

# Internet Use in the Contemporary Media Environment

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*Although a significant amount of research has focused on traditional media choice and use, and even on some "new" media, these studies have either neglected the Internet and World Wide Web or were conducted prior to their recent popularity. This study offers a novel exploration of individuals' use of three Internet functions (information retrieval, information giving, and conversation capabilities) in the context of the use of other communication media. Data from 684 individuals demonstrate that the Internet is a multidimensional technology used in a manner similar to other, more traditional media. Specifically, conversation features of the Internet align with mediated interpersonal technologies (the telephone and electronic mail), whereas the Internet's information-retrieval and information-giving features are used in ways similar to mass media channels (newspapers, television, and books and magazines). In addition, needs fulfilled by these channels cluster in ways consistent with past research, regardless of the technologies employed to meet them.*

Recent developments in computer hardware and software, data exchange protocols, compression technologies, and the physical communication infrastructure have quickly made the Internet-World Wide Web (WWW) a viable communication technology used by an estimated 147 million people (Computer Industry Almanac, 1999) in 171 countries (Zakon, 1999). Researchers have examined Internet content (McLaughlin, 1996), policy (Kahin, 1997; McChesney, 1996), community and culture (Baym, 1995; Jones, 1995, 1997; McLaughlin, Osborne, & Ellison, 1997; Rheingold, 1993; Watson, 1997; Wise, 1997), commercial

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development (Donnelly, 1996; Ho, 1997; Hoffman, Novak, & Chatterjee, 1996; Spar & Busssgang, 1996), communication structure (Jackson, 1997), and user interaction patterns and norms (Garton, Haythornthwaite, & Wellman, 1997; McLaughlin, Osborne, & Smith, 1995). Although these accounts provide a detailed view of the Internet's form and functions, they rely largely on qualitative or anecdotal descriptions of Internet use. Little empirical research has systematically examined users' behaviors or their views on why they have adopted the Internet and how they use it (for an exception see Parks & Floyd, 1996). To a degree, this is not surprising given the fast pace of technological development. This rate of change, however, only underscores the importance of a rigorous examination of new communication technologies' development, use, and social effects.

A related gap in our knowledge is individuals' reasons for choosing to use the Internet, *in conjunction with other communication technologies*. Although people have many options when selecting communications media, only a small portion of media choice explanations considers the *range* of media options users have available to them at any particular time. The uses and gratifications approach to the study of media use offers some insight into the reasons that people choose a specific medium over alternative channels of communication. However, this insight is limited by the fact that studies comparing gratifications across a variety of communications media are somewhat rare. Elliot and Quattlebaum's (1979) claim that "most gratifications research has focused on specific media content or on the more general uses of a specific medium" is still true today (p. 61).

Studies that have considered people's uses of communications media within a multiple-medium environment find that different media may be used to fulfill different needs (Adoni, 1979; Cutler & Danowski, 1980; Danowski & Cutler, 1978; Dobos, 1992; Elliot & Quattlebaum, 1979; Katz, Gurevitch, & Haas, 1973; Kippax & Murray, 1980; Lichtenstein & Rosenfeld, 1983, 1984; Lometti, Reeves, & Bybee, 1977; Perse & Courtright, 1993; Weaver, Wilhoit, & deBock, 1980).<sup>1</sup> Despite these studies, however, we do not yet have a thorough understanding of individuals' motivations for media use in view of their many options in today's complex media environment. This observation, coupled with the rapid development of and sparse research on the Internet as a communication and information tool, suggests that many questions about individuals' media choice and use remain unanswered.

A central concern is the ways in which communication technologies are actually used and the individual needs they fulfill, in view of the many functions that communication media perform. In this regard, the networked computer is especially interesting (see Postmes, Spears, & Lea, 1998). Whereas most "traditional" communication technologies were developed with a single function in mind (e.g., the telephone originally was

designed to transmit audio signals person-to-person), the networked computer is capable of many different functions: person-to-person communication (e.g., electronic mail), group communication (e.g., "chat" groups), or mass communication (e.g., online newspapers), to name only a few. The many capabilities of computer communication via the Internet suggest shifts in the technologies that separately or in combination might satisfy individuals' needs. In addition, the nature of the needs that people fulfill through media use may evolve as a consequence of the changing functions of communications media.

This research examines issues raised by the introduction of new communications technologies. By exploring individuals' Internet use in the context of their use of other communications media, and by considering the myriad of potential needs that might be satisfied by media use, this study seeks to paint a more complete portrait of the contemporary media environment. In order to accomplish this, we first explore how individuals perceive and use the various functions of the Internet in conjunction with other media. Second, we examine the dimensions of individual needs that are fulfilled by various communication technologies. We then discuss the implications of the findings in terms of the contemporary media environment.

### Internet and World Wide Web Use

In spite of the appropriateness and timeliness of the Internet as a topic of study, we know remarkably little about its selection and use. Although a great deal of empirical research has been done on the selection and use of "new" technologies, these studies preceded or did not include the Internet (Cohen, Levy, & Golden, 1988; Danowski, 1988; Dobos, 1992; Fulk, 1993; Levy, 1980, 1987; Perse & Courtright, 1993; Rice, 1992, 1993; Rice & Danowski, 1993; Rubin & Bantz, 1987, 1988; Rubin & Rubin, 1989; Salvaggio & Bryant, 1988; Schmitz & Fulk, 1991; Walther, 1994; Williams, Phillips, & Lum, 1985; Williams & Rice, 1983). Thus, whereas there is a growing body of research on computer-mediated communication and electronic mail (see Garton & Wellman, 1995), and some literature on the uses and gratifications of several channels considered together, researchers have yet to empirically examine Internet communication simultaneously with other technologies.

In studies that have compared computer communication in conjunction with other media, Rice (1993) included desktop videoconferencing, electronic mail, and voice mail in his list of new technologies, Perse and Dunn (1998) examined computer ownership and connectivity, and Perse and Courtright (1993) examined people's uses of the "computer" generically, without isolating any of its specific functions.<sup>2</sup> Perse and Dunn (1998)

found that only 3.3% of their sample had accessed the Internet in the past year from home (in 1994), whereas Perse and Courtright found that the computer was rated low in social presence (see below) and not strong at accommodating socioemotional communication. In part, Perse and Courtright (1993) attributed their findings to the low diffusion of computers and the low adoption of electronic mail and bulletin boards, noting that "the computer's low rating for communication need satisfaction may reflect unfamiliarity and low use of computers for communication" (p. 499).

Although accurate at the time (their data were collected in 1988), this is certainly not the case today. With email and Web access becoming nearly ubiquitous among personal computer users and networked personal computer penetration steadily gaining on other media (Morgan Stanley, 1996), lack of exposure and access are no longer such limiting factors. Similarly, usage data indicate that the number of Internet users is increasing dramatically each year (CommerceNet Research Center, 1998; Pew Research Center, 1999). Thus, it is time to take to action Perse and Courtright's call that "future research should consider whether the almost certain increase in use of [computer] technology for communication will influence the functional image of this medium" (p. 499).

### Functional Images of Communications Media

New communication technologies such as electronic mail and the Internet present novel issues in models of media use, in light of rapid technological advancements (Straubhaar & LaRose, 1996) and somewhat contradictory findings concerning their perception and use. Empirical and anecdotal evidence illustrates sometimes contrasting views on why new technologies are selected, the tasks for which they are best suited, and people's perceptions of these media. Theories of media selection and use can help to explain both the purposes for which new media are being used as well as how they are used in ways similar to other technologies.

#### *Media Attributes and Media Selection*

One of the earliest models of media choice proposed that people select communication technologies based on a medium's attributes. The social presence model (Short, Williams, & Christie, 1976) claims that communication media vary in the degree to which they can convey the physical presence of communicators. The model arranges media along a continuum from low (e.g., numeric data) to high social presence (e.g., face-to-face) and contends that individuals will select the medium that they perceive to have the highest social presence.

Like the social presence model, media richness theory (Daft & Lengel, 1984) proposes that people select communication technologies based largely on the attributes of the medium. The theory posits that media can be arranged on a continuum from "lean" to "rich," based on their speed of feedback, variety of channels, personalness of source, and richness of language used. Media richness theory also considers the context of use by proposing that individuals will seek to match the richness of a communication medium with the complexity of the task for which it is used.

Rice (1993) reported that newer media were rated by users as more appropriate for information exchange tasks requiring low social presence. Similarly, Perse and Courtright (1993) found new media to be better for task performance and the computer to be rated low in social presence. However, recent accounts suggest that newer media such as electronic mail and other forms of computer-mediated communication are used effectively for socioemotional tasks (Danowski, 1988, 1993; Markus, 1994; Parks & Floyd, 1996; Rheingold, 1993; Rice & Love, 1987; Walther, 1992, 1996). The use of "lean" media for "rich" tasks calls into question media choice models based primarily on users' rational assessments of media attributes.

Current evidence suggests that this discrepancy may be due to shifting norms and understandings of new media. Danowski (1988, 1993) proposed that media such as electronic mail are actually rich media, not lean, because they stimulate discussion and interpretation of meanings more than do other media. Fulk and Boyd (1991) note that research on media richness is more supportive of the media continuum as applied to traditional rather than new media. Markus (1994) echoes this position in her finding that media richness theory is fairly well able to predict perceptions and use of older communication technologies but that newer media behave less reliably. She attributes this to the "shared cultural norms" surrounding these well-established traditional technologies that are absent in the use of newer ones (p. 523).

These views suggest that examination of media characteristics independent of the broader communication contexts in which they are used may not be an effective strategy. Thus, although social presence and media richness models emphasize users' consideration of media attributes, recent evidence suggests that shared perceptions and collective experiences with technologies are important in the assessment and selection of media as well.

### *Individual and Social Needs and Media Selection*

Recent models of media selection and use suggest that it is not primarily the attributes of media that determine use, but rather such factors as assessments of needs fulfillment, appropriateness, social norms, and peer

evaluations of media. Both the social influence (Fulk, Schmitz, & Steinfield, 1990) and the uses and gratifications models of media choice and use (Blumler & McQuail, 1969; Katz, Blumler, & Gurevitch, 1974; Katz et al., 1973) illustrate this. The social influence model recognizes that media perceptions are subjective and socially constructed. Influences can come from others, through vicarious learning, and from situational factors such as individual differences or those factors that facilitate (e.g., training, support) or constrain media use (e.g., geographic barriers and time constraints).

In tests of the social influence model, Schmitz and Fulk (1991) found that technology use was influenced by close co-workers and by one's immediate supervisor. Fulk (1993) found that the social influence of one's group predicted individual attitudes toward and use of technologies more strongly when group attraction is high than when it is low. Rice and Aydin (1991) found that above the traditional influences of system use and membership in occupational categories, social information processing influenced individual attitudes concerning technologies. Thus, contrary to models of media selection that propose that individuals choose media based largely on the features or attributes of the technologies, the social influence model portrays users as active processors of subjective and contextual information.

Consistent with social influence models, the uses and gratifications (U&G) perspective views individuals as purposive and active, specifying that people select media based on needs. Although a vast inventory of needs has been examined, people seem to use various media for such core motivations as getting information, being entertained, interacting with others socially, and gaining insight into one's personal identity (Ang, 1995). Using value-expectancy theory, the U&G perspective proposes that individuals choose to use media based on their beliefs and feelings about how well doing so will satisfy their needs (Palmgreen, 1984).

Morris and Ogan (1996) argue that the U&G perspective may be useful to begin the scholarly inquiry into Internet communication. Similarly, Rafaeli (1986) discusses how U&G is important for exploring electronic communication because of its "comprehensiveness," or its ability to examine the multiple uses to which various technologies might simultaneously be put. Surprisingly, relatively little U&G research has addressed the issue of new communication technologies, yet "it is a crucial one if we are to gain a better insight into the uses people have for . . . new communication systems" (Palmgreen, 1984, p. 49).

### *Functional Images*

Following Lichtenstein and Rosenfeld (1983, 1984), Perse and Courtright (1993) claim that "normative images" of communication media, or the

“widely shared perceptions about a medium’s typical usage,” affect individuals’ uses of those media (p. 486). Because new technologies are especially prone to appropriation and redefinition by users (Feenberg, 1992, 1995; Poole & DeSanctis, 1990), the normative images of relatively new, widely used, and rapidly changing technologies are evolving quickly, resulting in ambiguity surrounding the choice and use of new technologies.

Combining the various explanations of media choice and use, it is proposed that *functional images* of media distinguish communication technologies according to their most salient features and uses (i.e., functions). The functional image of a medium is based on collectively held notions of how the medium is used that are formed through its long-term use. A medium’s functional image is composed of both its “functional alternatives” (media that satisfy similar needs) and its “normative image” (widely shared perceptions of a medium’s usage) (see Lichtenstein & Rosenfeld, 1983, 1984; Perse & Courtright, 1993; Rubin & Rubin, 1985). Consequently, functional images can be understood through an examination of (a) which technologies users associate closely with one another and (b) the purposes for which a medium is used (the needs it fulfills). Given recent and widespread changes to the communication technology landscape, coupled with the complex interdependence of communication technologies on each other, reevaluation of the functional images of media is a timely pursuit. Thus, the following research questions are proposed:

RQ1: Which communication technologies are being used similarly (i.e., what groups of technologies exist)?

RQ2: Which groups of technologies are most useful for satisfying specific individual needs?

### Motivations for Communication Technology Use

As the media used to address individual needs change, so too do people’s perceptions of those needs. Evidence for this comes from research which finds that the introduction of new communication technologies leads to a functional reorganization of media gratifications (Elliot & Quattlebaum, 1979; Morris & Ogan, 1996; Williams et al., 1985). With the shift toward networked computers capable of point-to-point communication and information transfer in the 1990s, individuals’ access to others with whom they can communicate has undergone a fundamental shift (Malone & Rockart, 1991). The evolution of computers from machines used predominantly for the execution of work tasks to machines often used to play games, communicate with loved ones, read a newspaper, or plan a vacation, for example, may mark shifts in perceptions of need satisfaction. In such instances, information seeking and entertainment needs

may become blurred, at least as achieved through the computer. With the convergence in media technologies may come a convergence in the needs that they fulfill.

Past research in mass and organizational communication has tended to separate needs or tasks along relatively social and instrumental dimensions, generally speaking. Uses and gratifications studies, though quite comprehensive in their conceptualization of individuals' needs that are satisfied via various channels, tend to de-emphasize task-oriented, or instrumental, needs.<sup>3</sup> Organizational communication research, alternatively, focuses on the ability of communication technologies to address relatively instrumental needs or ends that occur in the execution of organizational tasks. Given the convergence of work and non-work technologies, and the attendant blurring of home and work roles, a reexamination of social and instrumental needs simultaneously is warranted (Morris & Ogan, 1996). Such an examination serves to assess empirically which needs users perceive to be met by which technologies.

As proposed in research questions 1 and 2, communication technologies may form distinct functional images or groups that may, in turn, vary in the extent to which they are used to fulfill individuals' needs. Conversely, at issue here is the extent to which individual needs might form distinct motivations for media use and the ways in which different communication technologies may be used to fulfill these needs.

RQ3: Which individual needs are perceived to be similar to one another (i.e., what groups of needs exist)?

RQ4: Which groups of needs do different communication technologies fulfill best?

## METHOD

### Participants

Data for this study were collected in late 1997 and early 1998. In order to assess Internet-use behavior in conjunction with other media, a target sample possessing the requisite Internet skills was required. Internet users are typically young (over half are under 36) and well educated (approximately half have completed college), with the greatest proportion of expert users in their early- to mid-twenties (GVU Center, 1997). Thus, the majority of participants were drawn from undergraduate communication classes taught at two universities in the United States, one in the Midwest and the other on the West Coast ( $N = 504$ ). In addition to these

respondents, and in order to round out the sample, convenience samples of respondents who were not in college provided additional data for the study ( $N = 180$  or 26% of the sample).

A total of 684 surveys were completed. The range of respondent ages was 15 to 76 years, with a mean age of 24.40 years ( $SD = 10.54$ ). Due largely to the oversampling of college-age students, sample members had a mean of 14.66 years of education ( $SD = 1.76$  years). There were 276 (40.4%) male respondents and 396 (57.9%) female respondents (12 failed to provide their gender), and home zip codes indicated that they represented a relatively large geographic area: 305 unique zip codes were given, originating from 8 different states. Overall, respondents in the sample were reasonably experienced in Internet use, rating how often they use the Internet-WWW as 3.88 ( $SD = 1.75$ ) on a 7-point scale (where 1 = "I never use the Internet/WWW" to 7 = "I constantly use the Internet/WWW"). In addition, respondents indicated that their level of expertise on Internet use as 4.05 ( $SD = 1.79$ ) on a 7-point scale (where 1 = "I am not at all expert" and 7 = "I am completely expert") and their level of access to the Internet-WWW as 5.55 ( $SD = 1.75$ ) on a 7-point scale (where 1 = "It is extremely difficult for me to access the Internet/WWW" to 7 = "It is extremely easy for me to access the Internet/WWW").

## Procedure

The survey was introduced as a study of how individuals "use different communications media." Respondents were asked to complete a questionnaire designed to assess their usage of 9 different communications technologies for satisfying 21 needs.<sup>4</sup> To guard against respondent fatigue in what was a rather lengthy questionnaire, three versions of the survey were created that presented the various communications media in different order. The three forms were administered randomly. In addition, due to the fact that some of the technologies (e.g., Internet "chat" functions) on the survey are still not widely used as compared to others (e.g., the telephone), respondents were given the option to skip sections that dealt with these more advanced technologies, if they "never used" them.

## Measures

*Communication technologies or media* represent both traditional and contemporary channels. Nine channels were selected for this study: face-to-face, telephone, newspapers, television, books and magazines, electronic mail, and three separate functions of the Internet. Due to the versatility of

the Internet and the many uses to which it is being put by users, the Internet was broken down into various communication and information functions: information retrieval (typically performed via web "search engines," information giving (through such means as personal web sites or by "posting" information to others' sites), and conversation (e.g., "usenet" groups and "chat rooms" that enable users to talk with others on topics of mutual interest, asynchronously or in real time, respectively). These three features of the Internet-WWW are proposed to represent the major functions for which the technology is currently being used and to be sufficiently different from one another to warrant individual consideration.

*Individual needs* were derived from extant research on uses and gratifications of media as well as from studies of technology use in organizations. Doing so addresses the aforementioned blurring of technology use for work and social purposes. In addition, a diverse set of needs is crucial for the reevaluation of needs dimensions in view of the multitude of choices available in the contemporary media environment.

Uses and gratifications research has consistently focused on the social integration, personal identity, entertainment, and information uses of media (Ang, 1995). Social integration needs involve establishing and maintaining contact with others and include such things as *to get to know others, to have something to do with others, to stay in touch, and to feel less lonely*. Personal identity needs involve such self-discovery items as *to learn about myself and others and to gain insight into myself*. Entertainment needs typically include items such as *to be entertained, to play, to relax, and to pass the time away when bored*.<sup>5</sup>

Several studies have examined information needs fulfilled by technology use. The capabilities of advanced communication and information technologies suggest that both getting and providing information are important needs fulfilled by modern communication media (Fulk, Flanagin, Kalman, Monge, & Ryan, 1996). Consequently, *to get information, to learn how to do things, to provide others with information, and to contribute what I know to a pool of information* were all included in this research.

Finally, instrumental needs are derived from organizational communication technology research and involve persuasion or negotiation in attaining some desired end. Instrumental items from Short et al. (1976) and Rice (1993) that were used in this research included *to generate ideas, to negotiate or bargain, to get someone to do something for me, to solve problems, and to make decisions*. Additionally, it has been suggested that beyond any instrumental uses, media can be chosen due to their symbolic value (Sitkin, Sutcliffe, & Barrios-Choplin, 1992; Trevino, Daft, & Lengel, 1990). Accordingly, status enhancement was viewed as a potential motivation for media use and the needs *to feel important* and *to impress people* were included as well. Thus, a total of 21 need statements were used in this research (see Table 1).

TABLE 1  
Mean Ratings for Utility of Channels for Satisfying Communication Needs (N = 684)

Need	B & M	E-mail	FtF	Int - Rtrvl	Int - Cnv	Int - Gvg	NP	Phone	TV
to get information	4.48	4.27	4.49	4.63	3.77	3.81	4.49	4.25	4.10
to generate ideas	4.12	3.65	4.41	3.81	3.63	3.85	3.50	3.58	3.34
to negotiate or bargain	2.48	3.27	4.35	2.36	2.72	2.91	2.53	3.68	2.21
to learn about myself and others	3.73	3.62	4.34	3.19	3.63	3.27	3.44	3.71	3.32
to be entertained	4.36	3.92	4.21	3.86	4.22	3.54	3.79	3.86	4.64
to get to know others	3.07	3.87	4.55	2.82	3.88	3.18	2.98	4.10	2.81
to learn how to do things	3.92	3.22	4.26	3.82	3.28	3.32	3.08	3.32	3.43
to impress people	2.39	2.32	3.28	2.21	2.42	2.69	2.31	2.32	1.94
to have something to do with others	2.53	3.70	4.24	2.52	3.58	2.89	2.33	3.84	3.22
to provide others with information	3.23	4.19	4.34	3.12	3.58	4.00	3.22	4.16	2.90
to get someone to do something for me	2.11	3.55	4.15	2.22	2.72	2.81	2.04	3.89	1.95
to solve problems	3.40	3.49	4.28	3.67	3.06	3.33	2.74	3.85	2.48
to play	3.20	3.50	4.06	3.49	3.85	3.28	2.42	3.37	3.43
to stay in touch	2.78	4.40	4.34	2.85	3.76	3.24	3.29	4.53	2.99
to relax	4.09	3.49	3.92	3.19	3.62	3.20	3.46	3.66	4.43
to make decisions	3.23	3.31	4.19	3.26	2.92	3.13	3.05	3.73	2.54
to contribute to a pool of information	2.90	3.50	4.06	2.76	3.21	3.74	2.94	3.34	2.54
to gain insight into myself	3.36	2.71	3.85	2.52	2.93	2.77	2.63	2.88	2.55
to pass the time away when bored	4.09	3.66	3.84	3.54	3.99	3.11	3.48	3.70	4.35
to feel less lonely	2.75	3.14	3.98	2.30	3.19	2.39	2.23	3.71	3.05
to feel important	2.28	2.54	3.31	2.11	2.53	2.53	2.24	2.68	1.93

NOTE: B & M = books and magazines; E-mail = electronic mail; FtF = face-to-face; Int-Rtrvl = information retrieval via the Internet-WWW; Int-Cnv = conversation via the Internet-WWW; Int-Gvg = information giving via the Internet-WWW; NP = newspapers; Phone = telephone; TV = television.  
1 = low use, 5 = high use.

**TABLE 2**  
**Agglomeration Schedule for Cluster Analysis of Technologies**

<i>Stage</i>	<i># of clusters</i>	<i>Combination</i>	<i>Distance coefficient</i>
1	8	2 and 8	1.153
2	7	1 and 6	3.036
3	6	1 and 7	3.869
4	5	2 and 4	4.243
5	4	1 and 5	5.273
6	3	1 and 9	7.290
7	2	1 and 2	10.535
8	1	1 and 3	22.346

### Analysis

Research Questions 1 and 3 were assessed by cluster analysis.<sup>6</sup> The data were analyzed by a hierarchical cluster procedure, which begins with squared Euclidean distances as the similarity measure and uses the average-linkage between-groups method of cluster identification. Three criteria were used to determine the appropriate number of clusters. First, the number of clusters was plotted against the distance coefficients, forming a graph that is analogous to the scree test commonly used in factor analysis to determine the number of factors (see Aldenderfer & Blashfield, 1984). As in factor analysis, the point at which the curve flattens out is an indication of where to stop combining clusters. Second, between-cluster distance coefficients ("dissimilarity") ratios were calculated between the distance coefficients at contiguous stages and compared for their magnitude. Larger ratios indicate greater separation between clusters, suggesting the optimal number of cluster solutions. Finally, after the number of clusters was tentatively determined using these criteria, each of the clusters was examined for its theoretical relevance.

Research Questions 2 and 4 were investigated using repeated-measures MANOVA with the clusters derived from Research Questions 1 and 3, respectively, as the independent variables and mean use ratings as the dependent variables.

## RESULTS

### Descriptive Analyses

Almost all respondents indicated that they use the "traditional" media, including telephone (100%), face-to-face (99%), books and magazines (99%), newspapers (99%), and television (98%).<sup>7</sup> Ninety percent of the

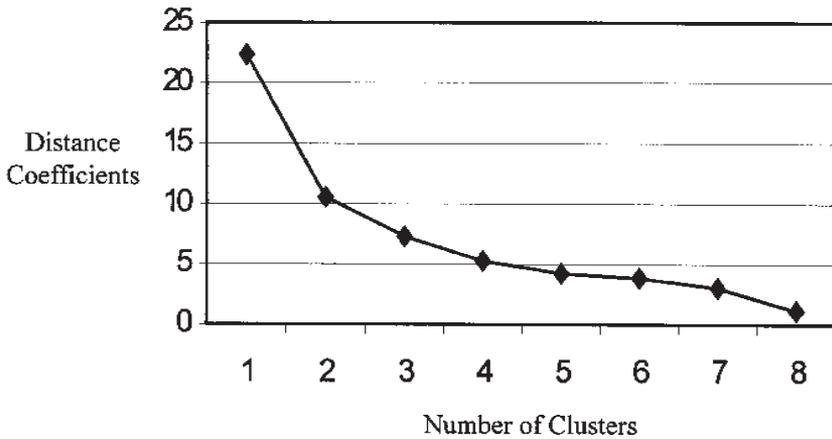


Figure 1: Scree Plot for Technologies Clusters

respondents said that they use electronic mail and 82% indicated that they use the Internet for retrieving information. Although smaller percentages indicated that they use the Internet for conversing with others (32%) or for giving information (23%), these are still notable given the fact that widespread use of the Internet is a fairly recent phenomenon. Table 1 shows the mean ratings for how well each of the 9 communication technologies satisfies each of the 21 needs.

### Functional Images

The first research question concerned similarities in media use. Similarities were assessed by a cluster analysis of the communication technologies according to how useful they were in satisfying the 21 needs. Discounting the extreme 8-cluster solution, the agglomeration schedule (see Table 2) shows that the dissimilarity ratios are greatest between Clusters 2 and 1 (ratio = 2.12), with the second highest dissimilarity ratio occurring between Clusters 3 and 2 (ratio = 1.45). Similarly, Figure 1 shows that the scree plot leveled off after 2 or 3 clusters. Applying the criteria described earlier, a 3-cluster solution best described the data.<sup>8</sup> Cluster 1 was composed of a single medium, face-to-face communication. This cluster was labeled *unmediated interpersonal* communication. Cluster 2 included Internet-conversation, telephone, and electronic mail. This cluster was labeled *mediated interpersonal* communication. Cluster 3 contained television, Internet-information retrieval, Internet-information giving, books and magazines, and newspapers. This cluster was labeled *mass* communication.

**TABLE 3**  
**Mean Ratings by Technology Clusters (N = 684)**

<i>Need</i>	<i>Unmediated interpersonal</i>	<i>Mediated interpersonal</i>	<i>Mass</i>
to get information	4.49	4.19	4.38
to generate ideas	4.41	3.60 <sup>a</sup>	3.69 <sup>a</sup>
to negotiate or bargain	4.35	3.39 <sup>a</sup>	2.42 <sup>a</sup>
to learn about myself and others	4.34	3.67	3.41
to be entertained	4.21 <sup>a</sup>	3.89	4.15 <sup>a</sup>
to get to know others	4.55 <sup>a</sup>	3.96	2.93 <sup>a</sup>
to learn how to do things	4.26	3.27	3.53
to impress people	3.28	2.31 <sup>a</sup>	2.23 <sup>a</sup>
to have something to do with others	4.24	3.72 <sup>a</sup>	2.66 <sup>a</sup>
to provide others with information	4.34	4.10	3.15
to get someone to do something for me	4.15	3.61	2.10
to solve problems	4.28	3.61	3.04
to play	4.06	3.44	3.11
to stay in touch	4.34 <sup>a</sup>	4.37 <sup>a</sup>	3.00
to relax	3.92 <sup>a</sup>	3.55 <sup>a</sup>	3.80
to make decisions	4.19	3.46	3.01
to contribute to a pool of information	4.06	3.39	2.83
to gain insight into myself	3.85	2.79 <sup>a</sup>	2.78 <sup>a</sup>
to pass the time away when I'm bored	3.84 <sup>a</sup>	3.68 <sup>a</sup>	3.85 <sup>a</sup>
to feel less lonely	3.98 <sup>a</sup>	3.40	2.59 <sup>a</sup>
to feel important	3.31	2.59	2.16

NOTE: *Unmediated interpersonal cluster* = face-to-face; *Mediated interpersonal cluster* = conversation via the Internet-WWW, telephone, and electronic mail; *Mass cluster* = books and magazines, information retrieval via the Internet-WWW, information giving via the Internet-WWW, newspapers, and television.

Means with matching subscripts within the same row are *not* significantly different from one another. Significant differences are at  $p < .01$ .

1 = low use, 5 = high use.

Research Question 2 (which asked which groups of technologies are most useful for satisfying specific individual needs), was tested by a repeated-measures MANOVA with the technology clusters as the independent variable and the 21 mean need ratings as the dependent measures. The omnibus  $F$  was significant,  $F(2, 2004) = 131.84, p < .0001$ .<sup>9</sup> Table 3 shows the results of the follow-up tests used to determine how the three technology clusters differed in terms of fulfilling each of the 21 needs.

Unmediated interpersonal communication (face-to-face) was significantly better at fulfilling all needs except entertainment (rated same as mass), staying in touch (rated same as mediated interpersonal), and passing time when bored (rated same as mass). Mediated interpersonal communication was significantly better than mass communication for all needs

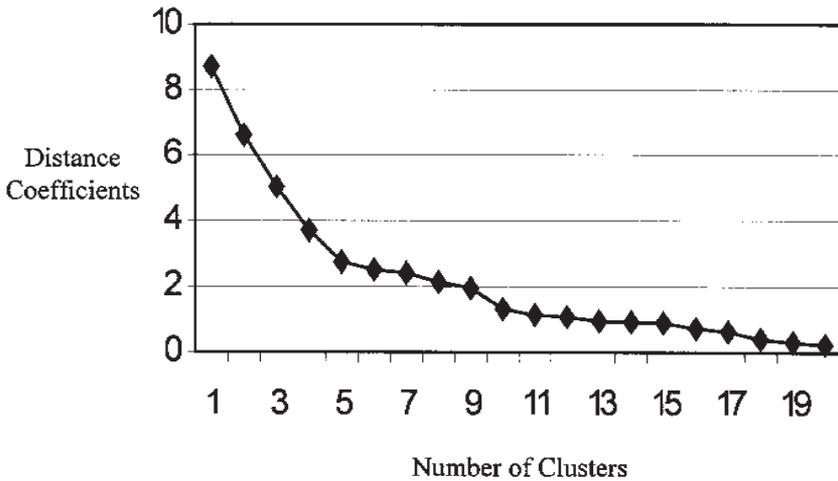


Figure 2: Scree Plot for Needs Clusters

except for: get information, generate ideas, entertainment, learn how to do things, impress people, relax, gain insight into self, and pass the time away when bored.

#### Motivations for Technology Use

Research Question 3 sought to discover which individual needs are perceived to be similar to one another. Using the same criteria as before for selecting the number of clusters, a 10-cluster solution fit the data best. As seen in Figure 2, the curve of the scree plot begins to level off after 10 clusters. Table 4 indicates that the largest dissimilarity ratios (after Stage 3)<sup>10</sup> are found between Clusters 10 and 9 (ratio = 1.48) and between Clusters 4 and 3 (ratio = 1.36).

Cluster 1 was labeled *information* and consisted of a single item (to get information). Cluster 2, *learn*, included three items (to generate ideas, to learn about myself and others, to learn how to do things). Cluster 3, *play*, was another single-item cluster (to play). Cluster 4 consisted of three items (to be entertained, to relax, to pass time away when I'm bored) and was labeled *leisure*. Cluster 5 was composed of items that were concerned with *persuasion* (to negotiate or bargain, to get someone to do something for me). Clusters 6 and 7 both had social aspects. Cluster 6 consisted of two items (to have something to do with others, to feel less lonely) and was labeled *social bonding*. Cluster 7 included items that were concerned with *relationship maintenance* (to get to know others, to provide others with

**TABLE 4**  
**Agglomeration Schedule for Cluster Analysis of Needs**

<i>Stage</i>	<i># of clusters</i>	<i>Combination</i>	<i>Distance coefficient</i>
1	20	8 and 21	.244
2	19	15 and 19	.311
3	18	12 and 16	.411
4	17	3 and 11	.637
5	16	6 and 14	.741
6	15	2 and 4	.900
7	14	9 and 20	.936
8	13	2 and 7	.961
9	12	6 and 10	1.087
10	11	5 and 15	1.141
11	10	12 and 17	1.327
12	9	2 and 13	1.959
13	8	3 and 9	2.150
14	7	6 and 12	2.410
15	6	8 and 18	2.509
16	5	2 and 5	2.754
17	4	3 and 6	3.698
18	3	1 and 2	5.026
19	2	3 and 8	6.606
20	1	1 and 3	8.717

information, to stay in touch). Cluster 8, *problem solving*, was task-oriented (to solve problems, to make decisions, to contribute to a pool of information), and Cluster 9 consisted of items concerned with personal *status* (to impress people, to feel important). Finally, Cluster 10 was composed of only one item (to gain insight into myself) and was, therefore, labeled *insight*.

Research Question 4 asked which groups of individual needs are best fulfilled by different communication technologies. In this analysis, the 10 needs clusters served as the independent, grouping variable, and the mean need ratings by technology served as the dependent measures. The omnibus  $F$  was significant,  $F(9, 907) = 18.39, p < .0001$ . Table 5 reports the results of the follow-up tests.

A number of interesting findings emerge from an inspection of the needs cluster ratings. The vast majority of the technologies were used heavily to fulfill information seeking needs. Six of the 9 technologies were assessed as most useful for getting information: books and magazines, electronic mail, face-to-face, the information-retrieval capabilities of the Internet, the information-giving capabilities of the Internet, and newspapers. Information seeking was the second most highly used function of the telephone and the television, whereas the conversation capacity of the Internet was used slightly more heavily for play and leisure purposes than for information seeking. Together, this indicates that information seeking is a

TABLE 5  
Mean Ratings by Needs Clusters (N = 684)

Technology	Information	Learn	Play	Leisure	Persuasion bonding	Social bonding	Relationship maintenance	Problem solving	Status	Insight
Books and magazines	4.48	3.92	3.20 <sub>abc</sub>	4.18	2.29 <sub>d</sub>	2.64	3.03 <sub>ae</sub>	3.18 <sub>bef</sub>	2.34 <sub>d</sub>	3.36 <sub>cf</sub>
Electronic mail	4.27 <sub>a</sub>	3.50 <sub>bcd</sub>	3.50 <sub>ghij</sub>	3.69 <sub>eg</sub>	3.41 <sub>dihkl</sub>	3.42 <sub>eklm</sub>	4.15 <sub>a</sub>	3.43 <sub>flm</sub>	2.43	2.71
Face-to-face	4.49 <sub>ab</sub>	4.33 <sub>acde</sub>	4.06 <sub>gh</sub>	3.99 <sub>fij</sub>	4.25 <sub>aklm</sub>	4.11 <sub>gkn</sub>	4.41 <sub>hlm</sub>	4.17 <sub>abmn</sub>	3.29	3.85 <sub>j</sub>
Internet – information retrieval	4.62	3.61 <sub>ab</sub>	3.49 <sub>ac</sub>	3.53 <sub>bc</sub>	2.29 <sub>def</sub>	2.41 <sub>djg</sub>	2.93	3.23	2.16 <sub>e</sub>	2.52 <sub>fg</sub>
Internet – conversation	3.77 <sub>abcd</sub>	3.51 <sub>aefg</sub>	3.85 <sub>behj</sub>	3.95 <sub>chj</sub>	2.72 <sub>klm</sub>	3.38 <sub>lno</sub>	3.73 <sub>dghjn</sub>	3.06 <sub>kop</sub>	2.48 <sub>l</sub>	2.93 <sub>mp</sub>
Internet – information giving	3.82 <sub>abc</sub>	3.48 <sub>adefg</sub>	3.28 <sub>dhijk</sub>	3.28 <sub>ablmn</sub>	2.86 <sub>loppq</sub>	2.64 <sub>ors</sub>	3.45 <sub>bjmnt</sub>	3.40 <sub>egknt</sub>	2.61 <sub>pru</sub>	2.77 <sub>qsu</sub>
Newspapers	4.49	3.38 <sub>a</sub>	2.42 <sub>bcd</sub>	3.58	2.29 <sub>bef</sub>	2.28 <sub>ceg</sub>	3.16 <sub>a</sub>	2.91	2.27 <sub>djg</sub>	2.63
Telephone	4.25 <sub>a</sub>	3.54 <sub>bcd</sub>	3.37 <sub>b</sub>	3.74 <sub>cefg</sub>	3.79 <sub>dhi</sub>	3.77 <sub>fhj</sub>	4.26 <sub>a</sub>	3.64 <sub>dghj</sub>	2.50	2.88
Television	4.10	3.36 <sub>a</sub>	3.43 <sub>a</sub>	4.47	2.08 <sub>b</sub>	3.14	2.90	2.52 <sub>c</sub>	1.94 <sub>b</sub>	2.55 <sub>c</sub>

NOTE: *Information* cluster = to get information; *Learn* cluster = to generate ideas, to learn about myself and others, to learn how to do things; *Play* cluster = to play; *Leisure* cluster = to be entertained, to relax, to pass the time away when I'm bored; *Persuasion* cluster = to negotiate or bargain, to get someone to do something for me; *Social Bonding* cluster = to have something to do with others, to feel less lonely; *Relationship Maintenance* cluster = to get to know others, to provide others with information, to stay in touch; *Problem solving* cluster = to solve problems, to make decisions, to contribute to a pool of information; *Status* cluster = to impress people, to feel important; *Insight* cluster = to gain insight into myself.

Means with the same letter in the subscript within the same row are *not* significantly different from one another. Significant differences are at  $p < .01$ . 1 = low use, 5 = high use.

common function of nearly all communication technologies, emerging clearly from among all of the needs.

Fulfilling leisure needs was also a common function to which technologies often were put. Books and magazines, the Internet's information retrieval and information giving features, and television were all used heavily to fulfill this need over others. Similarly, relationship maintenance was a need that was commonly fulfilled by multiple technologies: electronic mail, face-to-face, and the telephone were all used heavily in this regard.

Relative to other needs, learning was strongly fulfilled by two of the three Internet technologies (information retrieval via the Internet and information giving through the Internet), indicating that they were used more for this purpose than in the fulfillment of other needs. By contrast, other media were used mostly for other purposes, when compared across the needs met by each technology. Collectively, this indicates that Internet technologies, unlike other media, are used strongly for learning, as opposed to other needs.

Among other findings were that electronic mail, face-to-face, and the telephone tend to be used highly to fulfill a number of needs. Specifically, all three media are used heavily, as compared to other technologies, to fulfill persuasion, social bonding, and relationship maintenance needs. To a slightly lesser extent, these technologies are also used for play and status fulfillment.

Face-to-face communication ranks highly across all needs. Notably, however, it is used less for the fulfillment of leisure needs, as compared to its strong showing across all other needs dimensions. As mentioned earlier, Internet-conversation capabilities are used primarily to fulfill play and leisure needs, distinguishing it from similar technologies of the telephone and electronic mail and suggesting that it is used less to communicate with specific others and more for the entertainment value derived from such features as, for example, chat and usenet functions.

## DISCUSSION

### Functional Images

Three clusters of technologies, labeled unmediated interpersonal, mediated interpersonal, and mass communication, were identified in this study. Similar to prior studies comparing a variety of media (Elliott & Quattlebaum, 1979; Rosenfeld & Lichtenstein, 1983; Perse & Courtright, 1993; Rice, 1993), face-to-face communication was distinct in its usage as illustrated by the fact that it clustered with no other communications channel. In contrast to prior research (Perse & Courtright, 1993), however, com-

puter-based technologies did not cluster alone. Instead, computer communication aligned with either traditional mass or traditional interpersonal channels: Internet information-retrieval and information-giving capabilities clustered with television, newspapers, and books and magazines (mass communication cluster), whereas Internet-conversation capabilities and email clustered with the telephone (mediated interpersonal communication cluster).

Further, unlike recent research (Rice, 1993) where "new" media clustered together with each other (yet largely apart from more traditional ones), new communication technologies were found to be functionally equivalent with more traditional media, pointing to a convergence among media in terms of their functional images. One explanation for this is Rice's (1993; Rice & Associates, 1984) observation that technologies with high "substitutability" (those whose functions can be met by other media) show a tendency to shift over time in terms of users' appropriateness or use ratings of them. This would suggest that newer media are transitioning toward the roles of more traditional ones due to their capacity to improve or augment the capabilities of existing technologies.

For instance, in a relatively short period computer-based technologies have evolved from being viewed as largely unrelated to other media in terms of their need fulfillment (Perse & Courtright, 1993) to fundamentally interwoven with them. People seem to be integrating computer communication into their daily repertoire of communication tools and using computer-based technologies to fulfill a variety of needs just as they use more traditional media. The functional image of email, for example, is now becoming like that of the telephone, a good way keep in contact with friends and family. Similarly, the functional image of surfing the Web has become similar to the newspaper or television, a good place to glean information and to be entertained. This indicates that the uses of new media evolve as users become more familiar with them (Hiltz & Turoff, 1978, 1981) and, as Rice (1993) predicted, more stable or positive assessments of new media "might await greater diffusion and familiarity" (p. 479). This also suggests that a theoretical convergence of diffusion of innovations and uses and gratifications research may be a fruitful avenue for further research. That is, uses of communication technologies may change over the various phases of adoption and should, therefore, be examined at each stage of the diffusion process.

The current level of content convergence among Internet-based and more traditional technologies has important implications for theoretical approaches that explain or describe individuals' media choice and use behavior. For example, traditional print media delivered via an interactive web site can be extremely rich, as assessed by media richness criteria, when combined with hypertext or hypermedia links to additional text,

photographs, audio, or video. Possibly as a result, we found convergence in the usage of video- and print-based technologies, resulting in a single mass media cluster, whereas Perse and Courtright (1993) found video technologies (cable, movies, television, and VCR) and print media (magazines, books, and newspapers) to constitute separate clusters. This suggests that in the contemporary media environment, it is important to go beyond media attributes, such as print (text) or video, and consider users' conceptions of a medium's functional image in assessing media choice and usage. The implication is that with increasing content convergence across media, theoretical perspectives relying on assessments of media attributes (i.e., social presence and media richness theories) may become increasingly problematic as media become less distinct.

The general issue of content convergence among Internet-based and more traditional technologies also suggests a rival explanation for the finding that old and new media were assessed as similar by our respondents. Because, for example, radio and television stations stream their content across the Internet and newspapers and magazines post their content online, respondents might have confounded the media of this study that were initially assumed to be distinct. An alternative explanation for some of our findings, then, is that people see Internet-based technologies as not distinct from more traditional ones simply because they deliver content in common. However, it is unlikely that either the level of content convergence is sufficiently great at this point in time, or that individuals have sufficiently abandoned their notions of new and traditional media functionality, to have a significant impact in this regard. Nonetheless, this possibility is intriguing and becomes a more plausible explanation for a convergence in individuals' media usage over time as more and more content is migrated across delivery platforms. Consequently, future research should account for this type of convergence.

In terms of the utility of the technology clusters for satisfying communication needs, unmediated interpersonal (face-to-face) communication was by far the most useful and most versatile channel for need satisfaction, rated highest for fulfilling 18 of the 21 needs. Consistent with past research, and despite a growing number of increasingly complex and powerful media choices, nothing quite compares to face-to-face communication in terms of satisfying individuals' needs. Studies of face-to-face communication typically find that it is extremely useful for satisfying a wide variety of needs (Elliott & Quattlebaum, 1979; Perse & Courtright, 1993; Rice, 1993) and no other channel of communication seems to be able to compete with the rich involvement that face-to-face interaction provides. Face-to-face communication was only surpassed by mediated interpersonal communication in fulfilling the need to stay in touch, a finding that attests to the distance-bridging ability that those media afford.

Similarly, face-to-face communication was not significantly better than mass communication in satisfying the needs to be entertained and to pass time. This too makes sense considering the minimum effort required and the maximum variety in content offered by mass communication (Cohen & Metzger, 1998).

The results also illustrate that clusters of technologies classified as mediated interpersonal and mass communication are being used to satisfy significantly different needs. Mass media were clearly used for informational (e.g., to get information) and leisure purposes (e.g., to be entertained). Mediated interpersonal technologies were used mainly for social bonding (e.g., to feel less lonely), relationship maintenance (e.g., to stay in touch), problem solving (e.g., to solve problems), and persuasion purposes (e.g., to negotiate or bargain). Whereas Rice (1993) found that new media were rated as more appropriate for fulfilling lean information exchange tasks (as opposed to socioemotional relation tasks), this study found that new media are used for relatively rich tasks as well as lean ones. This finding supports the notion that newer media may transcend strict media richness predictions (Fulk & Boyd, 1991; Markus, 1994) and be used for socioemotional or complex tasks (Danowski, 1988, 1993; Walther, 1994, 1996; Walther, Anderson, & Park, 1994).

### Motivations for Technology Use

According to Williams et al. (1985), "one reason for studying the new technologies is to examine how, or if, gratifications change with media characteristics" (p. 244). Such an examination is particularly timely due to the convergence of media forms and uses, and increased technological connectivity, communality, and interactivity (Fulk & DeSanctis, 1995; Fulk et al., 1996; Rogers, 1986). Thus, we examined whether the gratifications derived from using communications media have been reconfigured as communication technologies have changed.

The results show that communications needs haven't changed significantly, even if the means of communicating have. Ten needs clusters emerged from the analysis: information, learn, play, leisure, persuasion, social bonding, relationship maintenance, problem solving, status, and insight. Consistent with earlier findings (as detailed in the Measures section), but contrary to recent trends in the convergence of technological functions (for work and play uses, for example), these needs clusters roughly parallel general areas of needs found in past research. Therefore, traditional needs clusters endured regardless of the technologies employed to address them. So, although Williams et al.'s (1985) suggestion is theoretically intriguing, our results show that basic gratifications have not changed during the Internet's diffusion to date. This supports studies of

new technologies that have found that "communication needs appear to transcend communication channels or contexts" (Rubin & Rubin, 1989, p. 107). Thus, it appears that technologies meet needs and not that needs meet technologies.

The fact that getting information was an important need across channels suggests that a primary goal of communication, regardless of the medium used, is to get information. Somewhat unexpected in this regard is the extent to which the Internet was used to get information, particularly in relation to other technologies. Of all channels, the Internet was the most highly used for getting information, over other technologies such as newspapers, television, books, and magazines. This suggests some potentially problematic issues of information verity and credibility in the new media environment.

Whereas newspapers, books, magazines, and television all undergo certain levels of factual verification, analysis of content, and editorial review, for the most part Internet information is not subject to the same level of scrutiny. Although Internet sites that parallel their print counterparts, such as major newspapers and periodicals, do invoke the same editorial processes as their print forms, they constitute a relatively small portion of the information found on the Internet. More common, at least at this time, is less formal information generated by special interest groups, individuals, and organizations, the level of editorial review for which is not explicit. One consequence is that editorial functions that were formerly the responsibility of the information producer or publisher now fall upon the shoulders of the media consumer (Gilster, 1997; Scheuermann & Langford, 1997). However, existing research on the perceived credibility of traditional versus Internet-based information sources has not produced consistent findings (Johnson & Kaye, 1998; Mashek, 1997; Pew Research Center, 1999). Thus, it is not clear how users interpret the credibility of Internet information, the level of scrutiny they apply to it, or what verification measures they may be invoking.

It should be noted that it is unclear from this study precisely what kinds of information users are retrieving over the Internet or the differences they perceive among various information types. The fact that uses and gratifications studies comparing media do not consider the content of media sources under study is a criticism of the perspective that is true of the current study as well. Thus, future research should explore the types of information retrieved via the Internet, the uses to which such information is put, the distinctions that users make in regard to seemingly conflicting needs that they use the Internet to fulfill, and the skepticism with which users approach information. It would be interesting, for example, to see if people make a distinction between news and entertainment information on the Internet or to locate the various levels of skepticism, scrutiny, or verification applied to Internet information by source or purpose.

There are a number of other limitations of the current research. For example, the U.S.-centric convenience sample used comes at the usual price of generalizability, and the percentages of respondents using the technologies in this study are not indicative of user skills more generally. In addition, the list of technologies and needs was not comprehensive. Although efforts were made to follow past research and remain true to the current media environment, the inclusion of other technologies and needs might have altered the findings.

## Conclusion

Our data, a decade after Perse and Courtright's, reveal that a number of important changes have occurred in the use of computer-based communication technologies. Media once considered to be low in social presence and need gratification now appear to be considered rich multi-function channels, capable of most tasks once provided only by more traditional media. This study thus provides empirical confirmation that the Internet is a multidimensional communication technology used to fulfill well-understood needs in novel ways.

In addition, the findings of this research suggest that new communication technologies, although extending users' capabilities in important ways, eventually become folded in with more traditional media. Our data show that even fairly new technologies are employed in much the same way as more traditional channels in the fulfillment of a relatively enduring set of needs. Thus, although perspectives that focus on media attributes in order to explain individuals' reasons for media use (e.g., social presence or media richness) remain important, an examination of the functional images of communication technologies adds a great deal to our understanding of the current media environment. By considering both a technology's functional alternatives (which other technologies are used similarly) as well as its normative image (the widely shared perceptions of the technology), such an examination stands to capture the socially derived nature of communications media and to suggest important heuristics for thinking about new technologies as they evolve.

## NOTES

1. Cross-media studies have also found that different media fulfill similar (or overlapping) needs; that is, several communications media are both distinct and overlapping in need satisfaction.

2. Dobos (1992) also examines "new technologies" but it is not stated in the article which specific technologies she considers.

3. This is not to be confused with the uses and gratifications literature that defines "in-

strumental" use of the media as using media for information-seeking purposes, rather than for ritualistic or diversionary purposes (see Rubin, 1984). As we use the term here, instrumental needs refer to specific task-related or strategic needs (e.g., decision making or problem solving) rather than general information-seeking needs.

4. Technically speaking, there were only seven different communications technologies, but various uses of the Internet-WWW were separated into three functions: information retrieval, information giving, and conversation, as detailed in the Measures section.

5. A criticism of the U&G approach as applied to new technologies is that it is somewhat tautological because presenting respondents with gratification typologies created from studies of "old" media may not capture new and unforeseen gratifications that may be associated with new communications media (Palmgreen, 1984). Because the purpose of this study is to see how new technologies serve communication needs in comparison to old communication media, gratifications derived from studies of both "old" and "new" media are included here.

6. Because the aim of this study was to identify similarities among communication technologies along functional dimensions, and not to identify a smaller number of underlying dimensions in the data, cluster analysis was the preferred analytic strategy (see Cattell, 1978; Lorr, 1983; Perse & Courtright, 1993; Poole & McPhee, 1995). However, because Barnett and Danowski (1992) have found that the combination of multiple data reduction methods adds to the validity of results, a factor analysis was also performed on the data. Findings from the factor analysis were largely consistent with the results of the cluster analysis, offering further validity to the results. In addition, multidimensional scaling techniques were not used because the focus of the research was to identify, for example, clusters of communication technologies used in similar ways to fulfill needs, not to distinguish how the clusters differed from one another. However, exploring the relations among technology clusters using multidimensional scaling techniques is both an interesting and important avenue for future research.

7. Among these channels, face-to-face and books and magazines use were less than 100% due to missing data whereas some people reported that they "never use" television or the newspaper, resulting in its reported rates of use less than 100%.

8. Although more distinct separation may occur at a greater or lesser number of clusters, cluster solutions can profitably be constrained by an evaluation of interpretability. That is, too many or few clusters defeat the purpose of cluster analysis—to determine, based on the separation among Euclidean distances, the number and nature of groups that are meaningfully distinct from one another. With the current analysis, there are 1 to 8 possible clusters (all 9 variables grouped together or 7 variables grouped independently plus one group of 2 variables). However, such extreme solutions do little to help evaluate the nature of groups formed by variables' values. Thus, a heuristic that constrains the extremes of the possible range of clusters is a reasonable exercise, *when done with caution*. That is, although the extreme numbers of cluster solutions might be disregarded in view of the lack of information they provide, this should only be done where there exist strong, alternative cluster solutions, based on the agglomeration and ratio data. In the absence of such support, the heuristic stands to be too strongly biased by researcher subjectivity rather than based on the empirical evidence.

In this specific analysis, the agglomeration and ratio data reveal that an 8-cluster solution was the strongest, followed by a 2-cluster solution and a 3-cluster solution. The 8-cluster solution was discarded due to the lack of discriminatory information it provides. In examining the 2-cluster solution, it is seen that face-to-face clusters alone with all other technologies clustered together. Given that such a solution fails to discriminate technologies sufficiently, and considering the fact that the 3-cluster solution was empirically strong as well (while providing a more rigorous solution), the 3-cluster solution was selected.

9. Levene's test revealed that the population variances differ for the data, violating the assumption of homoscedasticity. However, this violation is not considered to be serious when group sample sizes are about equal, as they were in this study (Glass, Peckham, & Sanders, 1972; Hinkle, Wiersma, & Jurs, 1988).

10. (Please refer to note 8.) Although the single best cluster solution (based on the agglomeration and ratio data) was an 18-cluster solution, the alternative (and second strongest) 10-cluster solution was selected. This 10-cluster solution aids in evaluating the nature of groups formed by the Euclidean distances.

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