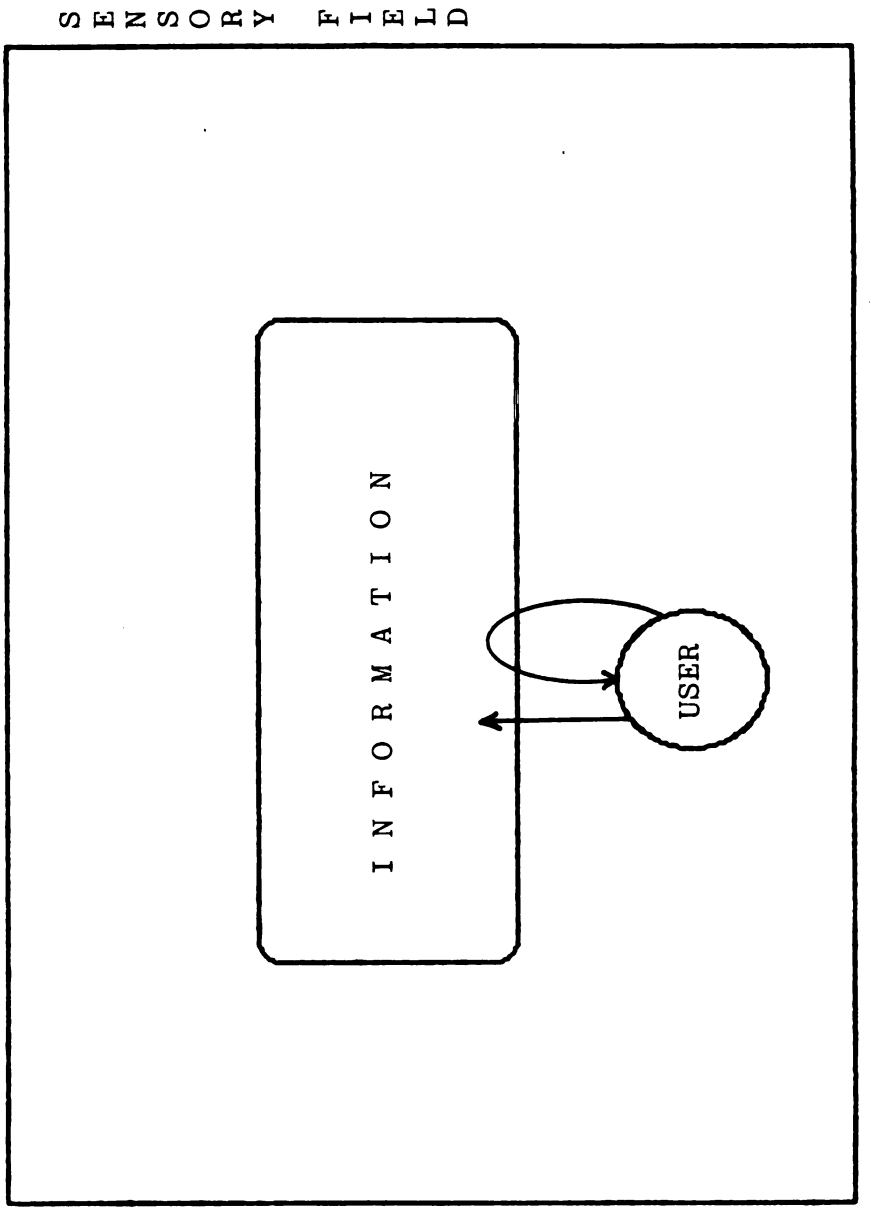

Figure 6: Intrapersonal Information Exchange

range extends further. They might also perceive and assign meaning to temperature and touch, and monitor various body parts and functions. This sketchily defines the range of available stimuli. The person consciously and unconsciously perceives many of the available stimuli-- some because the stimuli are obtrusive and attract attention (e.g., a mosquito biting them) and others because the person seeks to notice (e.g., a unique wildflower). Walking through the forest adds the sound of crunching leaves and twigs to the body of available stimuli.

Interpersonal Information Exchange

Figure 7 adds a second user to the information system, to model dyadic communication. In this case, the box denotes the combined sensory fields of both individuals, which may exceed the individual sensory field of either user. There is a body of information available to be perceived by both users, although some of the information may be accessible only to one of the users. This is represented by the lines dividing information into compartments. Some compartments of information are available to both users. Other information may be accessible to only one user. Both users can provide information and selectively perceive information.

Thus, when one user speaks, the tangible audible signal that is speech becomes part of the information available in the sensory field to be perceived. The second user may elect to perceive that stimuli, and assign meaning to it.

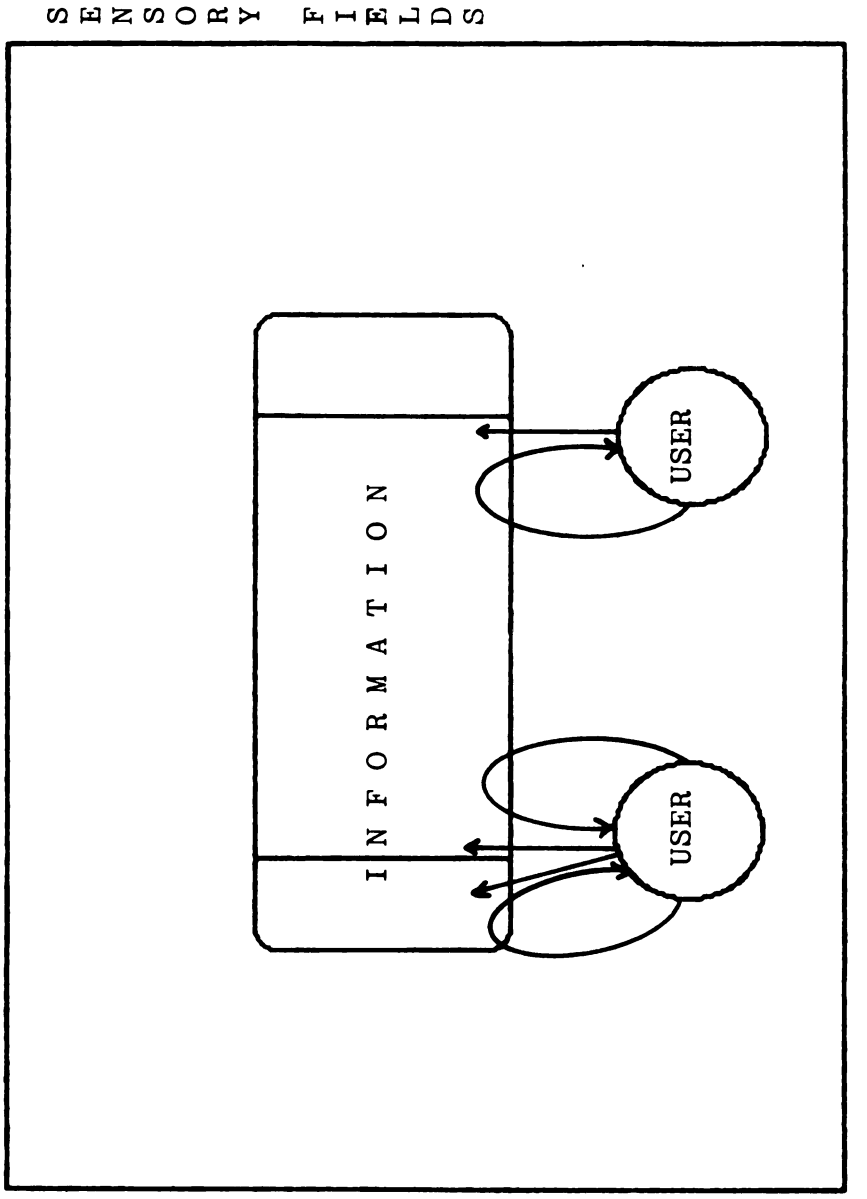

Figure 7: Interpersonal Information Exchange

The second user also has the option of adding information to the system. Some information is added to the system intentionally. Other information is added non-purposively, such as non-verbal kinesics (e.g., body language) or reflex reactions to an unexpected stimulus.

Unlike traditional models which focus on the transmission of a single message from source to receiver, this view of information models the overall processs rather than any particular message. Both users can provide and use information. Meaning is exchanged, rather than pieces of entropy.

MODELING MEDIATED INFORMATION EXCHANGE

Mediated Interpersonal Information Exchange

In Figure 8, the major change is that the sensory field is replaced with some sort of media network or system. Mediated interpersonal information exchange is interpersonal information exchange where the users are separated in time and/or space. They do not share the same complete sensory field. Instead of providing information to and selecting information from their immediate sensory field, the information is collected and/or transmitted over technologies which to varying degrees restrict the shared sensory field. Media use does not take place in a sensory vacuum-- but the sensory stimuli available to be shared are more limited than those available face to face. Telephony, CB and shortwave radio, mail, electronic mail and videophones are examples of systems over which mediated

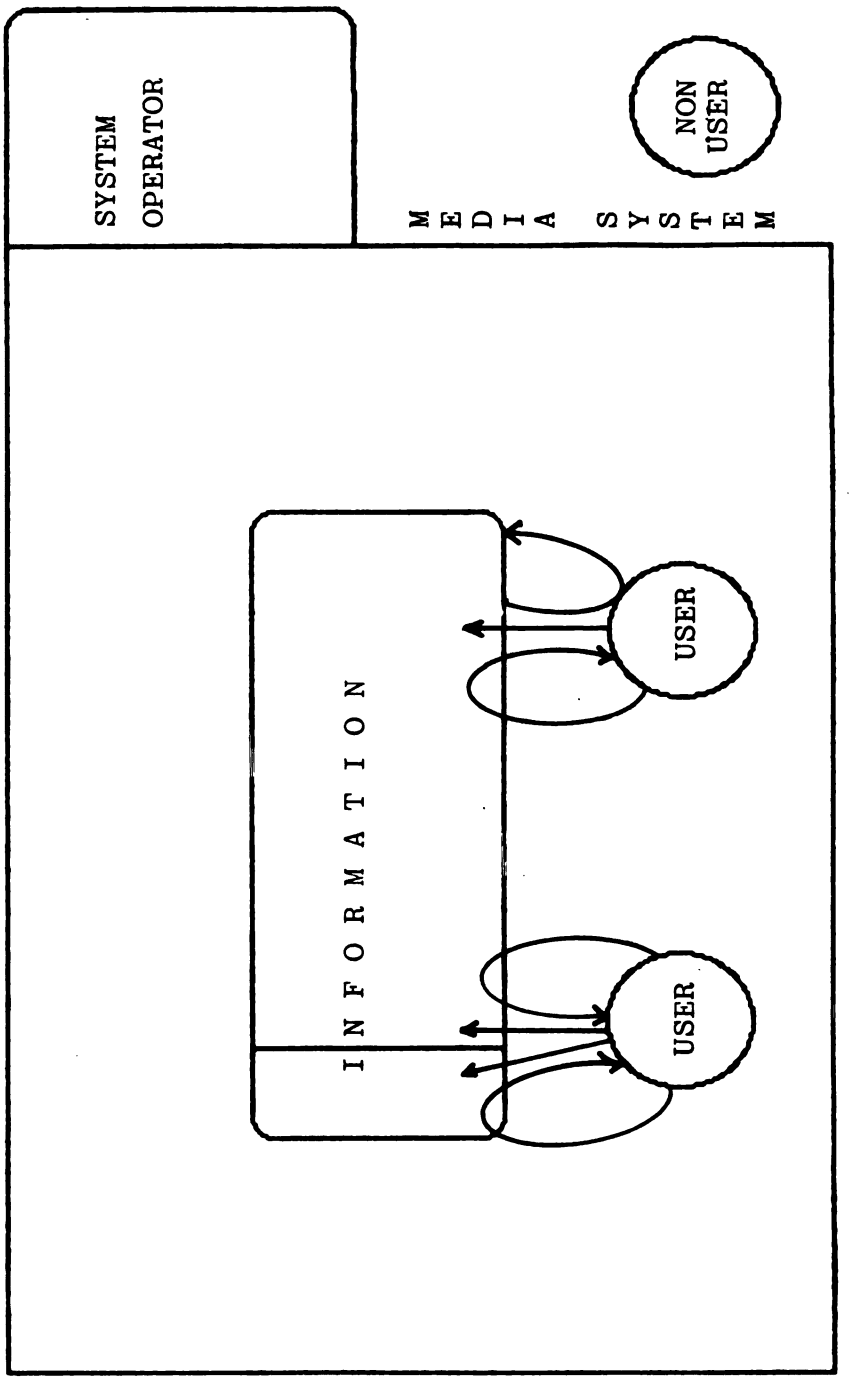

Figure 8: Mediated Interpersonal Information Exchange

information exchange can occur. The model focuses attention on information collected over the media system.

The box in Figure 8 represents the sensory field of the mediating system, rather than the user's environment. For telephony (see Figure 9), the box is the limits of voice communication over a telephone. Within those boundaries, there exists a body of potentially perceivable stimuli (information) available to both users (all of which is carried over the phone line).

Typically in mediated information exchange, restrictions are imposed by the characteristics of the carrier system on the sensory channels over which information can be exchanged. Telephony limits the users to a small bandwidth of auditory information. Early videophones were designed to provide a single visual perspective (one camera angle) at a time, plus audio. Some computer systems limit users to text. There may also be temporal limitations, for example, the transportation-based postal system currently prohibits instantaneous information exchange.

Transmisson carrier systems are often vast, complicated socio-economic systems (such as the telephone or mail system). Thus, when a media system is introduced, a system operator who structures and operates the media system is also usually introduced. Almost inevitably there are more influences than just a system operator on network configuration (how the hardware is connected) and operation protocols (the way the media system is designed to work),

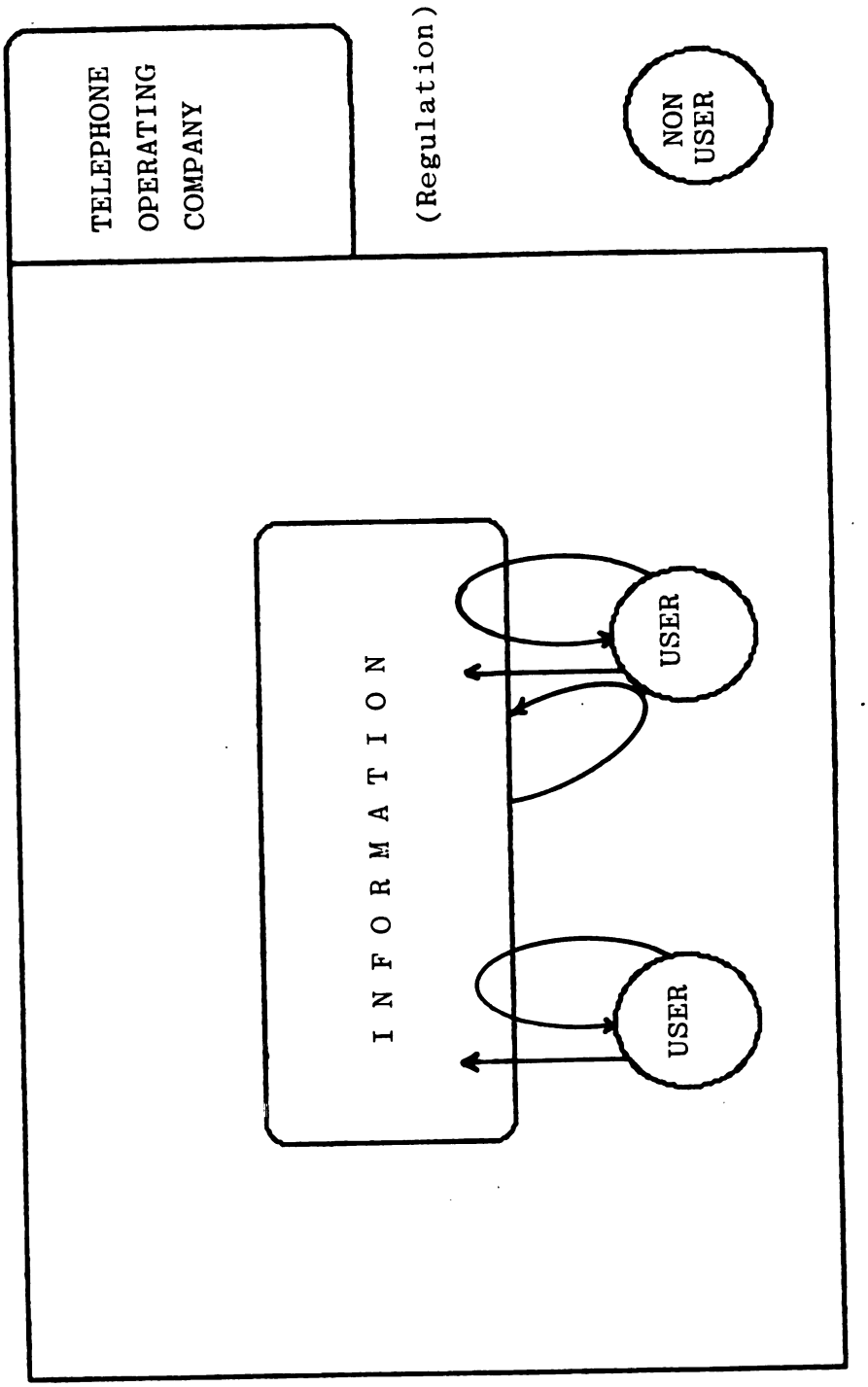

Figure 9: Telephony

including technological, economic and regulatory factors. Telephone operating companies continue to provide government mandated universal service to all areas. They are also beginning to experiment with specialized services such as the "Gab Line" tested in Chicago over which multiple users can call in and talk with whoever else has dialed that number (Metcalfe, 1985).[7] The system operator may have little or great influence on possible network configurations. Even content can be restricted by a system operator. (For example, obscene phone calls are illegal.) Government regulations or economic factors limiting or prescribing use may exist.

Depending on technical factors, a system operator may have the capacity to monitor use of the system. With telephony, all calls are logged by phone numbers, time of day and duration of the call for billing purposes. This type of feedback is represented by the looped arrow in Figure 8 from the information system to the user and back to the system.

The carrier systems also to some extent dictate who can be communicated with and how. Two users must both have access to a system in order to use it to communicate. Technologies can also be limiting; those without a CB radio are exclude from that network. The "non-user" who does not have access to a particular network is added to the model. There are two types of non-users: those who cannot use a system, either because they live outside the area where a system is available or because they have chosen not to or

are unable pay some fee (e.g., a cable subscription) and those who have access to a system but do not choose to use it. Identifying nonusers who are denied access usually points to potential social impacts of a particular media system.

If two users have access to a carrier network, they can use that network to provide and select information intended for each other. The body of information available is much more limited than in non-mediated interpersonal information exchange-- and a larger proportion of what is available is there because it is intentionally communicated. But the basic process is the same. Consider the example of a computer conference. The confines of the information system are defined by the physical network configuration and the conferencing software which link two or more users. Over that network there is a body of available information -- including noise from the computer network, plus whatever text information introduced by both users. Each user can actively provide text information and select information from available content to perceive and interpret.

As with interpersonal communication, there may be more than two users. Various configurations of group communication can occur over conferencing media systems.

Mass Mediated Information Exchange

By mass mediated information exchange, I am referring to mediated systems which information available to multiple (or a "mass" of) users. Thus, rather than two users, there

are three or more users. Figure 10 is a generic mass mediated information exchange model, to replace traditional mass communication models.

In this type of media system, there is frequently but not always a differentiation between information providers and information users. An information provider is a specialized user who functions primarily to provide information to the system. Traditional mass media systems (e.g., newspapers, radio and television) do not permit users to add information to the pool of available content. However, many new systems do. Depending on the system, both users and information providers can provide and retrieve information.

Information is viewed as a body of content available over the media system, from which users select rather than as a discreet message targeted for a specific receiver. Feedback in traditional media systems consists primarily of relatively rare instances when a user contacts an information provider (represented by the direct arrow from user to information provider). As with mediated interpersonal networks, there are non-users who do not have access to the system, and at any given time, there are also non-users who could have access to the system.

The model varies, depending on the specific media system being described. Figure 11 models broadcast television. The available information in a broadcast television system is all of the programming being broadcast

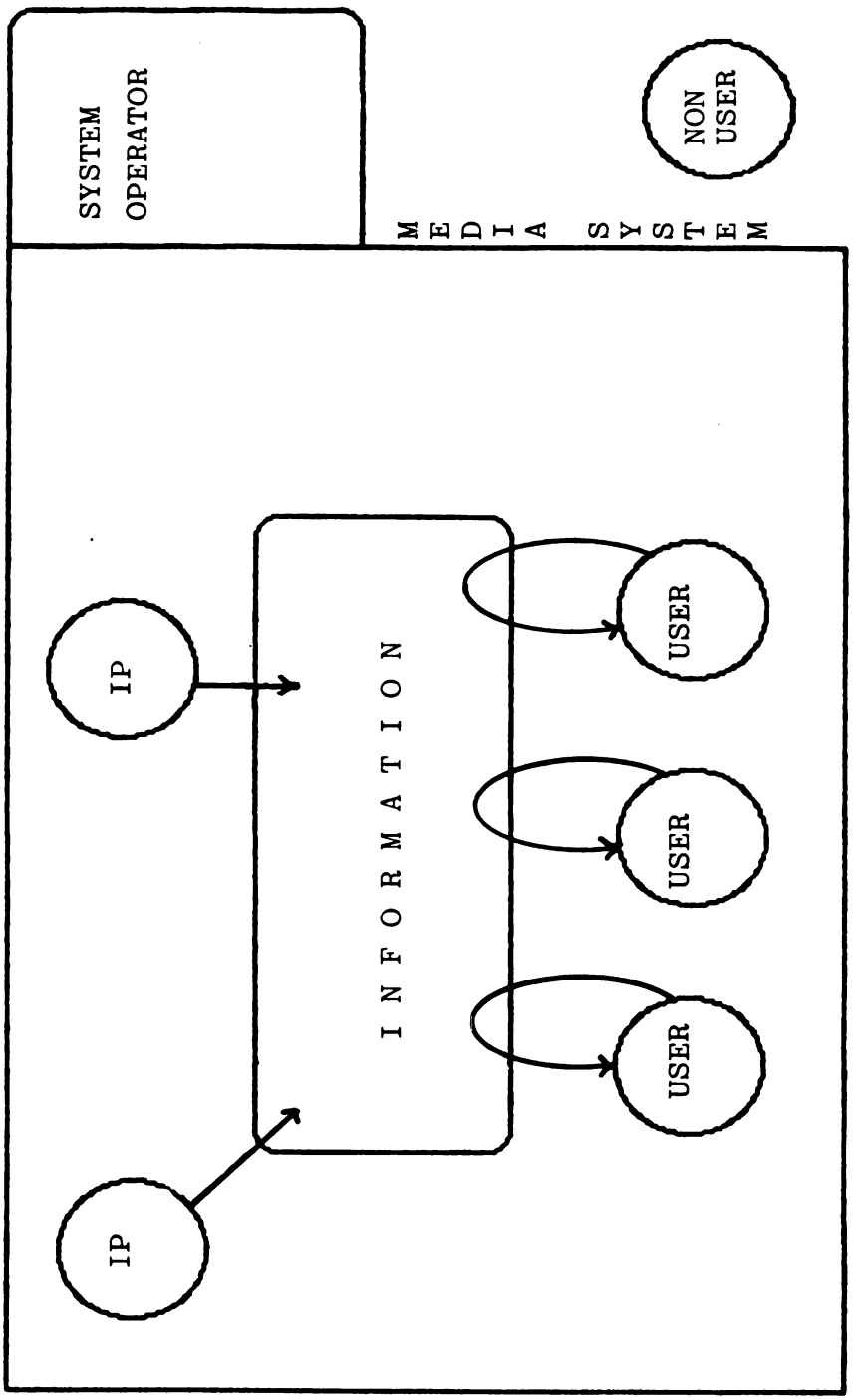

Figure 10: Mediated Mass Information Exchange

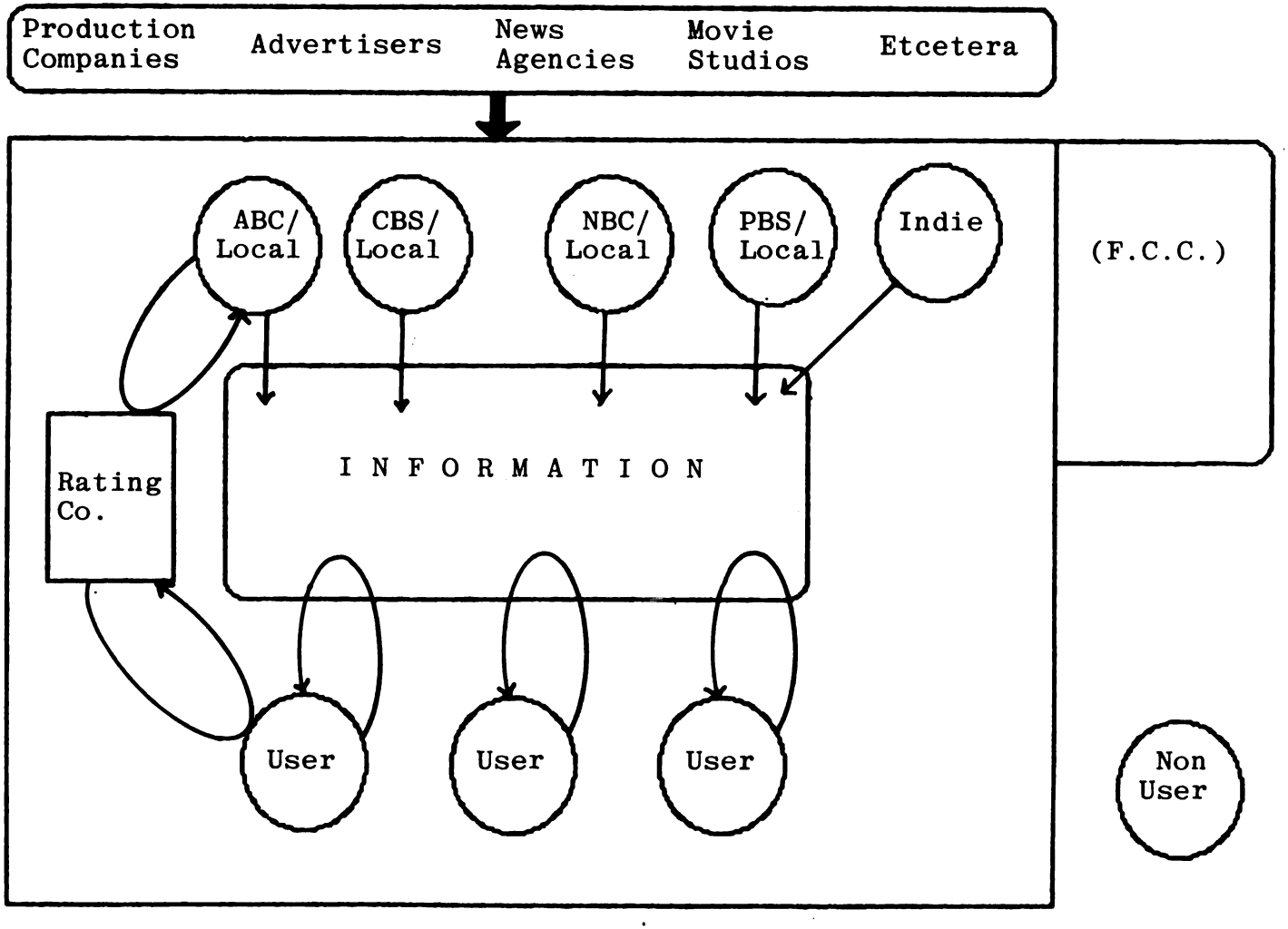

Figure 11: Broadcast Television

(and receivable over a standard television set) at a given time. Technically there is not a system operator, but the single greatest influence on the structure of broadcasting in the U.S. has been government regulation. The initial decision to make broadcasting a local service dictated station signal strengths and coverage areas. In granting licenses the F.C.C. determines who will select the information providers. In assigning frequencies the F.C.C. determines how many stations will be available in a given location.

Content is provided by the national commercial and public television networks through their local affilliates as well as by local independent stations. Indirectly, content originates with production houses, advertisers, news agencies, movie studios, independent producers and so on, although hese are not part of the central system from a user perspective. Users ometimes provide feedback to the information providers (IPs). A new element, the rating companies, is added. They seek feedback from a sample of users and report viewership data to the IPs and others.

In the case of cable television (Figure 12) there is an obvious system operator: the cable company franchised by city government to install and operate a cable system. The system operator (SO) selects IPs. When public access channels are provided, users have the opportunity to become IPs, through those channels. This is represented by the line from user, through public access channels, into the information collection. The information pool is

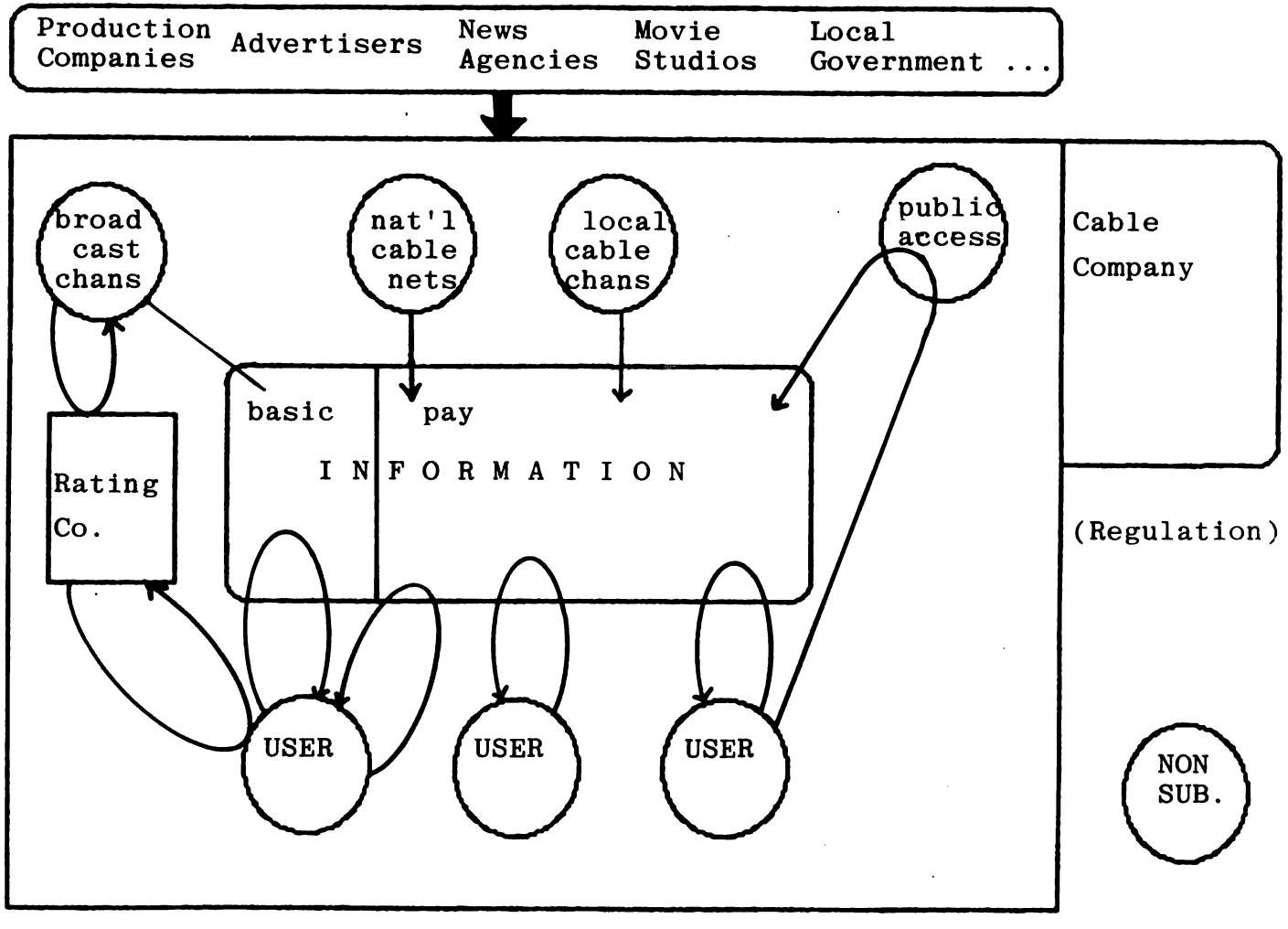

Figure 12: Cable Television

compartmentalized. Some is available to all users (Basic Cable) and some is available only to those who pay more (Pay Cable). The non-subscriber is shown, as a non-user who does not have access to the system. Feedback occurs in the same way as for broadcast television.

Figure 13 is also a model of cable television, but for two-way cable, with the capacity for system monitoring of viewership and electronically polling users about program content or issues of interest. (In some experimental interactive cable systems, subscribers have channel selectors which double as response pads, permitting them to send electronic messages to the headend computer at the cable system. At certain points in a program, users are polled about their opinions or feelings. Summary statistics of all responses may be tabulated and displayed on the channel, as part of the program.) The interactive functions allow users to provide information to the media system during polling. This is represented by the arrow from user to information. However, the arrow stops at the edge of the information collection because although users can exchange information with the system, they cannot add content to the cable channels which other users can access. In addition, two-way cable permits the cable system to monitor viewership. This continuous feedback is represented by the looped arrow from the information system, reaching out to each user, and bringing viewership data back to the information system.

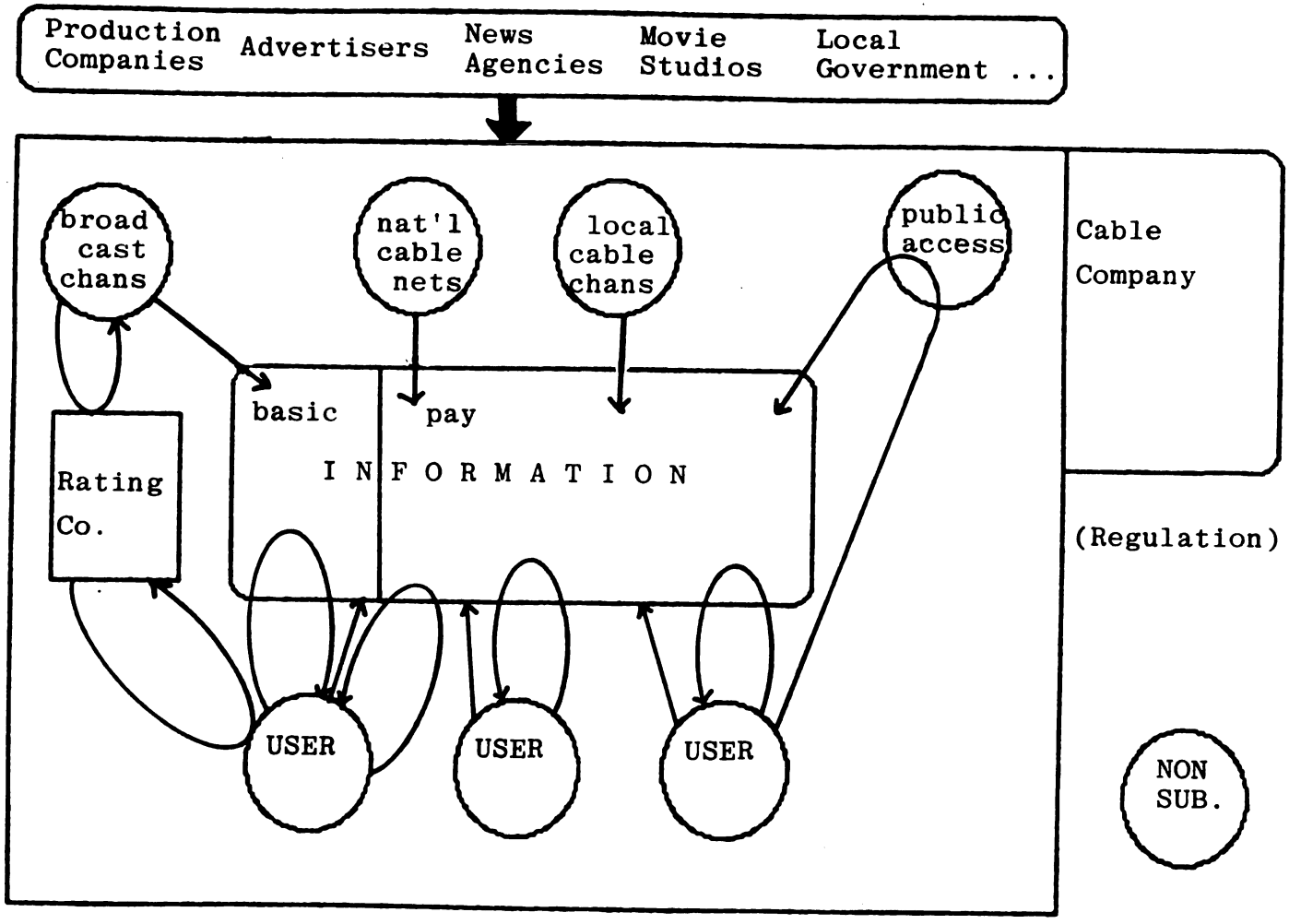

Figure 13: 2-Way Cable Television

With interactive cable, the information system is a "smart" system in that the system computer can process information received by a user, and add information to the collection for access by a user. After reading audience responses to a poll question, the cable computer can switch the channel output from a videotape source to its own internal character generator to report the results of the poll, then switch back to the videotape source. The user influences content as one of many votes, but is unable to add information directly to the cable system.

Each media system can be modeled separately. The models are user-oriented, focusing on how the system and user interact to exchange information. Media systems which may not seem comparable may share the same model of how information is exchanged. For example, interactive cable television (Figure 13) is modeled with the same configuration as electronic text news retrieval (Figure 14). In both cases a system operator selects information providers. There are users who pay to subscribe and non-users who do not. Users access information from the information colleciton. They can interact with the system but they cannot add information that others can access. And the system can monitor use. The model helps look past obvious differences in content and format, to the structure of information exchange.

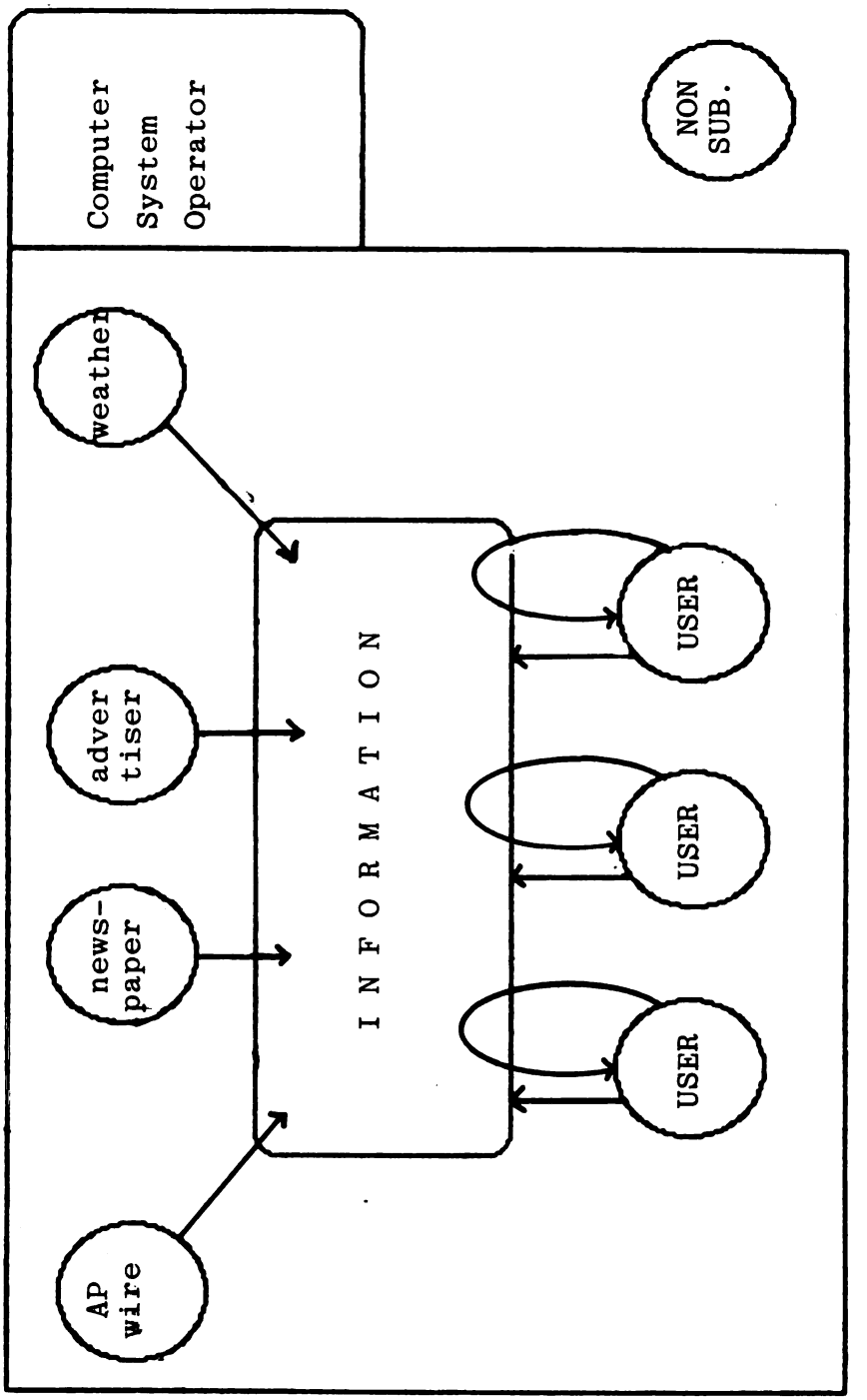

Figure 14: Electronic News Retrieval

A model of home videocassette use (Figure 15) presents an interesting scenario: The user is a system operator. The user selects IPs and selects content from among what the IPs have to offer. Possible IPs include rental houses, off-air and cable television recording, user-produced content, and cassettes borrowed from other users. The user acts as a system operator by selecting programs to record off the air, by renting tapes and by producing television shows on videocassette.

Mediated Intrapersonal Information Exchange

As with videocassette recorders, the user of a personal computer is also the system operator (Figure 15). The user purchases a computer and software. Again, with a home computer, the information system itself is smart. Users can interact with the computer system, add and retrieve information. However, the information users add to their personal computers is rarely information which other users will access. More likely, users seek to process information (e.g., word processing or data analysis) with assistance from the computer. Thus, computers are media system used for information processing-- the mediated equivalent of thinking, which was defined as intrapersonal information exchange. Processing information over a media system is parallel to internal processing of information.

Three types of mediated information exchange have been discussed: interpersonal, intrapersonal and mass. Within those types, the model for each media system is

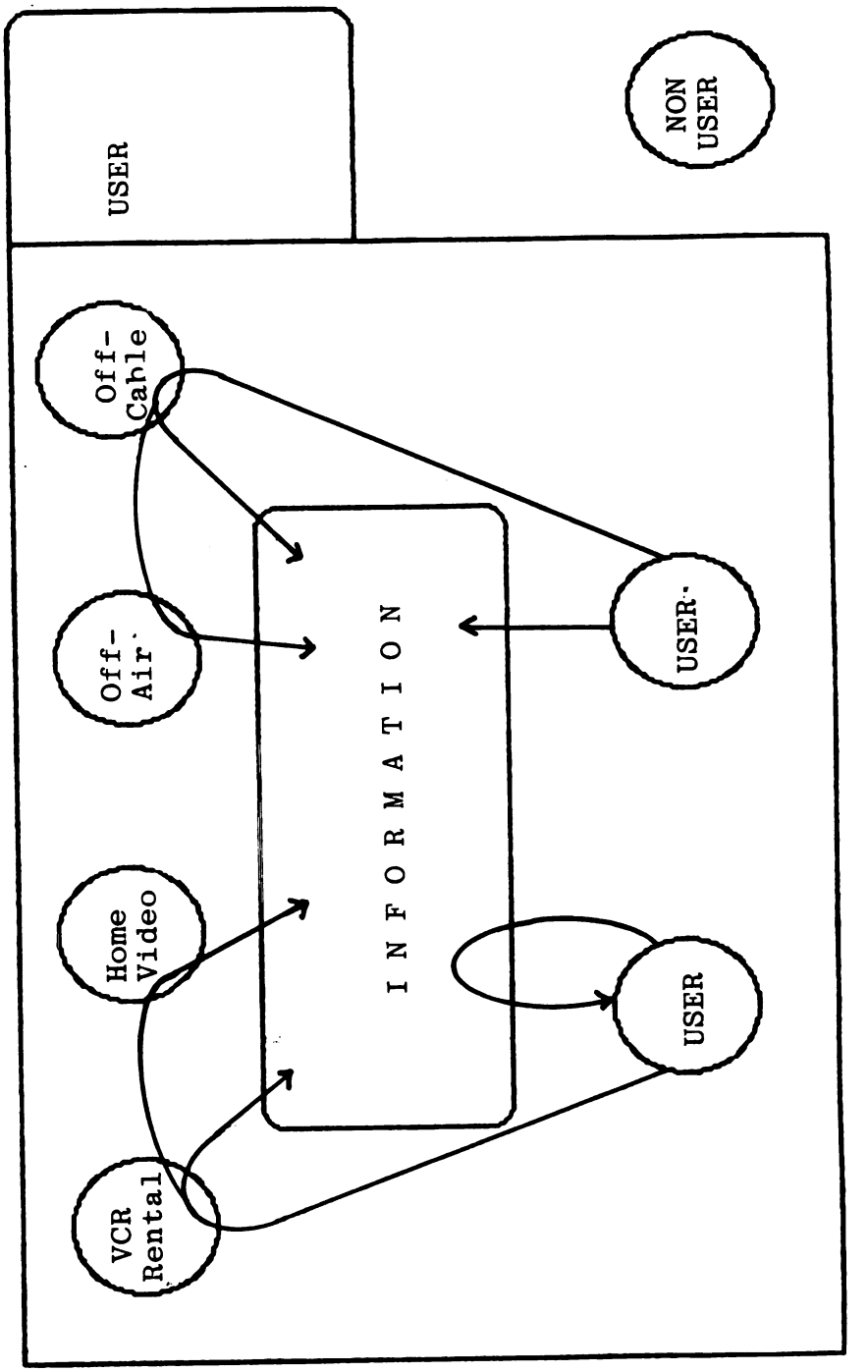

Figure 15: VCRs

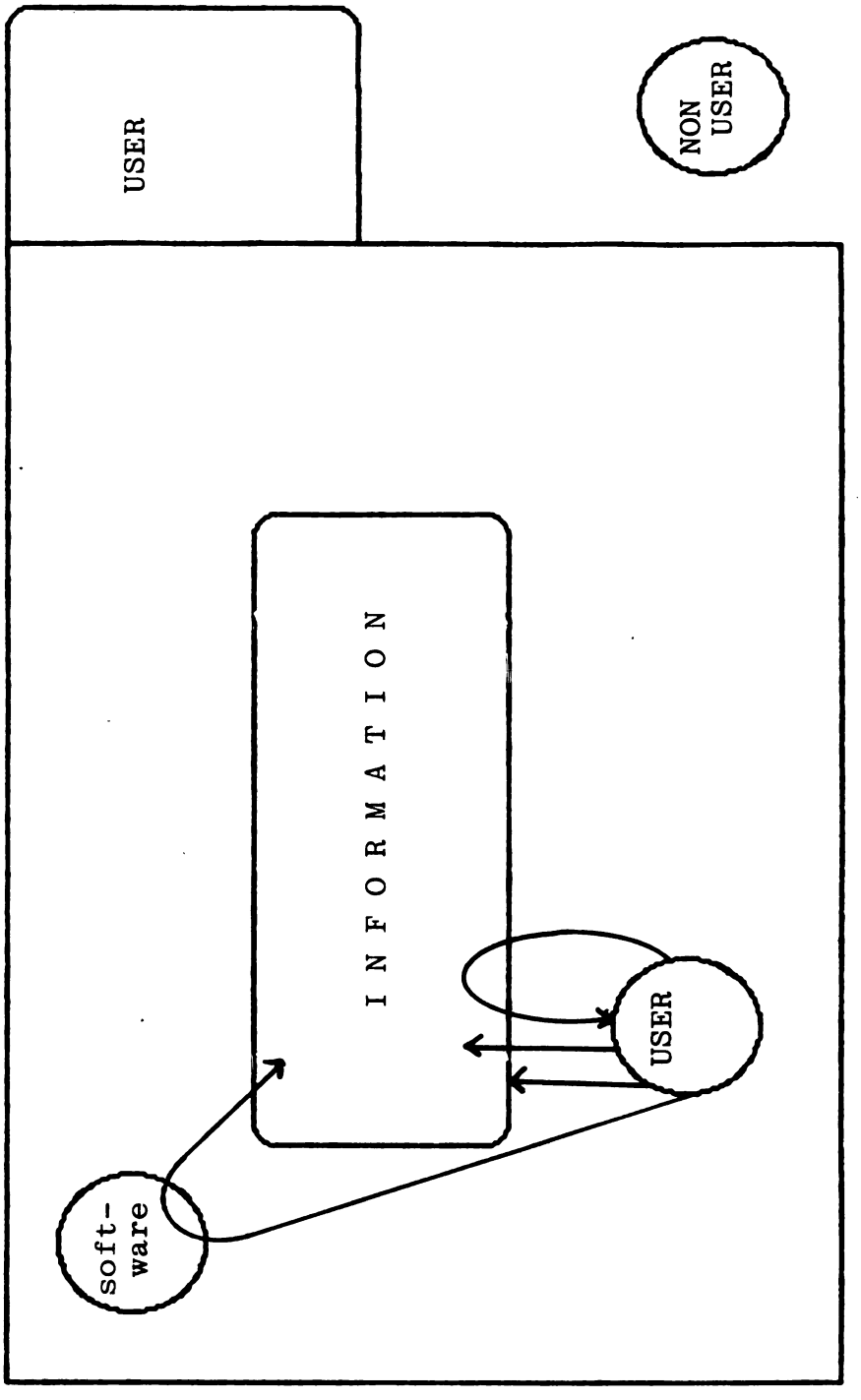

Figure 16: Personal Computer

specially tailored to the operation of that media system. Many of the newer media systems allow more than one type of information to occur. For example, electronic bulletin boards permit users to send messages to other specific users (interpersonal information exchange) or to provide general bulletins which can be read by all users (mass information exchange). There are basic components used in building each model (such as users, information, information provider, etc.) which can be applied to each media system, be it intrapersonal, interpersonal, mass or some combination thereof.

RELATING THE MODEL TO THE PROPOSITIONS

Here, the propositions derived in Chapter 1 will be examined in relation to the model of information exchange generated in Chapter 2. Implications for research are suggested.

P1: Information may be sought or selected, not merely sent.

While traditional models of communication feature a source sending a message to a receiver, the models of information exchange show the user selecting information rather than being a passive receiver of a message. This is modeled by the arrow which originates from a user, reaches into the collection of information and returns to the user. Specialized information providers (and other users) may send information to a collection of available information, but it is up to the user to select and interpret the message. The user is always rather than never viewed as an active

selector of information. Selective exposure and other media impact research implicitly incorporate this assumption. Now the assumption is evident in the model.

P2: Many media systems require active users.

The user has already been shown as an active selector of information. Proposition 2 points out that the amount and nature of user activity varies across media systems. In face to face information exchange the user selects information by simply attending to it. With cable television the user changes channels to select different content (and then further selects information by attending to it once a channel is chosen). With teletext the user selects information from numbered menus by entering a number in a keypad. (Amount of user activity required by a media system) is not specifically modeled-- models for more active systems do not look different than models for less active systems. However, by focusing researcher attention on user activity, awareness of the importance of factors such as degree of requisite user activity may be heightened.

P3: Activity is a user trait as well as a medium trait.

User activity varies from one user to another. Some avidly seek diverse content while others make as few active choices as possible. As above, users with different activity levels are not modeled differently. But (the presence of the information seeking arrow) suggests possible research foci. Selective exposure research, examining why users expose themselves to which information is one example. Exploration of activity as a user trait is another.

Differential effects of methods of selecting information (as described under proposition 2) is a third.

P4: Person-machine interactions are a special form of communication.

In some of the models users are shown providing information to the system (illustrated by the arrow from the user to the information collection, ending at the system boundary). The system may respond by making the requested information available (or it may not respond at all). Person-machine information exchange is another area which has received considerable research attention. Artificial intelligence (AI) research seeks to program computers which can respond humanly, learning and drawing inferences. Computer phobia research examines who interacts successfully with media systems, who is afraid and why. Media schema research considers how users approach machine components of media systems such as videotex: what mental models users employ when they interact with a particular media system.

P5: Continuous feedback is a special kind of feedback in which use behavior is measured on an ongoing basis for all users.

Two-way cable television and videotex are examples of continuous feedback media systems. Their diagrams feature arrows originating at the information system, reaching to the user and returning to the system. Such measurement has vast possibilities for studying use behavior. The presence of continuous feedback may also affect the content offered over a media system. Studies might compare media systems which do and do not have continuous feedback to determine

responsiveness of content to user preferences.

P6: The distinction between source and receiver is only present some of the time, to varying degrees.

Traditional models of communication distinguished source from receiver. The models of information exchange presented here diagram the process by which information is exchanged over time rather than focusing on the exchange of a single message between one source and one receiver. When users could provide and select information, they were identified as supplying information to the collection of available information (as diagrammed by the arrow from user into the information collection). In media systems where there are specialized information providers (such as television), information providers were added to the model. The presence of information providers does not necessarily preclude users from also providing information that others can access; it depends on the media system. For example, Figure 15 models VCR use, where the user can produce shows or select from IP sources such as rental stores. The models show that media systems vary in terms of who provides information and who selects it.

P7: Both interpersonal and mass communication can occur over a variety of communication systems.

In this chapter models of interpersonal and mass mediated information exchange were discussed. New media systems may permit both interpersonal and mass information exchange, as well as even intrapersonal information exchange. The number of users and the information selection

and provision arrows identify ways in which a media system can be used. In addition to the model components reviewed in relation to the 7 propositions of Chapter 1, the model includes a system operator and non-users. System operators may be distinct from or the same as information providers for a media system. Research might study the impacts of different kinds of system operators on content. Non-users are increasingly recognized in research, particularly dealing with media systems like cable television, in which there is a large proportion of non-subscribers. With the increase in subscription media systems, there is an increase in the importance of the non-user. This model includes the non-user, focusing attention on those who do and do not have access to information.

Modeling a media system requires making specific assumptions about how it is used. This helps make researchers aware of information exchange processes associated with the particular media system being modeled which might otherwise not be realized. Much of the value in models is in shaping one's general conceptions of a phenomenon. There is heuristic value in teaching about the nature of media systems and information exchange. Research value also is derived from the ways in which a model focuses attention. A computerized bibliographic search of citiations of the models of communication reviewed in Chapter 1 identified 81 citations of 6 models (Shannon and Weaver, 1949, Newcomb, 1953, Westley and MacLean, 1957, Lasswell, 1948, Schramm, 1954 and Berlo, 1960)[8] between 1972

and 1984. The majority of citations occurred in textbooks and compendiums of communication theory which described and defined communication. The value of the model of information exchange presented here lies in its focus on the user as an active receiver and in its specification of media system participants and their information exchange roles. Many components of the model are candidates for intensive research. The model is the product of one person's synthesis. The criticism it generates and the research it sparks will in part measure its utility.

The next chapter will develop a taxonomy of media system characteristics which move beyond the models presented, integrating the six dimensions of interactivity, the model characteristics and additional features to identify commonalities and differences comparing media systems.

END NOTES

1 Claude Shannon and Warren Weaver, The Mathematical Theory of Communication (Urbana: University of Illinois Press, 1949) p. 9.

2 Ibid., p. 27.

3 Theodore Newcomb, "An Approach to the Study of Communication Acts," Psychological Review, 60 (1953): p. 393.

4 Klaus Krippendorf, "Paradox and Information," Paper Presented at the International Communication Association convention (Dallas, 1982) p. 5.

5 Ibid.

6 Bruce Westley and Malcolm MacLean, "A Conceptual Model for Communication Research," Journalism Quarterly, 34 (1957): p. 32.

7 Conversation with Doug Metcalfe, Ameritech Services (fall 1985).

8 Shannon and Weaver, Mathematical Theory; Newcomb, "Communication Acts;" Westley and MacLean, "Conceptual Model;" Harold Lasswell, "The Structure and Function of Communication in Society," in The Communication of Ideas, ed. L. Bryson (New York: Harper and Row, 1948): 37-51; Wilbur Schramm, How Communication Works," in The Process and Effects of Mass Communication, ed. Wilbur Schramm, (Urbana: University of Illinois Press, 1954); David Berlo, The Process of Communication, (New York: Holt, Rinehart and Winston, Inc., 1960).

Chapter 3: A Taxonomy of Media System Features

Chapter 1 articulated a need for research which looks beyond individual media systems. A review of historical research trends revealed a pattern of repeating the same basic studies from epoch to epoch, substituting the latest new technology as the causal agent. There are too many emerging technologies to continue this trend. Scholars are calling for "theoretical progress that does not stop at the borders of each machine"[1] (Chen, 1984) through comparative media system research.

This chapter will develop two tools for conducting research which looks beyond the individual media system to underlying factors which vary across media systems: 1) a series of media system attributes related to function, channel and interactivity quantified for 53 hypothetical media systems and 2) a taxonomy of media systems grouping them on the basis of function. First, media system attributes which have been suggested by other researchers will be reviewed. Select media system attributes relevant in cross-media system comparisons will be defined and quantiied. Data estimates will be generated for 53 media systems. A taxonomy based on media system function will then be proposed and tested using the attribute data. Bivariate analysis will examine relationships between media system function and the other media system attributes.

Discriminant analysis will be used to test a classification schema. Implications for research will be discussed.

REVIEW OF OTHER CLASSIFICATION SCHEMAS

Paisley and Chen (1982) characterized computer media systems by presentation features, inputting and command features and content features[2] They adapted Bretz's (1971) attributes.[3] Presentation features include display rate, character resolution, use of upper/lower case, line length, number of lines per screen, graphic resolution, motion, color, music and sound effects. Inputting and command features include keyboards, keypads, other input devices, menus, other structured choices and command languages. Content features consist of instructional software, text files, message files and other databases.

The features Paisley and Chen developed are specific to media systems which are based on computers and do not generalize to all media systems. Beyond classifying attributes as relating to either display, interaction, or content realms, there appears to be no attempt to group attributes by underlying factors of conceptual concern. They identify individual components of computers rather than underlying factors. For example, the importance of line length, lines per screen, character resolution and upper/lower case display may relate to the amount of information available per screen of text, and its readability. These underlying concerns are not articulated and therefore the attributes are less suggestive of

meaningful research than they could be. Amount of information available is a richer concept than upper/lower case display. Further, the list of features is not a taxonomy in the hard science tradition: It cannot be used to classify computer media systems into a small number of discrete, meaningful categories.

Daft and Lengel (1984) developed a system for assessing the "information richness" of media systems. They conceptualized richness as the "potential information-carrying capacity of data."[4] Four constructs were used to determine richness: the speed of feedback, channels employed, personalness of the source and the form of language employed. Daft and Lengel's focus was on media systems used in business for interpersonal communication. Rapidity of feedback refers to the speed with which a response to a message can be received. Face-to-face communication is considered instantaneous, while mail is very slow. There are three levels of channel. Full visual and audio is available in face-to-face communication. The next level is audio only, with telephones. The final level is labled limited visual (which they do not define). Sources may be personal or impersonal. And language forms employed may include body language, natural language or numeric language. Face-to-face is most information rich, with immediate feedback, visual and audio channels, personal sources and natural and body languages. Numeric, formal communication (e.g., a computer output) is the least information rich, with very slow feedback, limited visual

Information Richness	Medium	Feedback	Channel	Source	Language
HIGH	Face to Face	Immediate	Visual, Audio	Personal	Body, Natural
↑	Telephone	Fast	Audio	Personal	Natural
	Written, Personal	Slow	Limited Visual	Personal	Natural
	Written, Formal	Very Slow	Limited Visual	Impersonal	Natural
LOW	Numeric, Formal	Very Slow	Limited Visual	Impersonal	Numeric

Figure 17: Characteristics of Media

channel, impersonal source and numeric language (see Figure 17).

Daft and Lengel define a continuum for comparing interpersonal communication media systems. An advantage of their schema is that it organizes a diverse set of information concepts and suggests interrelationships. A problem with the schema is that media systems are arrayed inconsistently along the continuum. The linearity of channel if audio is considered more rich than limited video and less rich than full visual is questionable. The availability of body language seems to be directly related to whether a visual channel is available. The nature of source as personal or impersonal seems as if it could vary within each medium. There can be a formal, impersonal face-to-face meeting or an impersonal telephone call (e.g., a randomly selected phone interview). By Daft and Lengel's definition, the personalness of a source is not a function of a media system, but of the relationships among users of a media system and the tone of the content.

Rice and Williams (1983) offered a more general list of constructs which may vary across media systems.[5]

1) Stimulus-conveying Restrictions refer to the channel limitations imposed by a media system (e.g., audio only).

2) Channel Redundancy is a combination of channel limitations and content. In order to have the potential to carry the same content over two or more sensory channels, a media system must carry information over two or more

channels (e.g., sight and sound). Further, to have channel redundancy, the same content must be offered over both channels. While Rice and Williams do not discuss the intricacies of channel redundancy, note that true redundancy is rarely achieved, except perhaps when the same words that are spoken appear visually in text form. Channel is a construct research at length by educational media specialists.

3) Potential for Interactivity is defined as the potential for immediate, two-way interpersonal exchange over a media system. This requires a technical configuration of a media system which allows for interpersonal communication and allows it to occur immediately.

4) Social Presence, which was already defined in Chapter 1, refers to how users of a media system would fill in such semantic differentials as "sociable-unsociable," "sensitive-insensitive," "warm-cold" and "personal-impersonal." The mean score of the summed scales equals the social presence.[6]

5) Privacy is a user's "consciousness of whether "outside" individuals may monitor and exchange." Greater perceived privacy is presumed to enhance the potential of a media system to become "personalized."[7]

6) Familiarity is measured by subjective ratings of different media which, according to Rice, "may be as much a consequence of our restricted use of the medium as of the physical restrictions a given technology may impose."[8]

Familiarity with media systems likely has major impacts on how study respondents rate other attributes of that media system. In fact, familiarity or experience with different media systems may have as much influence on subjective ratings of the utility of new technologies for performing various functions as the technological attributes of that media system. Rice also cites Phillips' study of the subjective ratings of different media as to their familiarity (combining inexpensive, old and common), importance (important, time saving, necessary) and personalness (personal and private).[9]

Rice and Williams, Phillips, Daft and Lengel, Paisley and Chen and others identify sets of attributes along which media systems vary. In this chapter, additional media system attributes will be defined. With the goal of facilitating comparative media system research, I will attempt to develop media attributes in ways not done in previous studies of media systems. Specifically, media attributes will not only be described; they will be quantified and applied to a sample of hypothetical media systems. The media systems are hypothetical in the sense that assumptions must be made as to how a media system operates. For example, there are various videotex services available with different technological and operational configurations. To quantify videotex media system attributes, one particular version of a videotex system must be assumed. The data will then be used to test a proposed taxonomy of media system types.

MEDIA SYSTEM ATTRIBUTES

The media system attributes discussed here are intended to be consistent with a number of criteria. Conceptually meaningful distinctions will be attempted. To facilitate this, the attributes will be related to concepts developed in detail earlier in the dissertation: dimensions of interactivity (from Chapter 1), media system function (i.e., intrapersonal, interpersonal and mass, from Chapter 2) and channel (discussed in the review of other scholars' media system attributes).

The proposed media system attributes will be operationalized and quantified to make it easy to compare media systems. The attributes should be quantifiable across all types of media systems, to permit statistical comparisons. Values for each proposed variable will be estimated for a diverse set of hypothetical media systems. This set of media systems includes the different kinds of media systems currently available. While the list will not be exhaustive it is designed to be representative.

Rather than focus on a small group of media like previous research cited in this chapter, a large group will be considered to test the applicability of the variables to many different types of media system and to permit some statistical inferences to the larger population of media systems. Data will be estimated for 53 media systems. The Appendix lists them using generic names (for example, the generic term "home NAPLPS videotex" as opposed to an actual NAPLPS videotex service like Viewtron or Gateway). A

brief description of assumptions about each media system is included. For less common media systems more information is provided.

The variables will be based on external, observable characteristics of a media system. Many of the constructs Rice and Williams (1984) identify are based on the subjective perceptions of users.[10] In addition to user perceptions, media systems have external, real-world features which can be assessed. For example, perceived familiarity is a combination of perceived expense, perceived age and perceived commonness of a media system. Actual costs to use a media system, when a media system was introduced commercially, and how widely it has been adopted can be determined, without surveying users. External attributes can include technological components as well as normal operations of a media system.

In the remainder of this section 19 media system attributes related to function, channel and interactivity will be defined and quantified and estimates generated for each media system.

Function

Chapter 2 paralleled traditional communication distinctions between intrapersonal, interpersonal and mass communication to model mediated information exchange. Older technologies tended to fit under a single category while some newer technologies integrated two or all three functions.

Media systems under the category of Intrapersonal Information Exchange allow a user to provide information which the media system acts upon in some way to alter or produce new information which is a result of action taken on the information provided. For example, a video game is an example of an information processing media system which does not provide interpersonal or mass communication. A user enters information about when to fire video machine guns. The device receives that information and responds by computing trajectories to determine if the moving video space duck has been "killed" by machine gun fire. If so, the video game shows the duck blowing up and adds a point to the user's total score.

Interpersonal Information Exchange media systems permit users to offer information to one or a small number of particular other users. For example, telephones are typically used to connect one person to another, and allow both to provide and receive information.

Mass Information Exchange media systems deliver information from a person or group to a mass of users. Broadcast television carries programming to millions of households simultaneously. Videotex carries pages of information to users at different times.

Integrated Information Exchange integrates two or three of the above functions. For example, home videotex services allow users to retrieve information available to a mass of users, to send electronic mail to a single specific user and

to calculate mortgage payments using financial software on the system.

Figure 18 shows the classification of 53 media systems by type of information exchange. Function is designed to be a nominal variable with four possible values corresponding to the definitions offered above. The integrated media systems are shown by the types of functions they combine. CB radio and bulletin boards offer mass and interpersonal information exchange services. Home videotex integrates all three.

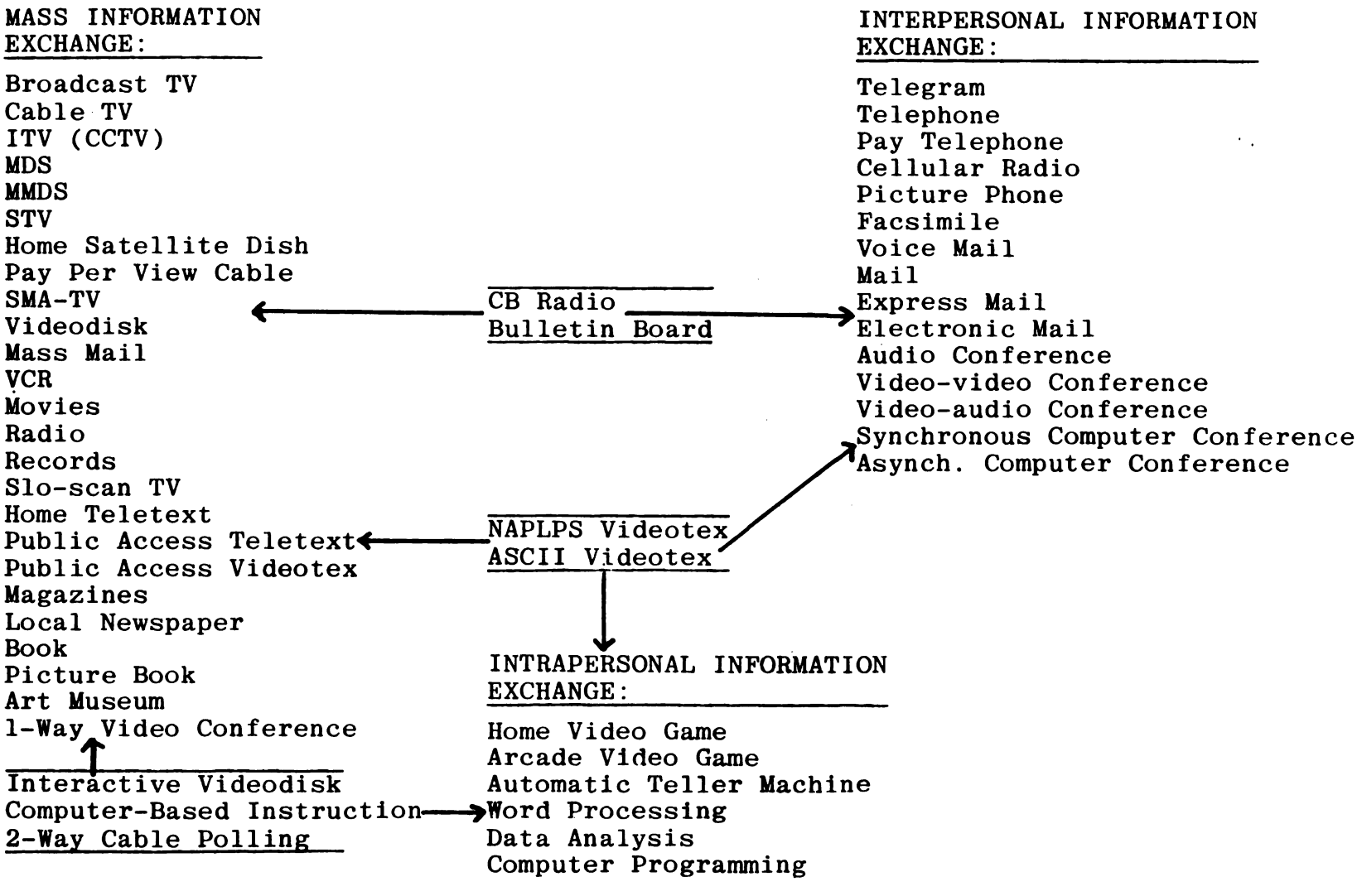

Figure 18: Media Systems by Function

While the data are described as estimates, in the case of function and many other variables they derive directly from assumptions about each hypothetical media system. For example, by definition, the hypothetical media system labeled broadcast television normally allows for mass information retrieval and not interpersonal or intrapersonal service. The process of classifying media systems by function is synonymous with explicitly defining the media system. If there is an argument about the "validity" of a classification, it is actually an argument about the classifier's definition of the media system. When studying a media system, it is important to consider carefully what functions it is used for that are of concern to the research. Specifying function assumptions explicitly may be useful step. Function assumptions about the 53 media systems are described below.

Information retrieval media systems include various permutations of broadcast, cable, satellite and microwave television and traditional mass media (books, radio, records, newspapers, etc.). Teletext and public access videotex are also pure information retrieval services. While mail is included as an interpersonal media system, mass mail is included as a mass media system because the functions are completely different. Media systems are classified by function and sometimes that is accomplished by separating one use of a media system from another as distinct media systems. Classification is based on normal uses of a media system. One-way teleconferences are

typically used to disseminate information to a large mass of users at one or more remote sites. One-way teleconferencing technology can be used to reach a single individual or small group, but that is rare. Similarly, teletext services could be elaborately programmed to simulate information processing in addition to information retrieval. If this were common, then that type of teletext system could be considered distinct from the straight information retrieval teletext systems. Finally, an art museum was included as an unusual example of mass mediated information exchange, to test the robustness of the taxonomy.

Interpersonal media systems include various person-to-person and group conferencing systems, from telephony to express mail to computer conferencing.

Information processing is currently the smallest category, consisting of video games, word processing and data processing, automated teller machines and computer programming.

In general, the categories are discrete. Forty-six of the 53 media systems classified fit under a single category. Most media systems specialize in one of the three information exchange functions. However, at least seven relatively new technologies confound the coding system because they integrate two or more functions. For example, interactive videodisk training and computer-based instruction combine the function of reaching a mass of individuals with the same content and the information

processing function of processing individual responses to programmed questions and providing feedback. In the case of mail, mass mail was treated as a separate system from interpersonal mail. And programmed teletext systems would be distinct from information retrieval teletext. But with computer-based instruction (CBI) the same user engages in information retrieval and information processing from moment to moment. It is harder to argue that there are two separate media systems. Likewise, audience polling over two-way cable television offers mass mediated content to users, but also processes the information they provide and responds to it. For example, users were asked to call plays for a football game, which were actually used. Electronic bulletin board systems permit mediated interpersonal information exchange but also can be used to provide mass information to all users of the service. Integrated or bundled telematic services such as ASCII or NAPLPS videotex actually permit all three modes of information exchange. As wideband transmission becomes more available and information processing more sophisticated, integrated systems will become more widespread and even more integrated. Home videotex services are typically limited by telephone line transmission to graphics and text content. A wideband transmission system would permit full motion video to be exchanged in the same ways.

In researching media systems it may be more appropriate sometimes to treat media system functions separately and other times to consider all functions served simultaneously.

Channel

The sensory channels over which a media system can transmit information have extensive impacts on the type of information available on media systems. Rice and Williams (1983), Daft and Lengel (1984) and Paisley and Chen (1982) each cite channel as a primary attribute.[11] Mediated information exchange is typically limited to sight and/or sound; touch, taste and smell are rarely available over traditional media systems. The availability of audio and visual channels can be quantified as dichotomies (1=present, 0=absent). Tables 3 and 4 show the quantification of channel for the media systems. Forty-five of the media systems carry visual information, and 31 carry audio. As with function, these data estimates are actually definitions. By implicit definition, telephones carry audio but no video while cable television carries both.

Rice and Williams (1983) and Daft and Lengel (1984) also identify channel limitations as an important media system feature.[12] Channel limitations may be considered in broad terms, such as whether a media system provides audio or video information. Within the realm of aural and visual channels, further limitations also apply. Designers of videotex and other computer systems must decide whether to create a system which offers 1) only text information (the least expensive, for literates, and most widely accessible configuration); 2) text and graphics (requiring a special graphics decoder for each user); 3) text, graphics and

Table 3. Channel Data for Mass Media.

	video	text	graphic	picture	motion	audio	speech	music	other
Broadcast TV	1	1	1	1	97	1	85	10	5
Cable TV	1	5	1	1	93	1	80	15	5
ITV	1	5	5	5	85	1	90	5	5
MDS	1	1	1	1	97	1	85	10	5
MMDS	1	1	1	1	97	1	85	10	5
STV	1	1	1	1	97	1	85	10	5
Home Satellite Dish	1	1	1	1	97	1	85	10	5
Pay Per View Cable	1	1	1	1	97	1	85	10	5
SMA-TV	1	1	1	1	97	1	85	10	5
Videodisk	1	1	1	1	97	1	85	10	5
Mass Mail	1	90	5	5	0	0	0	0	0
Videocassette	1	1	1	1	97	1	85	10	5
Movies	1	1	1	1	97	1	85	10	5
Radio	0	0	0	0	0	1	35	65	5
Record	0	0	0	0	0	1	25	75	0
Slo-scan TV	1	15	15	75	0	1	90	5	5
Teletext	1	70	30	0	0	0	0	0	0
Public Teletext	1	70	30	0	0	0	0	0	0
Public Videotex	1	30	15	25	25	1	10	5	20
Magazine	1	60	5	35	0	0	0	0	0
Local Newspaper	1	70	15	15	0	0	0	0	0
Book	1	100	0	0	0	0	0	0	0
Picture Book	1	30	35	35	0	0	0	0	0
Art Museum	1	2	44	44	0	0	0	0	0
1-Way Video Conf.	1	5	5	5	85	1	90	5	5

Table 4. Channel Data for Other Media.

	video	text	graphic	picture	motion	audio	speech	music	other
INTERPERSONAL:									
Telegram	1	100	0	0	0	0	0	0	0
Telephone	0	0	0	0	0	1	100	0	0
Pay Telephone	0	0	0	0	0	1	100	0	0
Cellular Radio	0	0	0	0	0	1	100	0	0
Picture Phone	1	0	0	0	100	1	100	0	0
Facimile	1	90	5	5	0	0	0	0	0
Voice Mail	0	0	0	0	0	1	100	0	0
Mail	1	90	5	5	0	0	0	0	0
Express Mail	1	90	5	5	0	0	0	0	0
Electronic Mail	1	100	0	0	0	0	0	0	0
Audio Conference	0	0	0	0	0	1	100	0	0
2-Way Video Conf.	1	5	5	5	85	1	100	0	0
2-Way Audio 1-Vid.	1	5	5	5	85	1	100	0	0
Sync Computer Conf.	1	100	0	0	0	0	0	0	0
Async Comptr. Conf.	1	100	0	0	0	0	0	0	0
INTRAPERSONAL:									
Home Video Game	1	5	95	0	0	1	0	10	90
Arcade Video Game	1	5	95	0	0	1	0	10	90
Automatic Teller	1	100	0	0	0	1	0	0	20
Local Word Process	1	100	0	0	0	0	0	0	0
Mainframe Analysis	1	100	0	0	0	0	0	0	0
Local Programming	1	100	0	0	0	0	0	0	0
INTEGRATED:									
Interactive Viddisk	1	5	5	5	85	1	90	5	5
Computer Instruct.	1	100	0	0	0	0	0	0	0
Cable Polling	1	5	5	5	85	1	90	5	5
Bulletin Board	1	100	0	0	0	0	0	0	0
NAPLPS Videotex	1	70	30	0	0	1	0	0	20
ASCII Videotex	1	100	0	0	0	0	0	0	0
CB Radio	0	0	0	0	0	1	100	0	0

pictures (requiring a distribution system with more bandwidth than telephone lines currently provide) or 4) text, graphics, pictures and full motion video (requiring a videotape or videodisk player at each user station, or wideband distribution). These four types of visual information (text, graphics, pictures and full motion video) are one way of describing the visual symbols used in media systems. Text refers to written language. Full motion video is the least abstract visual representation, followed by pictures and finally graphics which are the most abstract of the three. One could rate media systems as to whether it is technically possible for them to carry each type of visual information. If that method were used, then the data would again be definitions of the technical capacity of each system. Or, one could assign proportions to reflect the amount of visual information of each type which is typically available over a media system. The latter method provides richer information about differences between media systems. For example, although it is technically possible to present text information over broadcast television, little of the visual information available over broadcast television takes the form of text. Cable television on the other hand usually carries several channels which feature only textual information. Where technically impossible, the proportion for a category would of course be zero.

Tables 3 and 4 also contain estimated proportions of visual content devoted to each category of visual

information for the 53 media systems. These proportion channel estimates (for audio and video presentation) are not replicable. It would be possible to be more precise: One could sample representative content from an actual media system of each type and conduct formal content analysis to assign percentages to the different presentation variables. But this would entail tremendous effort, beyond the scope of an initial test of media system attributes. In assigning proportions this researcher attempted to reflect normative amounts of the various types of content and to be consistent across similar media systems. Thus broadcast television, MDS, MMDS, STV, and home satellite dishes were all rated with the same proportions of text, graphic, picture and full motion video content. The actual proportions assigned are sometimes questionable. To say that 97 percent broadcast television visual content is full motion video may or may not be true. However, to say that computer word processing consists of 100 percent text visuals is at least the case for many word processing programs. It is hoped that the estimates will accurately differentiate and group classes of media systems. Replication of the proportions by a second independent rater would be unlikely to arrive at the same numbers but should approximate differences between types of media systems.

The method used in estimating data was to list each media system on a 3x5 card, group them by shared characteristics, and then assign a value to each group.

Repeating this exercise for each attribute, a data set consistent across media systems was derived.

Seven groups of visual information proportions emerge. 1) Most of the computer-based media systems have 100 percent of their information in the form of text (e.g., computer-based instruction, electronic mail, computer conferencing, etc.). 2) Individually targeted print-based media systems which are physically or electronically distributed consist of approximately 90 percent text and 5 percent each graphic and pictoral information (e.g., mail, mass mail, facsimile). 3) The more general print-based media (magazines, newspapers and picture books) contain varying proportions of text, graphics and pictures. 4) Teletext and videotex systems are about 70 percent text and 30 percent graphics. Public access videotex with videodisk players in each terminal have the same relative proportion of text and graphics, but also present pictures and full motion video. 5) Videogames are primarily graphics (95 percent), with some text (5 percent). 6) Instructional and industrial television applications offer primarily full motion video (about 85 percent), with moderate to heavy complimentary text, graphics and pictures (5 percent each). 7) Commercial television systems are primarily comprised of full motion video information (perhaps 97 percent), with minimal text, graphics, or pictures. (Cable television has slightly more text information accessed by users, because of the many alphanumeric channels available.)

As with video, audio information may use different symbol systems. The predominant aural information mode is speech. Music is one type of abstact aural information, while sound effects are another. For each media system, the proportionate presence of speech, music and sound effects was estimated. The same caveats offered for video proportion estimates apply tothe audio proportions. Again the estimate was based on what is normal for a media system and not what is possible or infrequent.

Among mass media systems, there were two groups of audio presentation proportions. Commercial television systems have approximately 85 percent speech, 10 percent music and 5 percent sound effects. On instructional and industrial television there is typically more talk and less music or sound effects (about 90 percent, 5 percent and 5 percent, respectively). Exceptions include cable television which offers numerous music channels. Radio and records have much higher proportions of music. Public access videotex is largely silent, with beeps when users press buttons (about 20 percent of the time) and occasional speech and music when the videodisk player is activated.

Audio on the interpersonal media systems consists almost entirely of speech. It is possible (but cumbersome) to design music or sound effect messages for telephone conversations, but this is rarely done.

Intrapersonal media systems currently do not use speech, although it is technologically possible to include speech synthesis as a form of computer output. Video games

beep most of the time (perhaps 90 percent), with occasional electronic music (10 percent). Automatic tellers, like videotex, are silent except when keys are pressed.

Among the integrated media systems, interactive videodisk and cable polling resemble commercial television. NAPLPS videotex beeps when keys are pressed. (Not all NAPLPS videotex systems beep, but the hypothetical videotex system being rated is assumed to.)

Interactivity

The six dimensions of interactivity described in Chapter 1 were operationalized and data assigned for the 53 media systems. Data appear in Tables 5 and 6.

Amount of User Choice. The first dimension of interactivity identified in Chapter 1 was the amount of choice users have. Operationalizing the construct requires certain assumptions. The first assumption relates to whether choice is considered at a particular point in time. For example, with broadcast television, user choice at any particular point in time is represented by the number of channels over which content is available. Amount of choice across a day or week would be much greater, depending on the time frame selected. For consistency, choice will be considered at a particular point in time. Thus, for broadcast media, amount of user choice is the number of different channels with available content.

Some media systems, such as instructional television, are used to deliver particular content to a specific audience. An instructional program targeted for sixth grade

Table 5. Interactivity Data for Mass Media.

	user choice	initial effort	effort during	responsiveness	feedback	ease of adding	instantaneous	short delay	long delay
Broadcast TV	5	0	0	0	0	0	20	5	75
Cable TV	36	0	0	0	0	1	20	5	75
ITV	1	2	0	0	0	0	50	0	50
MDS	1	0	0	0	0	0	5	5	90
MMDS	5	0	0	0	0	0	5	5	90
STV	1	0	0	0	0	0	5	5	90
Home Satellite Dish	100	0	0	0	0	0	5	5	90
Pay Per View Cable	1	0	0	1	2	0	5	5	90
SMA-TV	36	0	0	0	0	0	20	5	75
Videodisk	200	1	0	0	1	0	0	0	100
Mass Mail	1	0	0	0	0	0	0	0	100
Videocassette	999	1	0	0	0	0	0	50	50
Movies	10	2	0	0	1	0	0	0	100
Radio	15	0	0	0	0	1	20	5	75
Record	999	1	0	0	1	0	0	0	100
Slo-scan TV	1	1	0	0	0	0	50	0	50
Teletext	100	0	1	1	0	0	0	50	50
Public Teletext	100	2	1	1	0	0	0	50	50
Public Videotex	100	2	1	1	1	0	0	0	100
Magazine	50	1	0	0	1	0	0	0	100
Local Newspaper	2	0	0	0	1	1	0	50	50
Book	999	1	0	0	1	0	0	0	100
Picture Book	50	1	0	0	1	0	0	0	100
Art Museum	200	2	0	2	1	0	0	0	100
1-Way Video Conf.	1	2	0	0	1	0	50	0	50

Table 6. Interactivity Data for Other Media.

	user choice	initial effort	effort during	responsiveness	feedback	ease of adding	instantaneous	short delay	long delay
INTERPERSONAL:									
Telegram	1	0	0	2	1	0	0	100	0
Telephone	0	0	1	2	2	0	100	0	0
Pay Telephone	0	2	1	2	1	0	100	0	0
Cellular Radio	0	0	1	2	2	0	100	0	0
Picture Phone	0	0	1	2	2	0	100	0	0
Facimile	1	2	0	2	1	0	0	100	0
Voice Mail	10	0	0	2	2	0	0	90	10
Mail	10	0	0	2	1	0	0	0	100
Express Mail	1	0	0	2	1	0	0	100	0
Electronic Mail	10	0	2	1	2	0	20	40	40
Audio Conference	1	2	1	2	1	2	100	0	0
2-Way Video Conf.	1	2	1	2	1	2	100	0	0
2-Way Audio 1-Vid.	1	2	1	2	1	2	100	0	0
Sync Computer Conf.	1	2	1	2	1	2	100	0	0
Async Comptr. Conf.	1	2	2	1	2	2	20	40	40
INTRAPERSONAL:									
Home Video Game	20	0	1	1	0	0	10	0	90
Arcade Video Game	20	2	1	1	1	0	10	0	90
Automatic Teller	1	2	1	1	2	0	10	0	90
Local Word Process	20	0	2	1	0	0	90	0	10
Mainframe Analysis	5	0	2	1	2	0	90	0	10
Local Programming	4	0	1	1	0	0	90	0	10
INTEGRATED:									
Interactive Viddisk	1	2	2	1	2	0	10	0	90
Computer Instruct.	1	2	2	1	2	0	10	0	90
Cable Polling	1	0	1	1	2	1	10	0	90
Bulletin Board	50	0	2	1	2	2	20	40	40
NAPLPS Videotex	500	0	2	1	2	2	10	40	50
ASCII Videotex	800	0	2	1	2	2	10	40	50
CB Radio	10	0	1	0	0	2	100	0	0

classes may be telecast at a particular time. Sixth grade classroom user have essentially one option: the show the class is watching, even if other content is available on other TV channels. Video and audio and computer conferences operate in a similar fashion. Likewise, students using instructional videodisk or computer-based instruction are likely to be required to view a particular lesson.

For every media system, user choice is defined in terms of a unit of analysis. For television the unit of analysis was assumed to be the channel, even though within a program there are many bits of information which the user may also choose whether or not to attend to. In estimating user choice for a media system the unit of analysis is chosen to reflect the unitizing of that media system. The actual identification of unit of analysis is arbitrary.

It is difficult to rate amount of user choice across the different types of media systems. Facsimile and express mail are used to transmit a business document for immediate use. Telegrams are used to reach another user with brief, specific information. As an information provider there is almost unlimited choice of people to whom telegrams or express mail could be sent. The number of people to whom one is likely to send express mail or telegrams is much smaller. As an information user retrieving information from a telegram or express mail it is unlikely that more than one telegram or express package will be received in a typical day. Thus, once one has become a user of the service (by receiving mail), there is a single choice of information to

retrieve. In an attempt to be consistent with coding of the mass media systems, user choice is defined as referring to choice from a user and not an information provider perspective. For facsimile, telegram and express mail then, the amount of user choice is one. Telephones and picture phones have no collected, available content. On the other hand, mail, voice mail and electronic mail all collect messages, so that there is available content collected for a user to retrieve. Here, the average number of messages available to a user at a particular point in time is estimated (e.g., 10 pieces of mail in a day). Bulletin boards offer more messages (approximately 50), while NAPLPS and ASCII videotex offer large numbers of messages, content areas and other types of information. Another alternative to the dilema of forcing the same scale on disparate media systems would be to only code user choice for information retrieval media systems. However, a goal of this exploratory analysis is to operationalize variables applicable to all 53 systems. Therefore an operationalization is forced. Future research involving these and other media system attributes should consider the appropriateness of assigning values along a single scale for diverse media systems.

Still other media systems offer users choice at the point of sale. For example, with videocassette rental and magazine, book or record purchase, user choice can be defined as the approximate number of different content units

(e.g., books or videocassettes) available. Users also have a purchase choice of home and arcade videogames and word processing programs. Some media systems provide users with a vast choice of content (e.g., books and videocassettes). An arbitrary value of 999 was assigned to those media systems with as many or more choices to keep the data from having even larger variance, for future analyses.

For intrapersonal systems, retrieval choice is assumed to occur in the choice of a bank terminal protocol or videogame, or word processing program, or data processing or programming language.

As stated previously, user choice is a cumbersome concept to apply uniformly across diverse media systems. The process of assigning values forces various assumptions about user choice which may not have been obvious issues prior to this exercise.

Effort Users Must Exert. The second dimension of interactivity in Chapter 1 was user effort. There are (at least) two unrelated types of user effort which could be considered: the effort users must exert to begin accessing a media system and the effort they must exert to select information once a connection has been established.

Low initial effort is required to use media systems which can be accessed from the home or office. These include telephones, cable television, mail, and so on. Somewhat more effort is required in order to use media systems such as videocassette or books because a user must travel to purchase or borrow information content to use later. The

greatest level of effort is involved when a user must travel to a particular location and use the media system from that location (e.g., a public access videotex terminal, a movie, a video conference). Low initial effort was coded as zero, medium effort one and greatest initial effort two, to ordinally quantify initial user effort.

Subsequent effort required to access information from a media system once a connection is established also varies. Minimal effort need be exerted to simply watch or read or listen to information (e.g., mail, television, radio). Somewhat more effort is needed to access information on teletext or videogames, with which the user must actively provide information in order to continue receiving any. Similarly, to receive information over telephone and certain other interpersonal systems, a user must verbally respond or request information. (Talking and entering alphanumeric requests for information on a keypad were treated as ordinal equivalents for the scale of user effort during use.) Finally, some media systems require complex written or typed responses. Using bulletin boards, mail, word or data processing, asychronous computer conferencing and the like require fairly extensive effort. Minimal effort was rated zero, intermediate effort 1 and complex response 2. Data estimates for user effort require fewer assumptions than user choice.

System Responsiveness. Rafaeli (1985) defined system responsiveness as the extent to which using a media system

resembles human discourse, how actively responsive a medium is.[13] None of the 53 media systems analyzed here approach Rafaeli's ideal of responsiveness. Many media systems are unresponsive during use (for example, television, newspapers, books, magazines, videodisk, etc.). Other media systems (particularly those based in part on computer technology) have some degree of responsiveness programmed into normal operation of the system. For example, error messages and "help screens" may be programmed to appear on computer systems such as videotex or electronic mail if the user makes a mistake or has a question. Still other media systems actually have a human operator standing by, to answer questions during use (e.g., telephones, an art museum, the post office, movies). Unresponsive media systems were coded zero, programmed, crude responsive systems were coded one, and systems which provide a human operator were coded two. Advances in the responsiveness of media systems will eventually permit application of a more diverse and sophisticated coding scheme for this variable.

System Monitoring of Information Use. The fourth dimension of interactivity defined in Chapter 1 was the capacity of a media system to monitor system use. Three levels of use monitoring were identified to operationalize this dimension. The first level included media systems in which system use can not be monitored other than by conducting specific research studies to observe samples of users. Two classes of media systems fit this level: one-way broadcast media systems such as television, radio and teletext (because once

a signal is transmitted there is no way to monitor use) and intrapersonal media systems such as home computers and videogames in which the user is the system operator (because use occurs in the home, beyond the observational scope of a non-resident).

The second level consists of media systems which are able to monitor use based on the structure of the system (for example, movie theaters sell tickets and can therefore determine the number of viewers of each movie), but cannot monitor use on an individual or household level (e.g., keeping track of who sees which movies how many times). Record, book, magazine and videodisk industries can monitor purchase behavior (although not actual use). Videogame arcade operators, audio conferencing companies and public access access videotex systems can all monitor use because users travel physically to a location available to the system operator for observation-- but these media systems do not track individual behavior.

The third level of system monitoring use includes media systems which can keep track of use behavior and link it with a particular household or individual. These include computer conferences, point-to-point telephone systems, and computer-based instruction or interactive videodisk when used in a school or work environment.

System monitoring of use was rated 0 for no monitoring, 1 for limited monitoring and 2 for continuous feedback. Given the definitions offered above, the data estimates are

actually clarifications about the nature of the media system.

Ease of Adding Information. This dimension refers to the extent to which users can provide information to the media system which a mass, undifferentiated audience can access. Of the 53 media systems, only 8 provide users with that capability, to different degrees (according to this researcher's experience with each media system). Some cable television franchises provide users with public access channels and production facilities for creating and airing their own programs. Two-way cable systems which poll their audiences interactively and report results allow users to influence some mass mediated information. Local newspapers may print letters to the editor. Local radio may put telephone calling users on the air. For each of these media systems, users' potential to add information is present but cumbersome and rare. Four other media systems (three of them integrated) allow users extensive opportunity to provide information to a mass audience: CB radio, home videotex and electronic bulletin boards. Ease of adding information was rated zero for most media systems, one for media systems with cumbersome opportunities and two for media systems where the opportunity to add information was readily available.

Limitations on Interpersonal Exchange. By definition, mediated interpersonal information exchange can occur only over interpersonal media systems or integrated media systems. The intrapersonal systems (e.g., videogames) and

mass systems (e.g., teletext) do not allow for interpersonal information exchange.

The channel variables already described represent a major source of limitations on interpersonal exchange, indicating whether audio and and visual channels are available and what types of symbol (e.g., text, graphics, pictures, etc.) can be used over the media system. An additional factor commonly cited as different across media systems is synchronicity. The least limited interpersonal information exchange occurs without significant delays in exchanging information. Some media systems operate with short delays of several hours or a day, while others impose a long delay of two or more days between the time information is encoded and the time users can access that information. As with channel, the relative proportion of information on a media system that is typically available instantaneously, after a short delay and after a long delay was estimated for each media system, based on assumptions about how information is exchanged over the media system.

Media systems such as telephones, CB radio and syncronous conferences were rated 100 percent instantaneous. Instructional television and one-way video conferences tend to be live (instantaneous) about half the time and tape delayed for at least several days the other half. Telegrams and express mail were 100% short delay. Voice mail is mostly short delay. while newspapers, teletext and home VCRs make information available after either a short or long

delay. The most common type was 100 percent long delay, encompassing books, magazines, mail, videodisk, movies and so on. Intrapersonal media systems such as interactive videodisk and automatic tellers primarily compile information which has been created over a long period of time, with a small amount of information added by the user during use. Some television services (e.g., pay television services) primarily carry movies which are preproduced, with occasional live events. Others such as cable and broadcast television regularly carry news which includes a larger proportion of live and recently produced content. A small set of computer-based media systems offer substantial proportions of all three types of information: home videotex, electronic bulletin boards, electronic mail and asynchronous computer conferences each carry information which is available instantly, after a short delay and after a long delay.

The attributes identified here are not exhaustive of the possibilities. For interactivity, other factors such as pacing (where the user might have no control, some control or complete control) could be developed. Beyond interactivity, features such as cost and penetration of media systems could be added. Those variables already defined will be used to demonstrate an approach to studying media systems.

TAXONOMIC CATEGORIES

Nineteen media system attributes have been defined and

data have been estimated across 53 media systems. In the process, various assumptions about how particular media systems have been clarified. To further explore the utility of media system attributes in conducting comparative media research, a discrete taxonomy of media systems will be proposed and tested using the estimated data.

In the physical sciences taxonomies are often used to classify cases into a small number of discrete categories, to permit parsimonious comparisons. For example, in physics, "it is convenient to classify matter into three states: gas, liquid and solid (Cromer, 1974.)"[14] The classification system for assigning substances to a particular state is based on two criteria: volume and shape. Solids have definite volume and shape. Liquids have definite volume but not definite shape. Gasses have neither definite volume nor definite shape. Water is the only substance commonly found in all three states, although other substances are commonly transformed in industrial and laboratory processes.

Each state of matter has some unique and some shared properties. The utility of the taxonomy lies in specifying and comparing the properties of matter across the three states. What properties do all gasses have in common, and what properties are unique to a particular gas? Much broader generalizations can be derived about the nature of the three classes of matter than would be possible considering every substance individually. There is also heuristic value in taxonomies which successfully describe

important differences between types of substances.

There is not a "correct" taxonomy for grouping media systems. At best, a taxonomy is useful. Even in physics, grouping matter as liquid, solid or gas is arbitrary-- the schema is used because it is a "convenient" tool for understanding properties of matter. Thus, the choice of taxonomic categories for media systems is arbitrary, but crucial.

Media systems could be classified into dichotomies such as computer-based versus non-computer-based or interactive versus one-way. Local, regional and national systems could be distinguished. Or systems could be classified by channel (e.g., audio with video, audio only, limited video). But rather than divide media systems by presentation or interaction or technology features, this analysis will test a taxonomy based on function. Communication scholars have long distinguished intrapersonal, interpersonal and mass communication.[15] Chapter 2 modeled mediated intrapersonal, interpersonal and mass information exchange separately. This section will examine the relationship between function and the other 18 media system attributes to consider the utility of a media system taxonomy based on function. First, bivariate mean comparisons of the four functional types of media systems will be examined. Then, discriminant analysis will be applied to a subset of the variables to test the classification capability.

BIVARIATE TAXONOMIC COMPARISONS

Here, data generated and described in the previous section will be used to compare the three original types of media systems (mass, interpersonal, and intrapersonal) along the 18 discriminating variables. Differences among media system types will be examined, including for integrated media systems which accomodate more than one type of information exchange. Statistical mean comparisons will not be used because the 53 media systems do not constitute a random sample, and other assumptions of analysis of variance are violated (normally distributed data, independent random samples and homoscedasticity (Blalock, 1979))[16]. Table 7 shows means and standard deviations by media system type comparing across mass, interpersonal and intrapersonal media systems for channel variables. All intrapersonal media systems coded and 92 percent of mass media systems use visual channels, compared to only 67 percent of interpersonal systems. Integrated systems are also likely to use visual channels. The types of media systems do not appear to be very different in their likelihood of using audio channels (50 to 68 percent), although there are differences in the kind of visual and auditory information available.

Intrapersonal systems feature predominantly text (68 percent) and graphic (32 percent) visual information. Interpersonal systems feature either text (45 percent) or full motion (18 percent). Mass systems are half full motion

Table 7. Channel Means by Function.

Variable:	Mass	Inter.	Intra.	Integrated
Video	92%	67%	100%	86%
(s.d.)	28	49	0	38
Text	22%	45%	68%	54%
(s.d.)	33	49	49	49
Graphics	9%	2%	32%	6%
(s.d.)	13	2	49	11
Pictures	10%	2%	0%	1
(s.d.)	18	2	0	2
Motion	50%	18%	0%	24%
(s.d.)	48	37	0	41
Audio	68%	60%	50%	57%
(s.d.)	48	51	55	53
Speech	51%	53%	0%	40%
(s.d.)	41	52	0	50
Music	11%	0%	3%	1%
(s.d.)	18	0	5	2
Other	4%	0%	37%	4%
(s.d.)	4	0	42	7
n of cases	25	15	6	7

(50 percent), followed by text (22 percent) and approximately 10 percent graphics and pictures. Integrated media systems follow the pattern of interpersonal systems, comprised of primarily text (54 percent) or full motion (24 percent). Adding the proportions of each kind of visual information does not sum to 100 percent because some media systems carry no visual information.

Speech is not present on intrapersonal systems, while music and other sound effects are not present on interpersonal systems. Mass media systems feature speech (51 percent) and music (11 percent) primarily. Again, integrated media systems most closely follow the pattern of interpersonal systems.

Table 8 shows means and standard deviations for the interactivity variables. Amount of user choice and initial user effort do not appear to differentiate media system type, but all of the other interactivity measures show differences. There is vastly more choice available to users of mass media systems (averaging 161 choices) than interpersonal (average=3) or intrapersonal (average=12). There is wide variation: the standard deviation for mass systems is 321. Integrated media systems closely resemble mass media systems.

Initial user effort was defined in terms of the necessity to travel in order to use a media system. Travel was not very different by media system type, although intrapersonal and integrated systems were less likely to

Table 8. Interactivity Means by Function.

Variable:	Mass	Inter.	Intra.	Integ.
User Choice	161	3	12	195
(s.d.)	321	4	9	323
Initial Effort	.80	.93	.67	.57
(s.d.)	.87	1.03	1.03	.98
Effort During	.12	.80	1.50	1.71
(s.d.)	.33	.68	.55	.49
Responsiveness	.24	1.87	1.00	.86
(s.d.)	.52	.35	0.0	.38
Feedback	.48	1.40	.83	1.71
(s.d.)	.59	.51	.98	.76
Ease of Adding Info.	.12	.67	0.0	1.29
(s.d.)	.33	.98	0.0	.95
Instantaneous	10%	56%	50%	24%
(s.d.)	17	49	44	34
Short Delay	10%	31%	0.0	17%
(s.d.)	18	44	0.0	21
Long Delay	80%	13%	50%	59%
(s.d.)	21	28	44	34
n of cases	25	15	6	7

Higher means indicate more of each attribute.

require travel. Intrapersonal and integrated systems required the most effort during use, and mass systems the least.

System responsiveness was greatest among interpersonal media systems, which tend to have a human operator available to answer questions. Intrapersonal and integrated media systems had some programmed help information, and mass media systems were generally unresponsive. Whether systems could monitor use is also most likely for interpersonal systems. For this variable, integrated media systems more closely resembled interpersonal than intrapersonal systems.

The opportunity for users to add information that a mass, undifferentiated audience could access was nonexistent for intrapersonal systems. Of the three major types, intrapersonal media systems most often allowed users to add information-- but not nearly to the extent that integrated media systems did.

Eighty percent of the information available on mass media systems was available after a long delay. Eighty-seven percent of interpersonal information was available instantly or after short delay. And half of the information on intrapersonal systems was available instantly, while the other half was available only after a long delay. The timeliness of integrated media system information was the most evenly divided across categories of the media system types, with the majority of information available after a long delay.

A strong relationship between interactivity and channel attributes and media system function emerges. Fourteen of the 18 attributes are notably different across mass, interpersonal and intrapersonal systems. The integrated systems have their own pattern, sometimes resembling one type of media systems, other times another.

DISCRIMINANT ANALYSIS

One further exploratory application of estimated media system data will be conducted. A subset of media system attributes will be used in a discriminant analysis to classify media systems by function. According to McLaughlin (1980), "Discriminant analysis is frequently employed in taxonomic research."[17] It can be used to test hypotheses about whether previously classified groups (e.g., mass, interpersonal and intrapersonal media systems) differ considerably on one or more linear combinations of a new taxonomic instrument. Validated taxonomic measures can then be used to classify ungrouped cases. In this section, discriminant analysis will be used to assess the taxonomic utility of channel and interactivity variables in classifying media systems. The discriminant classifications of each integrated media system into one of the three types will then be examined. Discriminant analysis will be repeated treating integrated media systems as a fourth taxonomic group.

The data are estimates by a single judge. Many of the assumptions for discriminant analysis are violated.

Discriminant analysis is used here to explore the efficacy of the proposed taxonomy. Findings should be considered suggestive, not definitive.

The number of discriminating variables in discriminant analysis is limited by sample size. A general rule of thumb is that about 10 times as many subjects (in this instance, media systems) as variables are needed. Thus, with 46 media systems across the three categories, a limit of 4 to 5 discriminating variables is imposed. According to McLaughlin (1980), "as a general rule, increasing the number of independent variables decreases the accuracy of classification."[18] They recommend that only variables which are significantly different across groups in bivariate comparisons be included as discriminating variables. To limit the number of discriminating variables and still test channel and interactivity, two separate analyses will be run, one for each set.

Within channel variables, the presence or absence of audio and video were omitted in favor of the more specific subcategories. For visual channels, all four subcategories were included: text, graphic, photo and motion. Under audio, music and "other" occurred infrequently. Only speech was included in the analysis.

For the interactivity discriminant analysis, user choice and initial effort were not particularly different by media system type and were therefore excluded from the analysis. Because of a need to further reduce the set from 7 variables to 4 variables and because synchronicity

reflected only one element of the initially defined "limitations on interpersonal communication" construct, the three measures of synchronicity (instantaneous, short and long delay) were also excluded. Thus, this discriminant analysis would be based on user effort during use, system responsiveness, system capacity to monitor use and ease of adding information that a mass of users could access.

McLaughlin (1980) specifies three assumptions of discriminant analysis: 1) mutual exclusivity and exhaustiveness of the taxonomic groups; 2) homogeneity of variance across each group and 3) multivariate normality of independent variables across groups.[19] Assumption 1 is satisfied by the definitions of mass, interpersonal and intrapersonal media systems. Each of the 46 media systems is categorized discretely. Assumption 2 is violated by the data, as can be observed from the widely variant standard deviations in Tables 7 and 8. Non-homogeneity of variance was confirmed by significant Box's M tests. Therefore, option 18 on the SPSS version of discriminant analysis was selected, causing calculations to be based on individual rather than pooled covariance matrices. Assumption 3 is also violated by the data, potentially threatening the validity of the test.

Four discriminant analyses were run: one classifying data into three groups and one into four groups, for channel and interactivity. Rather than present the full results for each analysis, the classification tables will be examined,

and the equation which best classifies media systems by function will be presented in full. Table 9 shows the classification tables for channel variables, and Table 10 does so for interactivity variables.

The three-group channel discriminant analysis correctly classified 76 percent of the media systems as mass, interpersonal or intrapersonal. Adding the fourth group, integrated media systems, reduced classification accuracy to 58 percent. Interactivity variables more successfully discriminated media systems by function. The three-group analysis correctly classified 87 percent of the systems, and the four-group analysis maintained high classification accuracy including integrated media systems as a separate category (81 percent). More detail will be provided for the three-group interactivity analysis.

Table 11 reports the discriminant function results. Both functions are significant. Function 1 has a canonical correlation of .90 and accounts for 84 percent of the variance, while function 2 has a canonical correlation of .66, accounting for 16 percent of the variance. Function 1 differentiates mass media systems from interpersonal media systems with intrapersonal media systems in the middle, separated from both extremes, while function 2 differentiates intrapersonal media systems from mass and interpersonal, as shown by the group means. System responsiveness is the major discriminator between mass and interpersonal systems, with interpersonal systems more

Table 9. Channel Classification.

THREE GROUP ANALYSIS

Actual Group	# of Cases	Predicted Group Membership 1	2	3
Group 1 (mass)	25	21 (84%)	2 (8%)	2 (8%)
Group 2 (inter.)	15	3 (20%)	12 (80%)	0 0
Group 3 (intra.)	6	0 0	4 (67%)	2 (33%)
Ungrouped (integ.)	7	2 (29%)	4 (57%)	1 (14%)

(76 percent of grouped cases correctly classified)

FOUR GROUP ANALYSIS

Actual Group	# of Cases	Predicted Group Membership 1	2	3	4
Group 1 (mass)	25	21 (84%)	0 0	2 (8%)	2 (8%)
Group 2 (inter.)	15	1 (7%)	5 (33%)	0 0	9 (60%)
Group 3 (intra.)	6	0 0	0 0	2 (33%)	4 (67%)
Group 4 (integ.)	7	2 (29%)	1 (14%)	1 (14%)	3 (43%)

(58 percent of grouped cases correctly classified)

Table 10. Interactivity Classification.

THREE GROUP ANALYSIS

Actual Group	# of Cases	Predicted Group Membership 1	2	3
Group 1 (mass)	25	20 (80%)	2 (8%)	3 (12%)
Group 2 (inter.)	15	0 0	14 (93%)	1 (7%)
Group 3 (intra.)	6	0 0	0 0	6 (100%)
Ungrouped (integ.)	7	1 (14%)	4 (57%)	2 (29%)

(87 percent of grouped cases correctly classified)

FOUR GROUP ANALYSIS

Actual Group	# of Cases	Predicted Group Membership 1	2	3	4
Group 1 (mass)	25	21 (84%)	1 (4%)	3 (12%)	0 0
Group 2 (inter.)	15	0 0	13 (87%)	1 (7%)	1 (7%)
Group 3 (intra.)	6	0 0	0 0	5 (83%)	1 (17%)
Group 4 (integ.)	7	1 (14%)	0 0	2 (29%)	4 (57%)

(81 percent of grouped cases correctly classified) responsive. Intrapersonal media systems are identified by the large amount of user effort required during use and the inability to add information that a mass audience can access. All four discriminating variables have significant Wilk's Lambdas, indicating that they play a significant role in classification and discrimination.

Examination of the individual case classifications shows that one interpersonal and five mass media systems were misclassified. Four of the ungrouped integrated media systems (ASCII home videotex, bulletin boards, computer based instruction and CB radio) were classified as interpersonal systems. Two were classified as mass (cable polling and interactive videodisk) and one as intrapersonal (NAPLPS videotex).

IMPLICATIONS FOR RESEARCH

The media system characteristics operationalized here do differentiate types of media systems by function. There are large differences across the four types of media systems for 14 of the 18 discriminating variables constructed in this chapter. Discriminant classification using a subset of interactivity variables classified 87 percent of the sample media systems correctly. One result of this study is to begin to identify relationships between interactivity and what a media system is used for.

Table 11. Discriminant Results.

CANONICAL DISCRIMINANT FUNCTIONS

	Function 1	Function 2
Eigenvalue	4.05	.77
Percent of Variance	84%	16%
Canonical Correlation	.90	.66
Wilk's Lambda	.11	.56
Chi Squared	91	24
Degrees of Freedom	8	3
Significance Level	.0000	.0000

DISCRIMINANT FUNCTIONS FOR GROUP MEANS

	Function 1	Function 2
Mass	-1.71	.23
Interpersonal	2.56	.49
Intrapersonal	.70	-2.18

STANDARDIZED DISCRIMINANT FUNCTION COEFFICIENTS

	Funct. 1	Funct. 2	Wilk's L.	P
Effort During	.28	-.99	.49	.0000
Responsiveness	.87	.18	.25	.0000
Feedback	.28	.27	.68	.0002
Ease of Adding Info.	.26	.61	.83	.0166

Mass media systems almost always carry visual information in the form of full motion video or text. When there is audio it tends to be speech and music. There is usually extensive user choice and minimal user effort. Mass media systems are rarely responsive and rarely are capable of monitoring use behavior. It is occasionally possible for users to add information to the system, but most of the information collected for mass media systems is made available to users long after encoding of that information has started.

Interpersonal media systems are the least likely to offer information over visual channels. When there is visual information, it is most often in the form of text, or occasionally full motion video. People tend not to communicate by graphic or pictire interpersonnally. Audio is exclusively speech. Interpersonal media systems offer little user choice of content to retrieve. Moderate user effort is required to exchange information. Interpersonal media systems are likely to be quite responsive and to be able to monitor use behavior. It is sometimes possible for users to add information that a mass audience can access. The majority of information is available instantly, or, for one third of the information, after a short delay.

Intrapersonal media systems always include visual channels-- most frequently text and some graphic. Audio is available on about half of the systems, almost exclusively some for form of audio other than speech and music. Intrapersonal media systems offer little user choice. Users

must exert the most effort to access information over this type of system. Intrapersonal media systems are somewhat responsive and sometimes can monitor use behavior. It is generally impossible for users to add information a mass audience can access. Half of the information available over intrapersonal media systems is available immediately, and the other half is available only after a long delay.

Some of these differences between media system attributes are likely to derive from technological factors. For example, system monitoring of media system use in interpersonal and integrated media systems is probably a side effect of being able to have two-way information exchange from point to point. Difficulty adding information to a system that a mass audience can access is related to how a media system is distributed: when the user is the system operator, then it is likely that they use a "stand-alone" unit which has no way to connect to other users' stand alone systems (for example, a home computer). Other media system attribute differences relate more to how information is exchanged. Few media systems use graphic or pictoral visual channels for information, perhaps because there is not a well developed symbol system like language which would permit messages to be encoded as graphic information. Mass information retrieval systems require little user effort and offer many choices. Information (as defined in Chapter 2) is usually offered over mass media systems with a long delay, because the information product

is more complex and presumably better if it is carefully produced rather than live or instantaneously transmitted.

Integrated media systems were found to have special characteristics, sometimes resembling mass media systems, sometimes interpersonal and sometimes intrapersonal. Most integrated media systems include visual information (primarily text and some full motion video). Audio is also available on a majority of systems, primarily in the form of speech. Integrated media systems offer extensive user choice and require considerable user effort to access information. The systems have programmed responsiveness and usually include the capacity to monitor use behavior. It is easy for user to add information that a mass audience can access. The majority of information is available after a long delay, but substantial proportions of information are also available instantly and after a short delay.

These unique characteristics of integrated media systems (which are primarily new technologies) suggest that technological developments are having and will continue to have substantial impact on how we exchange information and with whom. Further theoretical development is needed to guide the study of integrated media systems to understand the full impacts of being able to accomplish multiple information exchange functions over a single media system. As discussed earlier, some research will need to isolate specific functions. Research frameworks must be also be developed to accomodate multiple functions. For example, uses and gratifications research in which gratifications

have typically been associated with a single system function. How to handle uses and gratifications where two functions (e.g., intrapersonal and interpersonal) are available from a single media system is unclear.

Further, this dissertation has focussed on individual media systems. But users do not use a single media system. Media environments (the confluence of different systems available to a user) must be considered. Interactions among media systems could be examined. Some media systems may be complimentary (e.g., videocassette recorders and cable television: viewers with cable and a VCR can record more movies for later use from cable than from over the air channels). The interactions may be competitive (e.g., teletext and television: watching television and reading teletext cannot both occupy the same household TV set simultaneously). Or, the interactions may be substitutive (e.g., videotex and newspapers: newspaper publishers initially feared that videotex news services would reduce print newspaper readership).

Baldwin, Abel and Ducey (1984) identify different sets of meda available to users based on community population size.[20] Low population areas tend to have few available media systems, while high population areas have much richer media environments. Not only are there fewer choices, but the media systems serving low population areas offer less information than those same media systems in high population areas. The available competition and media system options

likely interact with use and impacts. A media system will have greater impact if only a few other media systems are available than if it is one of many user options.

Relationships between channel and interactivity factors and what a media system is used for have been suggested. An issue for future research is causality. Are the relationships based on technological convenience, or are certain channels and modes of interactivity more condusive to certain functions? For example, are audio and text more important in interpersonal information exchange than graphics, pictures and full motion video, or has technology simply denied access to these video forms until now? Will the graphic and pictoral language forms develop further when technologies are widely available for home use?

The media system attributes and data generated for each also have research utility. They illustrate the complex set of assumptions that are involved in specifying a media system in detail. Understanding the media system(s) under study points to new areas for research. Rather than comparing across a large number of media systems, a study might focus on one attribute and examine media system differences associated with subtle changes (e.g., comparing a few similar systems) or gross differences (comparing widely different systems). There is also heuristics value for students studying media systems to assign attribute values for media systems, to discover subtle differences and similarities.

The tables of data for 53 media systems may be useful in clarifying individual characteristics of media systems. Researchers seeking to isolate the impacts of a particular media system attribute can use the tables to select similar media systems which may differ along only one or a few attributes. For example, a study might examine the impact of user effort on learning and attitudes. Subjects in no-effort and effort conditions could be shown the same text content, but in one instance be required to request each additional page of information, while the other condition moves automatically though the entire set of information.

Further work on the taxonomy and media system attributes should focus on refining the definitions used and developing additional media system attributes. I do not believe that it will significantly improve the taxonomy to elaborately validate percentages of video information in each of the visual categories through content analysis. It is not really important whether movies are 90 percent or 91.5 or 100 percent full motion video. The problems lie more with the definitions which yielded the estimates. One set of assumptions and associated quantifications have been offered in this chapter. Other definitions are possible. Much more refinement in each area could occur, permitting finer distinctions than a 3-value code for amount of user effort and each of the other variables. In addition to refining the attributes defined here, many more attributes can be explored. A few examples: cost, penetration level,

when a media system was introduced, regulatory factors, system operator factors, and so on.

Grouping media systems by function results in media system categories which differ considerably. There appears to be conceptual utility in considering the relationship of function with form and interactivity. However, it is by no means the only taxonomic grouping possible. Perhaps it would also be useful to consider computer-based systems as compared to broadcast systems, or visual versus audio channels. Also, the set of media system attributes should be expanded to include such characteristics as cost, penetration, privacy, structure of information, etc. But this chapter has demonstrated a taxonomic approach to comparative media system study, and offered support for the value of distinguishing media systems by function.

Future research might also integrate these models and media system attributes into other areas (for example, assessing how interactivity and channel factors relate to learning, recall and attitudes toward media systems and media system content). How do media system attributes affect attention and arousal level? Under what conditions are media systems better suited to an information exchange task than face to face information exchange? This dissertation suggests a move away from studying media systems as separate entities, toward regarding important similarities and differences in particular media system attributes.

END NOTES

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2 William Paisley and Milton Chen, "Children and Electronic Text: Challenges and Opportunities of the New Literacy," (Stanford: Stanford University Institute for Communication Research, 1982).

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7 Ibid, p. 60.

8 Ibid, p. 57.

9 See Chapter 1.

10 Rice and Williams, "Theories Old and New."

11 Rice and Williams, "Theories Old and New;" Daft and Lengel, "Media Richness;" Paisley and Chen, "Children and Electronic Text."

12 Rice and Williams, "Theories Old and New;" Daft and Lengel, "Media Richness."

13 Sheizaf Rafaeli, "If the Computer is a Medium, What is the Message (I): Explicating Interactivity," Paper presented at the International Communication Association convention (Honolulu, May, 1985).

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APPENDIX

APPENDIX

DESCRIPTION OF HYPOTHETICAL MEDIA SYSTEMS

Broadcast Television

The set of television channels available without subscription fee "over the air" to homes with UHF and VHF antennae. The number of channels available varies by location; for coding purposes, 5 channels are assumed.

Cable Television

The set of tv channels carried by a cable system to subscribing homes. Some channels cost an extra monthly fee; the number and nature of channels varies across cable systems. Thirty-six channels are assumed.

ITV/CCTV

Closed circuit television systems such as those found in schools or businesses. Users must travel from their home to a particular place at a particular time to view programs. Intended use is assumed to be of a specific program, watched in a group, at a particular time.

MDS (Multipoint Distribution Service)

Home entertainment pay television carried on a single channel to subscribers via microwave. A special decoder is required to receive content.

MMDS (Multichannel Multipoint Distribution Service)

As above, but a multichannel service (currently up to 5 channels).

STV (Subscription Television)

A single channel broadcast home entertainment television subscription service requiring a special decoder to descramble pay programming.

Home Satellite Dish

Home downlink enabling the purchaser to receive as many as 200 channels currently carried on satellite.

Pay Per View Cable Television

Specialty channels offered on some 2-way cable systems. Viewers are charged for any program they watch for more than 5 minutes.

SMA-TV (Satellite Master Antenna)

Similar to cable television but usually offered within a smaller area (e.g., a mobile home or apartment complex). Because it doesn't require a government franchise, public and government access channels are rarely supported.

Videodisk

Home entertainment tv medium used mostly for watching movies purchased on pre-stamped, read-only disks. The selection of movies available on disk is limited.

Mass Mail

Use of mail as a mass medium, to send the same information to many homes or businesses.

Videocassette Recorder

Home player-recorder is used for recording and replaying broadcast or other tv content, viewing rented or purchased movies and other content and recording home video with a camera.

Movies

Movies seen at a theater. About 8 local theaters are assumed to be showing different movies at a given time.

Radio

AM and FM broadcast radio, assuming about 15 stations available in an area.

Records

Home entertainment medium used mostly for listening to music on prestamped, read-only disks.

Slo-scan TV

Limited bandwidth, black and white still-frame television often carried over telephone line. Programming is typically offered on occasion to a particular audience at a particular time. Users view programs in a school or office; special receiving equipment is needed.

Broadcast Teletext

Pages of text and graphic information transmitted over the vertical blanking interaval of a television channel. Home viewers use a special decoder to receive pages of information, responding to menus of choices. For adequate response time, the current norm is a maximum of 200 pages available at a time. In the U.S., typical content is news, sports and weather.

Public Access Teletext

WETA in Washington conducted a test of public access teletext. As above, but public access terminals were located throughout the city rather than private terminals in homes.

Public Access Videotex

Some companies are offering videotex services on public access terminals throughout a city. This analysis assumes that videodisk players are located in each terminal, to permit a combination of text/graphic information and periods of full motion video and audio. Amount of information is much less limited than broadcast teletext.

Magazines

A home entertainment medium. About 50 different magazines are assumed to be available for purchase at bookstores and newstands on a given day.

Local Newspaper

In most cities, there is a single local daily newspaper.

Books

A home entertainment medium. A wide variety of books are available in bookstores and libraries.

Art Museum

Within an art museum, there are attendants to answer questions and the work of hundreds of artists are on display.

Audio-only Conference

Two or more groups confer by telephone at a particular time. At most a single audio conference is available at a given time.

One-way Video Conference

A scheduled video conference is originated from a single site and carried, often by satellite to numerous other sites. The receiving sites have video monitors to watch and listen to conference but they have no means of interacting with the conference originators during the conference.

One-way Video Two-way Audio Conference

As above, but receiving sites may confer with the originators of the conference, usually by telephone.

Two-way Video Conference

As above, but receiving sites also originate video which may be included in the processed composite conference output.

Telegram

Typically, only a single telegram is received in a day. Thus there is only one content choice provided.

Telephone

Users can initiate a call to millions of possible phone numbers, but there is not information available to be used over the phone on an ongoing basis.

Pay Telephone
(Same as telephone, except user must travel to access system)

Cellular Radio (Mobile Telephone)
(Same as telephone, but used in a vehicle)

Picture Phone
(Wideband telephony including voice and video)

Facsimile
(Electronic transmission of a document over phone lines to another facsimile device) as with telegrams, at most a single document is transmitted when the system is used.

Voice Mail
(Voice messages stored on a special telephone, similar to answering machine) where the service is available, about 10 messages per day are assumed to be received.

Mail
Approximately 10 pieces of mail are assumed to be received per day.

Express Mail
(Arriving overnight) only one package arrives in a typical day, when express mail is received at all.

Electronic Mail
(Text messages stored on computer and transmitted usually by phone lines or a dedicated network) about 10 messages per day are assumed.

Synchronous Computer Conference
A computer conference in which two or more participants exchange information by computer and network (often telephone lines) in a conference arranged for a particular time.

Asynchronous Computer Conference
As above, but participants may be reading and sending messages at different times in a day or week rather than at the same time.

CB Radio
Various participants send audio messages to a particular other or to the undifferentiated mass of users. All other users can eavesdrop or participate.

Home Video Game
A dedicated video game or software used on a personal computer.

Arcade Video Game

As above, but located in an arcade with other games, available for play at a nominal fee.

ATM (Automatic Teller Machine)

Available from most banks for making routine transactions 24 hours/day.

Word Processing

For this analysis, assumed to occur on a computer located in the user's home or office, although distributed word processing is also possible.

Data Analysis

For this analysis, assumed to occur on a timeshared mainframe computer, with the user at a distant terminal connected by telephone line.

Computer Programming

For this analysis, assumed to occur on a computer located in the user's home or office, although distributed programming is also possible.

Interactive Videodisk

Videodisk training programs specially designed for interactions. The system is programmed to respond to user input by moving to different points on the disk. Full motion video and text and graphic information may be stored. Training generally occurs at a school or office because a laser disk player is required.

CBI (Computer-based Instruction)

As above, but only text and graphic, not full motion video information is available.

Two-way Cable Polling

Available over some two-way cable systems, audience polling on issues or on program aspects is arranged such that users may transmit responses to the cable headend which are incorporated into viewer averages and displayed over the cable channel.

Bulletin Board

A dial-up service for home users with a personal computer and modem; electronic mail and public "bulletin board" interactions as well as software exchange may occur.

NAPLPS Home Videotex

NAPLPS graphics and text making available millions of pages of information to subscribing users. Continuous feedback is possible. Users must actively select information. Electronic mail and banking can occur.

ASCII Home Videotex

As above, but only text, not graphics is available.

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