

Validation and Application of Electronic Proximity Theory to Computer-Mediated Communication in Groups

Joseph B. Walther¹

Michigan State University

Natalya N. Bazarova

Cornell University

This research presents an experiment based on the theory of electronic proximity, testing how the presence of alternate communication media, media bandwidth, information complexity, and users' communication skills affect proximity (the psychological feeling of nearness) and satisfaction that communicators experience using different communication channels. Groups communicated using one or two of several different channels, including face-to-face, desktop video, audio, and text-based chat, with channel differences between members in some groups. Predicted effects of bandwidth, information complexity, communication skills, and comparative media availability on proximity and satisfaction were observed. These findings demonstrate a confound in previous research on proximity theory, suggest newfound validity, and extend the model to interactive computer-mediated communication channels unanticipated by the original theory. Implications include the potential of electronic proximity to account for discrepancies in the research on computer-mediated communication that have been generated by other theories.

Keywords: *computer-mediated communication; interactive communication technology; electronic proximity; group communication; teleconferencing*

Accompanying the explosive adoption of Internet communication systems for groups, organizations, and personal relationships, among the most important and elusive questions confronting several fields have been these: How do people choose communication media, and what are the effects of those choices on communication? Several frameworks and theories have been imported, proposed, debated, and subjected to various empirical tests in relation to these questions, yet problems and inconsistencies have outweighed consensus on the answers these perspectives provide.

Thirty years ago, Korzenny (1978) offered "a general theory of mediated communication . . . given the role of electronic mechanisms in . . . interposing human contact" (p. 3). The theory of electronic proximity (TEP) is a formal, axiomatic theory that originally focused on face-to-face (FtF) communication, audioconferencing, and videoconferencing. The original exposition of the theory focused on group communication in

organizational contexts, although it attempted to “apply not only to electronically mediated communication, but all symbolic human interaction conducted over a wide range of channels” (p. 4). The theory predated the Internet, yet its conceptual definitions and level of abstraction offer a broad and potentially powerful approach to understanding the effects of electronic media it did not originally consider.

Despite its promise, the theory has not captured widespread attention over the years. This may be due in part to its highly formal presentation and in part to an unsupportive empirical test (Korzenny & Bauer, 1981). The previous test may have been flawed by methodological anomalies that confounded results, however, and the theory’s dismissal may have been premature. The present research reports an experiment that compares alternative communication media in group discussions in order to replicate and extend TEP with three particular objectives: to compare alternative communication media in group discussions in such a way that tests TEP, to demonstrate and account for methodological problems in the previous test of the theory, and to extend the scope of TEP for text-based computer-mediated, in addition to FtF and voice-based or video conferencing communication systems. Such research promises to reinvigorate a powerful, grand theory in a field that has become fragmented and to provide practical insights into methods of computer-based media selection and the effects thereof that can illuminate the task and interpersonal dimensions of computer-mediated communication (CMC) in groups and in other settings. Moreover, support for the theory offers an integrating framework with which to account for otherwise conflicting findings in the arenas of research on media choice and the interpersonal effects of communication technologies.

Theory of Electronic Propinquity

The theory of electronic propinquity is “a general theory of mediated communication” (Korzenny, 1978, p. 3). TEP was introduced prior to, and without consideration of, the Internet and text-based verbal communication such as e-mail or real-time chat, desktop videoconferencing, and other forms of computer conferencing that have grown prominent in recent years. It features a deductively derived and interrelated set of propositions and corollaries, with the cogency as well as the theoretical breadth to include a variety of communication formats. Because of these attributes, it holds the potential to unify, predict, and explain the consequences of using alternative media, including media that did not exist in specific form at the time of the theory’s introduction. TEP explains the effects of interactive communication media characteristics on human communication under different kinds of media choice conditions, via FtF, high- and low-bandwidth electronic communication systems, and, as this study extends, Internet-based (text-based) communication.

The theory primarily focuses on the relationships among several factors related to media, users, task, and setting, the combinations of which affect the *electronic*

propinquity construct, or the psychological feeling of nearness that communicators experience using different communication channels. Physical propinquity means nearness to another person and is associated with the opportunity to converse and a psychological feeling of involvement with others. Electronic propinquity, according to Korzenny (1978), is “electronic proximity, or electronic nearness, or electronic presence” (p. 7). It is conceptualized as a continuum of the subjective perception an individual holds that he or she is functionally, if not physically, close to someone else. According to the theory, propinquity is strongly associated with satisfaction, communication effectiveness, and task accomplishment. The factors theorized to increase electronic propinquity include (a) the *bandwidth* of the communication medium, (b) the capacity of the communication channel for *mutual directionality*, and (c) the communication *skills* of the individual communicators. Factors predicted to decrease propinquity include (a) the *complexity* of the information being exchanged, (b) the perceived number of communication *rules* to which the individuals must conform, and (c) the perceived number of *choices among communication channels* available to the individuals (Korzenny, 1978, p. 10). Essentially, the theory argues that one experiences greater propinquity when there is greater bandwidth (similar to Short, Williams, and Christie’s [1976] social presence theory), or when there is less information complexity, or greater mutual directionality (resembling Daft and Lengel’s [1986] media richness theory), or when there are greater individual communication skills, or fewer rules, or a smaller number of perceived choices among communication channels.

Several unique points emanating from these multiple contingencies deserve elaboration. First, TEP formulates that each of these attributes interacts with others in predictable ways and offers formal derivations of the possible combination of these attributes. Media richness (Daft & Lengel, 1986; Daft, Lengel, & Trevino, 1987), in contrast, offers that media that are rich are higher in *all* of the four basic attributes it defines (essentially bandwidth, mutual directionality, natural language, and personalization). It does not consider the possibility that a single medium, or a usage of a medium, may be high on some criteria and low on others and, if so, how rich that medium should theoretically be (for a review, see Walther & Parks, 2002). For instance, if a text-based, real-time chat message were sent from one individual to another, it could be (a) low on bandwidth, (b) moderate on mutual directionality, (c) moderate on natural language, and (d) high on personalization. Media richness theory does not specify, or even suggest, combinatory rules, nor assertions that the attribute subscales can simply be averaged or whether some dimensions take precedence over others. Propinquity theory allows for these dimensions to vary orthogonally and provides a calculus for the interrelationship among these dimensions in predicting outcomes of interest. Another unique point emanating from these multiple contingencies is that the effect on communication because of bandwidth can be restricted or relaxed by the operation of other factors, such as systematic variations in individuals’ communication skills, information or task difficulty, and the users’ perceived number of choices among communication channels available.

The latter construct—the perception of alternative channel availability—is another unique and potentially powerful dimension in TEP. The sixth proposition of TEP specifies that the fewer the number of communication channels perceived to be available, the more propinquity will be achieved by the remaining channels, all other things being equal. TEP predicts that the detriments of limited cues on communication may be attenuated in situations in which there are no high-bandwidth communication media alternatives available. A very simple illustration of this dynamic might be as follows: A manager believes that the greatest propinquity will be achieved using the highest bandwidth channel available. He would select a FtF conversation, but geographic separation from the prospective message receiver renders this impractical. Therefore, he would use the next highest bandwidth medium, videoconferencing, and he comes to believe that videoconferencing will be very propinquitous. Unfortunately, the receiver does not have videoconferencing at her location, and they cannot use it. He therefore turns to the telephone and expects it will deliver great propinquity. He calls; she does not answer (and her voicemail does not pick up). He must now turn to asynchronous e-mail and, as he does so, it will be as propinquitous.

One important aspect left unclear in the formulation of TEP is whether the greater propinquity resulting from fewer perceived media choices is a *perceptual* or a *behavioral* phenomenon. Walther and Parks (2002, p. 539) asked,

Does a low bandwidth medium merely seem richer when alternatives are limited? Or, if forced to rely on the structurally least expressive of media choices, does a user accommodate and expand the otherwise limited range of the medium through greater effort, greater application of communication skills, and the reduction of formality? Such an explanation would go far in explaining how lean media can be used for the effective performance of interpersonally-demanding tasks.

The exposition of the theory is inconsistent on this matter. Favoring the psychological contrast effect, Korzenny (1978) argued,

Sheer availability of media imposes restrictions as to which medium will be considered satisfactory in terms of perceived propinquity. . . . When the only means of propinquity we have is, for example, a telephone . . . and we need to make our presence evident, we use it and we consider it satisfactory since it is the only means of communication we have available. (pp. 19-20)

Yet, in discussing the application of communication skills, Korzenny argued that individuals may draw on their skills

for making up for the narrow bandwidth of a channel. . . . The more a person has mastered communication skills appropriate to a certain medium, the more the person will be likely to say that that medium provides an acceptable degree of propinquity. (p. 17)

These competing explanations can be addressed only through research simultaneously examining the role of skills and the role of media alternatives, using a succession of high- and low-bandwidth media.

The theory's proposition that propinquity remains great, even when bandwidth is low, as a result of restricted choice of media alternatives offers a powerful mechanism that can prompt new understandings of interactive communication media as well as explain other disparate research findings. It can, for example, account for anomalies in media richness research such as Markus's (1994) report that very successful managers, with presumably sharp media selection skills, routinely use low-bandwidth, or "lean" media—a lot of e-mail—for interpersonally demanding tasks and that they do so quite effectively. Walther's findings on the hyperpersonal effect of CMC depict circumstances in which text-based communication equals or exceeds relational effects derived from comparable FtF interactions (for a review, see Walther, 1996, 2007). In that research, for the most part, research participants were assigned to use one medium exclusively. Propinquity theory is consistent with the notion that, although users are inclined to prefer higher-bandwidth media for informationally complex conversations, when the choice of high-bandwidth alternatives is restricted, effective and satisfying communication takes place using lower-bandwidth media nevertheless. The notion that having comparisons to make drives down ratings of lower-bandwidth media is also reflected in CMC studies where direct comparisons among media were sought. In an educational setting, for instance, students' perceptions of the value and utility of technological instruction systems were affected more strongly by comparisons to what alternatives a person was being denied than because of the actual learning benefits of a particular system itself (ven den Berg & Watt, 1991). As will be discussed below, it is the unacknowledged presence of alternative media that may also have contaminated earlier research on TEP.

There may be several ways to conceptualize and operationalize media choice. In media richness and social presence research, prospective choices that users make among media has been an outcome variable, not a predictor or a moderator (e.g., Daft et al., 1987; Rice, 1993). It is hard to imagine a scenario in which to assess the propinquity of an unchosen medium if a user could truly choose a different one, except perhaps by first offering and then removing options, that is, making media alternatives salient but restricting actual choice. Therefore, the number of choices can also be conceptualized as whether or not there are alternative media present to users, even if some potential choices cannot be selected. As we argue, this element of choice—the presence of alternative media—appeared but was not recognized in previous TEP research and may have affected results unknowingly. In order to investigate that possibility, the present research replicated choice as the presence of alternative media and hypothesized its effects in order to examine its prior potential confound.

Propinquity theory has been subject to only one direct empirical test, which was not supportive. That test may have been methodologically flawed, however, and its conclusions

should be questioned. An experiment by Korzenny and Bauer (1981) featured a 3×2 design, with three types of communication channels and two levels of task complexity (the latter variable being an operationalization of the *information complexity* construct). In the *videoconferencing* condition, three participants were located in one room and three participants in another room, with the two rooms connected by closed-circuit television cameras. A television monitor and speakers in each room presented the images and dialogue of those in the other room, allowing participants to interact visually within and between rooms. In a second, audioconferencing condition, microphones and speakers, with no television, provided audio-only communication between the three individuals co-located in one room and three in another room. Finally, in a third condition, all six participants communicated FtF in the same room. The task complexity conditions involved group decision-making simulations requiring selection of employees for promotion when there were either clear differences between employees' qualifications (low complexity) or equal qualifications among employees (high complexity). After discussion and decision making, participants completed self-administered questionnaires assessing perceived proximity, perceived task complexity, satisfaction with the meeting, amount of feedback (perceived amount of information exchanged), and level of communication rules (perceived amount of regulation governing the interaction).

The results of that experiment did not support the theory. Multiple regression analysis did not yield the expected results on perceived proximity or satisfaction because of communication bandwidth, task complexity, and perceived communication skills. The feedback and rules factors achieved significant relationships, although rules had a surprisingly positive rather than negative effect on proximity. The authors acknowledged that measurement errors or other factors may have influenced matters but generally concluded that because the general linear model tested in the regression analysis did not achieve significance, and because the bandwidth factor failed to attain significance, the null hypothesis should be retained.

Faults in the Test of Proximity

Our own analysis concludes that Korzenny and Bauer's (1981) experiment contained several faults that may have contributed to the disappointing findings. First and most important, it did not achieve an appropriately controlled experimental design and contained a confounding factor. Although the three communication conditions differed in the media that connected the three-person subsets to one another (between rooms), the arrangements did not preclude media differences *within* the room, allowing the presence of FtF communication to persist. It is unclear whether each participant rated all the other participants independently in each session or if participants rated the session as a whole with regard to proximity, skills, feedback, and so on. If they rated all group members collectively, potential between-condition differences may have been diluted because of the mixed media within each of the

ostensibly mediated conditions, elevating all average scores and quashing potential between-condition differences. Even if participants rated each other successively and independently, the apparent inclusion of ratings for members' nonmediated (FtF) partners may have inflated overall ratings in conditions that would otherwise have varied because of audio or video communication conditions.

Alternatively, the theory's unique specification that the perceived propinquity of any communication medium is in part determined by the perceived availability of alternative, higher-bandwidth media may have played a role. In all ostensibly mediated conditions, participants could not help but be cognizant of the possibility of FtF communication (as they did indeed have within their rooms, but not between the rooms in two conditions). This confound should be expected by the theory itself to render perceptions of *any* alternative to FtF communication inferior and may have exaggerated negative ratings of the alternative media conditions, rendering them indistinguishable.

In addition, statistical issues may have played a role. It is becoming more widely recognized that the analysis of small groups frequently requires statistics that take into account interdependencies among interacting group members. Failure to do so, according to Kenny, Manetti, Pierro, Livi, and Kashy (2002), may lead to Type I or Type II errors, and the multiple regression procedures employed in the previous study are not described as having adjusted for this effect. Finally, the derived corollaries of TEP suggest that the causal factors may influence (i.e., offset or magnify) each other in the production of propinquity, suggesting the presence of interaction effects. Yet the analysis of interaction terms is not reported in Korzenny and Bauer's (1981) article.

Thus, the findings of the Korzenny and Bauer's (1981) research may be uninterpretable insofar as they support or reject the tenets of the theory. Unfortunately, they were interpreted as undermining the theory, and few references to the theory have appeared in the literature since that time. This is especially ironic given that media richness theory, and more recent reformulations of it (e.g., Carlson & Zmud's [1994, 1999] channel expansion theory), have incorporated some of the tenets originally appearing in TEP (e.g., task complexity and communication skills) but appear to have done so without cognizance of the earlier work.

The present study sought to test the theory in an experiment that might not only provide evidence for the predictive utility of specific propositions of the theory, but in so doing, also account for and demonstrate the confounding mixed-media factor in Korzenny and Bauer's (1981) experiment. In order to do so, the experiment was designed to explore the effects of uniform versus asymmetrical channel use within group discussions as a means of replicating Korzenny and Bauer's confounded conditions, in comparison to appropriate control conditions (uniform media), along various levels of bandwidth. The first hypothesis focuses only on bandwidth and alternative media to address the last and most unusual of Korzenny's (1978) major propositions, "The smaller the number of choices of channels, the more propinquity" (p. 11). Following Korzenny and Bauer's (1981) research, we hypothesize and test the same predictions with respect to satisfaction as well.

Hypothesis 1: The (a) propinquity and (b) satisfaction afforded by a medium differ when more than one medium is present, in the direction of its relative bandwidth. A medium produces lower propinquity and satisfaction when it is the comparatively lower bandwidth medium of those present.

According to TEP, we would expect no differences in propinquity between conditions in which a single medium is used exclusively by all communicators (i.e., there is no alternative medium available).

In addition to this proposition, TEP specifies derived corollaries that are more complex than the main effects of bandwidth, choice, or other factors alone. The other factors specified in the theory—communication skills, information complexity, communication rules, and amount of mutual directionality—also affect the effects of one another (e.g., “the more communication skills, the wider bandwidth”; Korzenny, 1978, p. 12). These factors should therefore interact in affecting the propinquity users experience when they employ various media. A reasonable test of the theory must therefore involve some of these contextual factors exogenous to media and the possibility of complex interaction effects. As interactions emerge, we may see that different levels of influence by one predictor reduce the influence of other(s), which is, as mentioned, a unique aspect of TEP among other media selection and effects theories. The present study also replicated Korzenny and Bauer (1981) by examining the influence of information complexity, instantiated by means of varying levels of task complexity, reflected in the following hypotheses:

Hypothesis 2: As complexity of information decreases, bandwidth increases, and the perceived number of choices among channels decreases, the greater the amount of (a) psychological propinquity and (b) satisfaction.

Unlike both social presence theory (Short et al., 1976), which focuses on bandwidth, and media richness theory (Daft & Lengel, 1986), which also recognizes the role of information complexity on media effectiveness, TEP proposes that users' communication skills moderate the effects of bandwidth and other factors. (Communication skills in media richness research are conceived as one's ability to select the most efficient communication medium [Daft et al., 1987], not, as in TEP, how to make a given communication medium achieve greater propinquity.) The previous study on electronic propinquity also sought to assess the effects of participants' communication skills on propinquity. The present study includes communication skills as an additional potential main or interaction effect along with media, choice, and complexity effects:

Hypothesis 3: As communication skill increases, complexity of information decreases, bandwidth increases, and the perceived number of choices among channels decreases, the greater the amount of (a) psychological propinquity and (b) satisfaction.

Method

Participants

Research participants ($N = 211$) were recruited from undergraduate communication and psychology courses at a U.S. research university, in exchange for their choice of extra credit or a cash incentive of US\$10. Participants' ages averaged 19.6 years ($SD = 2.20$), and 68% of the participants were male. Volunteers were provided appointment times and a map to the building in which the research was to take place, so that all members of a particular group reported to different initial locations, thereby preventing pre-experiment exposure to one another. Groups were scheduled to comprise four individuals, and 25 groups of four members were compiled; because of attrition, 37 groups of only three members were also compiled. Each participant completed a self-administered measure of communication skills prior to the study. Groups discussed one of three versions of a decision-making task that were designed to vary in their level of complexity, involving adjudicating among requests for government funding.

Experimental Design

The experiment replicated features of Korzenny and Bauer's (1981) research but with systematic offset control conditions that highlight the comparative effects of having different levels of media bandwidth available for some partners but not for others. In order to test the hypotheses, each of the following conditions was repeated with varied task complexity.

The following experimental conditions and communication media were employed:

1. All persons in one room using FtF communication (9 groups)
2. Some persons in one room with FtF communication, connected to other person(s) in other room(s) who used only desktop video plus audio (10 groups)
3. All persons in individual rooms connected to all others only through desktop video plus audio (10 groups)
4. All persons in individual rooms, some persons communicating via desktop video plus audio, connected to others who used only audio (9 groups)
5. All persons in individual rooms connected to all others, all using audio only (7 groups)
6. All persons in individual rooms, some using audio and text-based chat, connected to others who used text-based chat only (8 groups)
7. All persons in individual rooms connected to all others using text-based chat only (9 groups)

Thus, in all conditions, all members in a group communicated with each other. In half of the conditions (2, 4, and 6), a subset of members could communicate via a

higher-bandwidth medium, whereas communication among and between another subset was constrained to a lower-bandwidth medium. These conditions facilitated comparisons among participants' perceived proximity scores due to each communication medium when it was (a) the only medium in the group (and there were no alternatives present), (b) the comparatively highest bandwidth medium in a group (i.e., used alongside a lower bandwidth medium), or (c) the comparatively lowest bandwidth medium in a group (i.e., used alongside higher bandwidth medium).

FtF sessions were conducted in a large laboratory room. This room was also the location for FtF subsets of mixed groups that involved video and audio. For all other conditions, participants were individually located in lab or office rooms. Videoconferencing employed Web cams and the program IM4CAM (mirrored from <http://www.im.co.kr/>). Audioconferencing employed multiparty calling on the university's telephone system. Text chatting employed the mIRC interface to an exclusive Internet Relay Chat channel.

Task

Although Korzenny and Bauer (1981) used low versus high task complexity as predictor variable in their analysis, TEP (Korzenny, 1978) originally specified that information complexity is a perceptual rather than absolute factor. Therefore, the present study developed variations of a group decision-making task in order to generate a range of information complexity perceptions but used perceived information complexity as a continuous variable in hypothesis tests.

Groups addressed one of three versions of a decision-making task, which varied in difficulty, a strategy used by Korzenny and Bauer (1981). In that study, groups were provided 10 information items that informed a decision about which one of two employees should be promoted.

The version defined as low complexity of information portrayed one employee as being very competent while portraying the other as only fair. The other version, defined as high in complexity, portrayed both employees as being very competent and equal on all job characteristics except two. (p. 486)

Further task details were not reported. The present study attempted to arouse information complexity in a similar fashion, by which "the perceived degree of discrepant factors . . . arouse(s) differential amounts of dissonance" (p. 481). The researchers created three modifications of a group decision-making task originally developed by Valacich, Mennecke, Wheeler, and Wachter (1993, reported in Mennecke, Valacich, & Wheeler, 2000). In the original version, a group takes the perspective of legislators who must allocate \$1.8 million in funds among several charity applications, with information about each charity provided and each application requesting \$1 million; no allocation may be less than \$500,000, and at least one must be

\$1,000,000. In the present versions, the most complex called on the group to allocate \$1.8 million among six applications. In the moderate complexity task, they must allocate \$3.8 million among six applications. And in the least complex version, they were to allocate \$1.8 million among four applicants. Because information complexity should result in “the difficulty in making a decision regarding a problem” (Korzenny & Bauer, 1981, p. 482), pretesting using a separate sample found that there was no difference in the amount of time required to satisfy these different versions and that the three tasks differed significantly on task difficulty scales from Jarboe (1988; “the problem we discussed was a hard one”) and Jurma (1978; “the task was simple,” “the task was easy”), which yielded a Cronbach’s $\alpha = .84$.

Measurement

In terms of measuring information complexity, the three 5-interval scales mentioned immediately above, in the task pretest, were also administered to participants in the main experiment, and their mean composed the operationalization of information complexity.

To assess communication skills, when individuals signed up in advance to participate in the study, they were provided a self-report measure of communication skills to complete before coming to the research site. The present study adopted a different strategy for the assessment of communication skills than that of Korzenny and Bauer (1981). That research collected postinteraction measures of perceived communication competence by having group members rate others on ten 1 to 100 scales (e.g., asked for feedback, repeated important points, summarized the conversation, asked questions, was articulate). That strategy was not followed for several reasons. First, although other terms in the original theory are sometimes concrete and sometimes perceptual variables, the theory specifies skills rather than partners’ perceived skills:

Communication skills, as a factor that determines perceived propinquity, is the only one which does not seem amenable to a phenomenological approach. The measurement of communication skills requires a normative criterion against which the skills of an individual can be compared. (Korzenny, 1978, p. 18)

As Korzenny and Bauer reflected post hoc, a measure that is immune to the effects of the interaction itself would be preferable because the interaction may influence perceptions of group partners (also see Kenny, Kashy, & Bolger, 1998). This concern also eliminated from consideration most published measures of communication competence (for a review, see Spitzberg, 2003), which are likewise administered on the basis of witness observations. Participants’ self-ratings following the group discussion might be similarly reactive. Therefore, a measure of a priori trait skill was sought. A thorough review of potentially applicable measures suggested that Riggio’s (1986, 1989) Social Skills Inventory met the criteria. Although this 90-item

measure may factor into dimensions of social sensitivity, emotional sensitivity, social control, emotional control, social expressivity, and social manipulation, a unidimensional structure of global social skills was computed with Cronbach's $\alpha = .88$.

Following group discussions, participants completed postdiscussion measures of propinquity (9 items) and communication satisfaction (17 items) in a round-robin fashion with regard to each group partner. Because Korzenny and Bauer's (1981) propinquity measure was unavailable, nine original semantic differential items were created to assess propinquity, with the range of responses on the scale of 1 to 7. Principal components analysis with Varimax rotation using data from one partner rating by each participant resulted in two factors, the second of which comprised only two items, but it reflected weak face validity regarding the propinquity construct (similarity-dissimilarity, alike-distinct) and was disregarded from further analysis. The other dimension retained five items with good factor loadings and reflected the nearness aspect defined by propinquity. Items included distant-nearby, close-far, together-separate, proximal-remote, and disconnected-connected ($\alpha = .91$).

Communication satisfaction with each partner was measured using 7-interval Likert-type scales, 15 adopted from Hecht's (1978) interpersonal communication satisfaction measure and 2 from Jarboe's (1988) measure of group communication satisfaction. Principal components analysis initially rendered a four-factor solution accounting for 38% of the variance. Three factors contained only one item, and these, along with items showing poor factor loadings, were removed. The remaining 11-item scale achieved $\alpha = .89$.

In order to provide the most parsimonious partial test of the theory, the present research did not assess perceived rules or perceived feedback. These two factors did affect propinquity in Korzenny and Bauer's (1981) study, whereas the other factors did not. It was considered more fruitful to re-examine the other factors under new conditions than to revisit those already linked to expected outcomes.

Results

The analyses employed hierarchical, multilevel analysis of variance including random-effects residuals to account for the nonindependence of data from group members (Kenny et al., 2002; Moritz & Watson, 1998). Analyses employed the SPSS MIXED procedure and included random-effects terms for multiple observations by individuals and for individuals nested in groups. This procedure calculates estimated marginal means (and standard errors) associated with the parameter estimates, which are referred to as means in the following results. Statistical power was estimated post hoc as .33 for an effect size of .05 due to comparative bandwidth effects or .28 for effects of absolute bandwidth (see Erdfelder, Faul, & Buchner, 1996).

The first hypothesis predicted effects on propinquity and satisfaction due to having multiple media present in groups and the bandwidth of the media in these

Table 1
Means and Standard Error Estimates for Effects of Presence of Alternative Bandwidth Media on Propinquity for Different Media

Comparative Bandwidth	FtF		Video		Phone		Text Chat	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
Lower	—	—	4.35	0.25	4.21	0.28	3.24 ^a	0.34
No alternatives	4.56 ^b	0.158	4.57 ^b	0.16	4.57 ^b	0.185	4.44 ^b	0.17
Higher	4.25	0.25	4.60	0.28	4.49	0.35	—	—

Note: FtF = face-to-face. Common superscripts indicate no difference.

conditions. Analyses for the effect of media alternatives compared propinquity and satisfaction ratings between scores from partners who used (a) the only medium in the group or (b) the comparatively highest bandwidth medium in a group (i.e., used alongside a lower bandwidth medium) to (c) the comparatively the lowest bandwidth medium in a group (i.e., used alongside higher bandwidth medium).

Both effects were significant on propinquity, and there was no interaction effect, $F(4, 260) = 1.28, p = .28, \eta^2 = .04$. The effects presented below describe all media generally, but to illustrate the results using the case of the phone we could say that phone communication differed in propinquity, not because of being phone communication but because of its relative bandwidth and whether or not alternatives were present. When phone was comparatively lower in bandwidth, that is, used alongside videoconferencing, it produced less propinquity compared to when the phone was comparatively higher in bandwidth, that is, used alongside text chat, or when it was used alone.

The media alternatives factor produced $F(2, 344) = 5.79, p = .003$. Pairwise comparisons revealed that propinquity was significantly lower when communication was done via the comparatively lowest bandwidth medium in a group ($M = 3.93, SE = 0.17$) compared to when the same medium was either the higher-bandwidth of two media ($M = 4.44, SE = 0.17; p < .02$) or there were no other comparative bandwidth choices available ($M = 4.54, SE = 0.09; p < .001$). Consistent with TEP, no difference in perceived propinquity was found ($p = .61$) between ratings among those who communicated with a comparatively higher-bandwidth medium and those among whom there were no comparative bandwidth choices (see Table 1).

The main effect for bandwidth also achieved significance, $F(3, 223) = 2.75, p = .04$. The bandwidth effect did not appear across all combinations of medium and alternatives. The effect was limited only to ratings from communication using the lower-bandwidth medium in mixed-media groups. Within that stratum, propinquity in text chat was significantly lower than propinquity was in video ($p = .009$) or in phone ($p = .028$) conditions.

When propinquity was compared between the different bandwidths in groups where all members used the same medium (all FtF, all video, etc.), there were no

Table 2
Means and Standard Error Estimates for Effects of Presence of Alternative Bandwidth Media on Communication Satisfaction for Different Media

Comparative Bandwidth	FtF		Video		Phone		Text Chat	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
Lower	—	—	5.27	0.18	5.33	0.196	4.44 ^a	0.25
No alternatives	5.22 ^b	0.15	5.23	0.14	5.37 ^b	0.16	5.34 ^b	0.16
Higher	5.32	0.20	5.46	0.22	5.90	0.26	—	—

Note: FtF = face-to-face. Common superscripts indicate no difference.

differences in propinquity among text chat, phone, video, or FtF. Likewise, among those partners in mixed-media groups who used the higher bandwidth medium, there were no differences in propinquity between conditions. Although a lack of significant differences provides no certain proof, the contrast between the choice and no-choice conditions is consistent with propinquity theory's sixth proposition and contrary to bandwidth-based predictions drawn from social presence and media richness theories.

Similar results were obtained for the dependent variable of communication satisfaction. There was a significant effect of bandwidth, $F(3, 223) = 2.87, p = .04$, and media choice approached significance, $F(2, 400) = 2.93, p = .05$, but no interaction effect, $F(4, 326) = 2.02, p = .09$; overall $\eta^2 = .04$. Less satisfaction was obtained using the comparatively lower bandwidth medium in mixed-media groups compared to using a higher bandwidth medium ($p = .01$) or when no bandwidth choices were available at all ($p = .01$; $M_{\text{low}} = 5.01, SE = 0.12$; $M_{\text{high}} = 5.42, SE = 0.14$; $M_{\text{no choice}} = 5.29, SE = 0.08$). This effect appears most pronounced in text chat: Pairwise comparisons revealed that when all group members communicated via text chat, communication satisfaction was significantly higher ($p < .002$) than when chat was the situationally lower bandwidth medium available ($M_{\text{no choice}} = 5.34, SE = 0.16$; $M_{\text{lower}} = 4.44, SE = 0.25$). For other media, pairwise comparisons showed no significant differences in communication satisfaction whether or not different media alternatives were present (see Table 2).

The bandwidth effect on communication satisfaction occurred only among partners who communicated via a comparatively lower-bandwidth medium in mixed-media groups, within which satisfaction in text chat was significantly lower than in either the phone condition ($p < .01$) or the video condition ($p < .01$). When no alternative media were present or when a medium was comparatively higher in bandwidth in mixed-media groups, no differences in communication satisfaction occurred between different bandwidths (see Table 2). Thus, the effects of alternative media presence on satisfaction can be said to affect CMC chat (which the theory predicted) more so than other media. Ironically, other media did not differ in satisfaction

due to bandwidth either. As can be seen from Table 2, no significant differences in communication satisfaction exist between different media that are used exclusively (i.e., no alternative media are present).

Hypothesis 2 predicted simultaneous relationships of bandwidth, media alternatives, and information complexity on propinquity and satisfaction, with information complexity operationalized as self-reported perceptions of task difficulty instigated by variations in task ambiguity. Given that TEP specifies contingencies among predictor variables (e.g., information complexity affects bandwidth), main effect and interaction terms were included in multilevel analysis. The three-way interaction effect was significant, $F(9, 314) = 1.98, p = .041, \eta^2 = .04$. Main effects for media alternatives and perceived task difficulty also obtained: for the presence of media alternatives, $F(2, 378) = 3.09, p = .047$, and for task difficulty, $F(1, 261) = 4.00, p = .047$. There was no main effect for media bandwidth, $F(3, 308) = 1.18, p = .32$.

In order to probe the interaction effect, the means for propinquity due to the interaction of media alternatives \times bandwidth were plotted at three different levels of perceived task difficulty, corresponding to the mean minus 1 *SD* (1.97), the mean (3.01), and the mean plus 1 *SD* (4.05) to represent low, moderate, and high levels. Comparisons among these scores revealed that when task complexity was perceived as difficult (ratings plotted at 4.05), the presence of alternative media moderated the effect of different bandwidths on propinquity. Partners who communicated using the comparatively lowest bandwidth medium in mixed-media groups (e.g., who used audio only in a group in which others had audio plus video) experienced significant differences in propinquity due to media bandwidth ($M_{\text{video}} = 4.65, SE = 0.34; M_{\text{phone}} = 4.00, SE = 0.38; M_{\text{text chat}} = 3.11, SE = 0.55$). However, when the task was again perceived as difficult, but no alternative media were present for comparison (all partners communicated using the same medium), propinquity was not significantly different between different bandwidth media ($M_{\text{face}} = 4.49, SE = 0.20; M_{\text{video}} = 4.73, SE = 0.21; M_{\text{phone}} = 4.50, SE = 0.26; M_{\text{text chat}} = 4.35, SE = 0.19$). No significant differences in propinquity occurred for different bandwidths if partners communicated via the comparatively highest bandwidth medium ($M_{\text{face}} = 3.85, SE = 0.30; M_{\text{video}} = 4.39, SE = 0.42; M_{\text{phone}} = 3.76, SE = 0.45$). These effects reflect the same pattern seen in the previous analyses, although this time they are embedded in the context of information complexity: When tasks are complex, and when no higher bandwidth media are available for comparison, the effects of bandwidth are significantly attenuated. But when tasks are complex and media comparisons can be made, lower-bandwidth media are less propinquitous.

When task difficulty levels were low or moderate, the interaction and bandwidth effects on propinquity largely retreated. When the task was moderately complex, the only effect of media alternatives on propinquity resulted when text chat was the lower-bandwidth medium ($M = 3.51, SE = 0.31$) rather than the exclusive medium of the group ($M = 4.46, SE = 0.19$), $F(1, 351) = 7.03, p = .008$. When the task was least complex, no significant differences occurred. It appears that when tasks are

easy, any medium may achieve as much closeness as FtF interaction. In such a case, mixing media does not reduce propinquity for the lower-bandwidth option, as the presence of media alternatives does when tasks are more demanding. Hypothesis 2a is generally supported: As complexity of information decreases, bandwidth increases, and the perceived number of choices among channels decreases, the greater the amount of psychological propinquity. The finding is somewhat attenuated for the across-the-board bandwidth effect, and the interaction is most pertinent in the case of text chat. Some contingent influence of the three predictors appears to occur.

Hypothesis 2b reflected the same prediction, but with respect to communication satisfaction rather than propinquity. The three-way interaction of information complexity, bandwidth, and apparent choice did not achieve significance, $F(9, 394) = 1.69, p = .09$, nor did any two-way or main effects emerge. Although there were some significant pairwise comparisons accompanying the analysis, the failure of the overall F test suggests that these simple differences were not consistent or robust enough to render reliable factorial effects. Hypothesis 2b is not supported.

Hypothesis 3 involved the analysis of an additional factor, communication skills, on propinquity and satisfaction to find out whether systematic individual differences among users would change the relationships between the other predictors on propinquity. A four-way interaction (communication skills, bandwidth, comparative media availability, and task complexity) was not significant for propinquity, $F(10, 299) = 1.72, p = .08$. Among the possible interaction and main effects, only the 3-way interaction of Communication Skills \times Task Complexity \times Comparative Media Availability was significant, $F(2, 371) = 3.60, p = .029, \eta^2 = .04$. Effects were probed by analyzing the continuous measures at values representing the mean minus 1 SD (for communication skills, 2.87), the mean (3.18), and the mean plus 1 SD (3.49) to represent low, moderate, and high levels of the variables. Table 3 displays the means on propinquity for the 3×3 array depicting the trends for task difficulty and skills. Results suggest positive effects of greater skills and simultaneously negative effects of task difficulty on propinquity. The effect of media alternatives appears within some cells but not others. That is, for some combinations of skill level and task difficulty, there were significant differences in propinquity when communication occurred via the lower-bandwidth option in mixed-media groups, in comparison to communication in groups with a single medium (and only once, when skills and difficulty were moderate, did low-bandwidth also differ from high-bandwidth media). These differences in propinquity did not occur in those cells where communications skills were highest, regardless of the level of task difficulty. It appears that greater communication skills can overcome the onerous effects of relatively lower bandwidth as well as the deleterious effects of task difficulty on propinquity. The failure of the bandwidth effect to contribute to the interaction or achieve a main effect parallels the TEP corollary that the more the communication skills, the greater the bandwidth.

The four-way interaction of communication skills, bandwidth, comparative media availability, and information complexity was significant with respect to differences

Table 3
Estimated Means and Standard Errors for Propinquity Because of
Combinations of Social Skills and Task Difficulty at Three Levels of Each Plus
Indicators of Differences Within Cells Because of Media Alternative Effects

		Social Skills					
		Low (2.87)		Med (3.18)		High (3.49)	
Task Difficulty	Relative Bandwidth	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
Low (1.97)	Lower	3.84 ^a	0.24	3.97 ^a	0.21	4.10 ^a	0.21
	Same	4.44 ^b	0.14	4.57 ^b	0.11	4.70 ^b	0.13
	Higher	4.79 ^b	0.26	4.85 ^b	0.23	4.91 ^b	0.23
Med (3.01)	Lower	3.88 ^a	0.18	3.94 ^a	0.18	4.01 ^{a,b}	0.21
	Same	4.67 ^b	0.10	4.34 ^b	0.08	4.60 ^a	0.10
	Higher	4.48 ^b	0.19	4.45 ^b	0.18	4.41 ^b	0.19
High (4.05)	Lower	3.91 ^a	0.25	3.91 ^a	0.28	3.92 ^{a,b}	0.35
	Same	4.50 ^b	0.14	4.51 ^b	0.11	3.51 ^a	0.14
	Higher	4.18 ^{a,b}	0.23	4.04 ^{a,b}	0.23	3.91 ^b	0.28

Note: Different superscripts within a cell indicate significant differences among scores within that cell, $p < .05$.

in communication satisfaction, $F(10, 344) = 1.87, p = .048, \eta^2 = .07$. A main effect for media alternatives also affected satisfaction, $F(2, 436) = 3.29, p = .038, \eta^2 = .01$.

Although greater communication skills were associated with greater satisfaction across the board, task difficulty appeared to exert a negative effect on satisfaction as well as the influence of other factors (see Table 4). In all cells where difficulty was moderate or great, there were no significant effects of bandwidth or media alternatives, no matter what the level of communication skills was. When task difficulty was low, there was a significant effect of media alternatives: Comparatively lower-bandwidth media were associated with less satisfaction across the three levels of skills. Within these cells, discussions by phone were significantly more satisfying than discussions by text chat, which appears to describe the significant bandwidth effect. Thus, communication satisfaction is greater by phone than by text chat but only when information complexity is relatively low and conversations take place in a mixed-media, phone-plus-chat group.

Finally, an analysis was conducted replicating the statistical technique reported in the original test of TEP by Korzenny and Bauer (1981). A multiple regression analysis was employed, with no correction for interdependence of observations, which forced the entry of all predictors (bandwidth, alternative media, task difficulty, and skills) simultaneously. The results, like those of Korzenny and Bauer, were not significant, $\text{adj. } R^2 = .007, F(4, 628) = 2.15, p = .07$. The analysis was then repeated using a backward-entry regression analysis to see if the removal of any predictors

Table 4
Estimated Means and Standard Errors for Communication Satisfaction
Because of Combinations of Social Skills and Task Difficulty at Three Levels
of Each Plus Indicators of Differences Within Cells Because of Media
Alternative and Bandwidth Effects

		Social Skills						
		Low (2.87)		Med (3.18)		High (3.49)		
		<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	
Task Difficulty	Relative Bandwidth							
	Low (1.97)	Lower	4.77 ^a	0.18	4.93 ^a	0.15	5.10 ^a	0.17
		Same	5.24 ^b	0.13	5.36 ^b	0.10	5.48 ^b	0.12
		Higher	5.29 ^b	0.21	5.42 ^b	0.18	5.55 ^b	0.18
Med (3.01)	Lower	4.85 ^a	0.14	5.12	0.13	5.39	0.15	
	Same	5.09 ^b	0.10	5.28	0.08	5.48	0.10	
	Higher	5.19 ^b	0.15	5.41	0.14	5.62	0.15	
High (4.05)	Lower	4.93 ^b	0.19	5.31	0.20	5.69	0.25	
	Same	4.93	0.13	5.21	0.10	5.49	0.13	
	Higher	5.09	0.19	5.40	0.18	5.69	0.22	

Note: Different superscripts within a cell indicate significant differences among scores within that cell, $p < .05$.

would improve the model. On the second step, bandwidth came out of the model, and the remaining terms achieved marginal significance, $F(3, 629) = 2.62, p = .05$. These analyses suggest a number of plausible conclusions: that Korzenny and Bauer's statistical analyses produced Type II error, that bandwidth effects are overcome by other factors as suggested by the sixth proposition of TEP, and/or that higher-order interactions are the most appropriate explanation for proximity levels as suggested by the derived corollaries of TEP.

Discussion

This study evaluated the impact of mediated communication and contextual factors on psychological feelings of closeness—electronic proximity—based on the theory proposed by Korzenny in 1978. This theory offers insights for understanding multiple influences affecting how people relate to one another using various communication media. According to Korzenny, a combination of factors, including media bandwidth, users' communication skills, information complexity, amount of feedback, communication rules, and perceived media choice, mutually determine communication satisfaction and proximity. Unlike other theories that propose communication states such as social presence to be a unitary function of media's

bandwidth, TEP offers a specifiable set of objective and perceived characteristics that includes and goes beyond bandwidth. The framework extends very well to computer-mediated settings—which the theory predated—both conceptually and empirically.

Summary and Implications of Findings

The first analysis demonstrated the effects of a limited set of predictors on propinquity. Some groups in this study used one medium only, whereas in other groups a subset of members used a higher-bandwidth medium (e.g., videoconferencing) while the entire group had a lower-bandwidth medium (e.g., audioconferencing). In mixed-media groups, group members who used a comparatively lower-bandwidth medium achieved lower propinquity than did members who used higher-bandwidth media. When bandwidth was even and there was no choice (all members used the same medium), bandwidth had no effect: There were no differences between ratings obtained as a result of chat, voice, video, or FtF communication among groups who used only one medium. The bandwidth of the channels interacted with the presence or absence of multiple communication media (i.e., media choice) on group members' levels of perceived propinquity.

The second analysis revealed that these patterns are also contingent on the perceived complexity of information under discussion. In this study, three versions of a task were employed to create varied levels of perceived difficulty in a manner similar to the type of operational definitions outlined in Korzenny and Bauer's (1981) previous attempt to substantiate the theory. The manipulation may be said to involve differences in task equivocality, a construct central to media richness theory (Daft & Lengel, 1986). However, TEP is clear with regard to the importance of *perceived* information complexity, and a variable reflecting participants' perceptions of task difficulty was used in the present analysis. Results indicated that when task difficulty was high, the contrast between lower- versus higher-bandwidth media in mixed-media groups again affected propinquity. In contrast, when the task was perceived as difficult but there were no comparative media present, or when tasks were easier, bandwidth was irrelevant: Greater propinquity was attained through any medium. This finding is consistent with TEP as well as media richness theory, although not with social presence theory. The final analyses included individual communication skills as well as perceived task difficulty. Communication skills were assessed using a well-validated self-administered measure of social skills prior to the groups' discussions. Communication skills increased propinquity, just as task difficulty reduced it. When skills were less than very high, the contrast among a lower-bandwidth and same-bandwidth tool persisted again. However, among communicators with the highest level of communication skills, different media and different combinations of media did not diminish propinquity. Communication skills appear to help communicators address the challenges of lower bandwidth and of *relative* bandwidth deprivation. This finding suggests that it is the application of communication skills that

allows users of lower-bandwidth media to achieve greater propinquity rather than a simple psychological contrast effect or illusion of propinquity that occurs when one has fewer choices of media, a question that the original formulation of TEP left open. When communication skills are lower, propinquity is lower, especially when there are variations in relative media use as well as greater task difficulty.

One question that has been raised with regard to TEP, between its original publication and this replication, has to do with the underlying cause by which fewer perceived media choices can yield greater propinquity, regardless of the objective bandwidth of the medium, whether, as Walther and Parks (2002) asked, it is a psychological contrast effect or a matter of behavioral accommodation. The current results suggest that the latter of Walther and Parks's speculations is most apt. More communication skills lead to more propinquity (unless impeded by great task difficulty); users can overcome limitations of a low bandwidth medium when they do not have the easier-effort, higher-bandwidth alternative in their immediate environment. There is a limit to this, in that great communication skills cannot overcome the propinquity-reducing effects of a highly complex task, but this limitation is no less true for FtF communication than it is for lower-bandwidth media. The finding that greater communication skills generally ameliorate the effect of relative bandwidth deprivation explains how CMC users compensate for the loss of multichannel expressiveness that FtF and video provides and make text-based CMC as propinquitous as any other channel. If, as Korzenny (1978) argues, social skills appropriate to the medium can be mastered or acquired, TEP may account for findings that an individual's history using CMC predicts whether an individual initiates disclosive personal relationships online (Parks & Floyd, 1996), which could also be described as propinquitous. This finding also adds a new dimension to social information processing (SIP) theory of CMC (Walther, 1992; for a review, see Walther, 2006). SIP theory argues, consistent with the TEP, that CMC users may imbue text with socioemotional and identity cues in order to make CMC as effective as FtF over time. SIP theory does not take communication skills into account, as the present results suggest it might.

The original theory refers both to communication skills and to skills with specific media. The present research invoked general social skills. In a sense the less differentiated, cross-media attribute offers a powerful factor and a far more simple experimental design than a number of medium-specific assessments would require. Moreover, the variable rendered main and complex interaction effects. An alternative approach would involve identifying suitable measures of skill for videoconferencing, audioconferencing, and CMC chat, respectively, in addition to general and specific FtF skills. It is not clear that an array of such measures exists. Although some efforts have been made to articulate a measure of CMC competence (e.g., Spitzberg, 2006), this measure is multidimensional rather than unidimensional and thus, for the present purpose, troublesome, for it would be difficult to collapse across dimensions. For one thing, several items focus specifically on asynchronous e-mail

and not real-time chat. Moreover, the 12 items for the “selectivity” dimension of this scale reflect values consistent with media richness theory, that is, that CMC is less suitable than other media for various interpersonal functions, an assumption that TEP appears to reject.

Status of TEP

The present results suggest that the previous dismissal of TEP was premature. The negative results obtained by Korzenny and Bauer (1981) appear to be an artifact promulgated by any of several factors. It may have been the inadvertent contamination of media choice or alternatives in the experimental setting by including FtF partners along with audio- or video-mediated partners in the same groups. In the previous study, the media alternatives proposition was not purposefully instigated and was not considered. The present research isolated the effect of multiple media availability and used it as a theoretical factor, supporting its potency. It may have been the statistical issues accompanying nonindependent data from interacting small group members or the lack of statistical interaction terms in their analysis. The present study employed statistical corrections for observations nested in groups and obtained statistically significant interactions more often than main effects.

This is only a partial study of the TEP. The theory includes several factors more, which this study did not include. It would be difficult to experimentally manipulate the present factors—media, choice, and task—while further varying the amount of feedback in a group and the amount of communication rules. Although the previous TEP study employed participants’ self-reports of feedback and communication rules, no manipulations were employed leading to systematic differences in feedback or rules. Future research must embrace these challenges and empirically examine these dimensions in small sets if not in the total composite of factors.

Support for the TEP in general, and its assertion that the perception of media alternatives reduces propinquity, may help us to understand other dynamics of online relations, particularly mixed-media or mixed-location virtual groups. Some previous research that has made claims about distributed groups has actually studied partially distributed groups (e.g., Cramton, 2001). That research has suggested that distributed group members who use CMC systematically make negative attribution errors about distant partners. In the current context, it appears that the negative effects asserted to be part of mediated communication in distributed groups are, to some extent, because of *partial* distribution and *mixed* mediation (FtF subgroups connected by CMC; also see Shami et al., 2004). Research that has restricted both collocated and remote virtual group partners to a single medium (e.g., Walther & Bazarova, 2007) may be immune to the media choice confounds that TEP makes a viable concern.

The interaction of bandwidth and other factors can also account for discrepancies and surprises in other CMC research. Unlike other theories that focus on bandwidth

alone, or interactions between bandwidth and task difficulty, TEP proposes several contingencies on the effect of bandwidth. From this perspective, as echoed by the present results, the effect of multiple communication cues is attenuated by the absence of other available media alternatives. The results help address the disparity between studies that find that users prefer FtF or other higher-bandwidth systems when given a choice and other studies in which experimental demands or naturally occurring circumstances such as distance, time, and resources constrict media choice to one mode, in which good or excessively positive (e.g., hyperpersonal) relations accrue (for a review, see Walther & Parks, 2002). Similarly, TEP can untangle otherwise perplexing findings. For instance, research exploring how college students maintain relationships with high school friends drew on media richness theory to predict a stronger reliance on telephones and FtF than CMC (Cummings, Lee, & Kraut, 2006). The study found, however, that students used e-mail and instant messaging most frequently. The researchers concluded post hoc that prohibitive telephone costs mitigated fair comparisons. TEP suggests that CMC might have been amply propinquitous and satisfactory for those students, especially if telephone costs reduced their media choices. TEP uniquely captures the contingencies to explain how otherwise expected preferences for high bandwidth as well as positive outcomes using low bandwidth can be reconciled. As such, a reconsideration of TEP may lend significant organizing power to the field of media selection and effects research that has hitherto been more fragmented than cogent.

Note

1. Portions of this work were presented at the 2007 annual meetings of the Interdisciplinary Network for Group Research and the National Communication Association. The authors extend their gratitude to Felipe Korzenny and Brian Spitzberg for their advice and to Tommy Allen, Travis J. Donley, Nick Di Liberto, Jonathan Masullo, Mark Matarazzo, Eric Nolan, Alden Roberts, Clark Schirmer, Joe Schliffer, Moira Sherry, Sara Steinbrenner, Ricky Stewart, and Kevin Sullivan for their assistance in research methods and data collection.

References

- Carlson, J. R., & Zmud, R. W. (1994). Channel expansion theory: A dynamic view of media and information richness perceptions. In D. P. Moore (Ed.), *Academy of Management: Best papers proceedings 1994* (pp. 280-284). Madison, WI: Omnipress.
- Carlson, J. R., & Zmud, R. W. (1999). Channel expansion theory and the experiential nature of media richness perceptions. *Academy of Management Journal*, *42*, 153-170.
- Cramton, C. D. (2001). The mutual knowledge problem and its consequences for dispersed collaboration. *Organization Science*, *12*, 346-371.
- Cummings, J., Lee, J., & Kraut, R. (2006). Communication technology and friends during the transition from high school to college. In R. Kraut, M. Brynin, & S. Kiesler (Eds.), *Computers, phones, and the Internet: Domesticating information technology* (pp. 265-278). New York: Oxford University Press.

- Daft, R. L., & Lengel, R. H. (1986). Organizational information requirements, media richness, and structural determinants. *Management Science*, 32, 554-571.
- Daft, R. L., Lengel, R. H., & Trevino, L. K. (1987). Message equivocality, media selection, and manager performance: Implications for information systems. *MIS Quarterly*, 11, 355-368.
- Erdfelder, E., Faul, F., & Buchner, A. (1996). GPOWER: A general power analysis program. *Behavior Research Methods, Instruments, & Computers*, 28, 1-11.
- Hecht, M. L. (1978). The conceptualization and measurement of interpersonal communication satisfaction. *Human Communication Research*, 4, 253-264.
- Jarboe, S. (1988). A comparison of input-output, process-output, and input-process-output models of small group problem-solving effectiveness. *Communication Monographs*, 55, 121-142.
- Jurma, W. E. (1978). Leadership structuring style, task ambiguity, and group member satisfaction. *Small Group Behavior*, 9, 124-134.
- Kenny, D. A., Kashy, D. A., & Bolger, N. (1998). Data analysis in social psychology. In D. Gilbert, S. Fiske, & G. Lindzey (Eds.), *Handbook of social psychology* (pp. 233-265). Boston: McGraw-Hill.
- Kenny, D. A., Manetti, L., Pierro, A., Livi, S., & Kashy, D. A. (2002). The statistical analysis of data from small groups. *Journal of Personality and Social Psychology*, 83, 126-137.
- Korzenny, F. (1978). A theory of electronic propinquity: Mediated communications in organizations. *Communication Research*, 5, 3-24.
- Korzenny, F., & Bauer, C. (1981). Testing the theory of electronic propinquity. *Communication Research*, 8, 479-498.
- Markus, M. L. (1994). Electronic mail as the medium of managerial choice. *Organization Science*, 5, 502-527.
- Mennecke, B. E., Valacich, J. S., & Wheeler, B. C. (2000). The effects of media and task on user performance: A test of the task-media fit hypothesis. *Group Decision and Negotiation*, 9, 507-529.
- Moritz, S. E., & Watson, C. B. (1998). Levels of analysis issues in group psychology: Using efficacy as an example of a multilevel model. *Group Dynamics: Theory, Research, and Practice*, 2, 285-298.
- Parks, M. R., & Floyd, K. (1996). Making friends in cyberspace. *Journal of Communication*, 46, 80-97.
- Rice, R. E. (1993). Media appropriateness: Using social presence theory to compare traditional and new organizational media. *Human Communication Research*, 19, 451-484.
- Riggio, R. E. (1986). Assessment of basic social skills. *Journal of Personality and Social Psychology*, 51, 649-660.
- Riggio, R. E. (1989). *Social skills inventory manual*. Palo Alto, CA: Consulting Psychologists.
- Shami, N. S., Bos, N. D., Wright, Z., Hoch, S., Kuan, K. Y., Olson, J. S., et al. (2004, October). *An experimental simulation of multi-site software development*. Paper presented at the Proceedings of CASCON '04, Toronto, Ontario, Canada.
- Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications*. London: Wiley.
- Spitzberg, B. H. (2003, August). *A user's guide to Spitzberg & colleagues' competence-related measures*. Unpublished manuscript, San Diego State University, San Diego, CA.
- Spitzberg, B. H. (2006). Preliminary development of a model and measure of computer-mediated communication competence. *Journal of Computer-Mediated Communication*, 11(2). Retrieved January 4, 2008, from <http://jcmc.indiana.edu/vol11/issue2/spitzberg.html>
- Valacich, J. S., Mennecke, B. E., Wheeler, B. C., & Wachter, R. (1993). Legislative dilemma. In B. Wheeler & B. Mennecke (Eds.), *ISWorld net research task repository*. Retrieved July 25, 2003, from <http://kelley.iu.edu/bwheeler/ISWorld/index.cfm>
- ven den Berg, S., & Watt, J. H. (1991). Effects of educational setting on student responses to structured hypertext. *Journal of Computer-Based Instruction*, 18(4), 118-124.
- Walther, J. B. (1992). Interpersonal effects in computer-mediated interaction: A relational perspective. *Communication Research*, 19, 52-90.

- Walther, J. B. (1996). Computer-mediated communication: Impersonal, interpersonal, and hyperpersonal interaction. *Communication Research*, 23, 1-43.
- Walther, J. B. (2006). Nonverbal dynamics in computer-mediated communication, or : (and the net : ('s with you, :) and you :) alone. In V. Manusov & M. L. Patterson (Eds.), *Handbook of nonverbal communication* (pp. 461-479). Thousand Oaks, CA: Sage.
- Walther, J. B. (2007). Selective self-presentation in computer-mediated communication: Hyperpersonal dimensions of technology, language, and cognition. *Computers in Human Behavior*, 23, 2538-2557.
- Walther, J. B., & Bazarova, N. (2007). Misattribution in virtual groups. *Human Communication Research*, 33, 1-26.
- Walther, J. B., & Parks, M. R. (2002). Cues filtered out, cues filtered in: Computer-mediated communication and relationships. In M. L. Knapp & J. A. Daly (Eds.), *Handbook of interpersonal communication* (3rd ed., pp. 529-563). Thousand Oaks, CA: Sage.

Joseph B. Walther (PhD, University of Arizona, 1990) is a professor in the Department of Communication and the Department of Telecommunication, Information Studies & Media at Michigan State University. His research focuses on the interpersonal dynamics of communication via computers in personal relationships, groups, and educational settings.

Natalya N. Bazarova (MS, Cornell University, 2005) is a PhD candidate in the Department of Communication at Cornell University. Her research focuses on social cognition and interpersonal processes in computer-mediated settings.