Communication Technology and Friendship

during the Transition from High School to College

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Abstract

Within social networks, relationships are "enacted." They grow or decline through communication and the exchange of social resources. Although geographic distance can inhibit enactment, telecommunication technologies (e.g., phone, e-mail, IM) are increasingly being used to maintain relationships over long distances. In this paper, we examine the role these technologies play in maintaining friendships. Taking advantage of a natural situation in which friendships are at risk of ending, we follow students in their transition from high school to college. When students move away from home, they reduce both their communication with their old high school friends and their sense of psychological connection to them. Longitudinal analyses show that communication slows the decline in psychological closeness, but psychological closeness does not slow the decline in communication. E-mail and IM are telecommunication technologies that are especially useful among these students for maintaining friendships. The usefulness of these technologies may stem from arbitrary pricing decisions, which allow students to use them frequently, rather than from their intrinsic features, such as media richness. Unlike the phone, pricing of e-mail and IM does not depend on either message length or the distance the message must travel.

Introduction

People maintain only a limited number of personal relationships. Researchers estimate that people typically keep ten to twenty important relationships, out of the approximately 1,000 individuals whom they interact with or can identify (e.g., Fisher, 1982; Wellman, 1992). Friendships, in contrast to family relationships, are especially fragile, and require active maintenance or they die (Canary & Stafford, 1994). While family ties exist because of the accident of birth and are often maintained through obligation, friendship and romantic relationships are voluntary. They grow, decline, and end through concrete actions (Allan, 1979).

In this paper we examine how young adults maintain friendships when faced with life events that threaten them, such as moving from high school to college. In particular, we examine the role that phone and computer communications play in maintaining these friendships as the parties move geographically apart.

In Duck's analogy (1988), friendships need a regular investment of effort; otherwise, normal centripetal forces cause the friendship to come apart. In this view, people develop and maintain particular relationships by enacting them, i.e., by carrying them out through regular exchanges of communication or social support (Duck, 1988). Initial factors that bring people together, such as common interests, shared work goals, beauty, or charm, lose power with time (Berg & Clark, 1986). These factors must be supplemented with behavioral exchanges that

affect whether the relationship will be valued and retained, or devalued and dropped (Berg & Clark, 1986). Regular contact is at the heart of friendship (Allan, 1979). We typically grow to like others with whom we communicate and spend time, and this liking drives further companionship (Newcomb, 1961). It is in this sense that friendships are enacted. They are maintained through communication and other behavioral exchanges.

Since at least the 1930s, we have known that physical proximity increases the likelihood of friendships and romantic relationships (e.g., Bossard, 1932; Festinger, Schachter, & Back, 1950). However, when people are separated by geographic distance, it becomes more difficult to enact relationships through communication and the exchange of social support. As a result, when people change residences and move away, personal ties often fade and dissolve. Rose (1984), for example, found geographic separation to be the factor most often associated with the disintegration of friendships.

Physical proximity is conducive to the growth and maintenance of personal relationships, whereas physical distance leads to their dissolution. In part, this is because proximity decreases the behavioral costs of communication between people and hence increases its frequency, while distance increases the costs and decreases the frequency. Proximity not only increases the frequency of communication, but also shifts the types of interactions between individuals. For instance, even if distant friends communicate frequently by phone and e-mail, the

distance itself make it difficult for them to spend leisure time together, to share common activities, to be physically intimate, or to exchange certain types of social support.

When people move apart, two factors contribute to the decline of the original relationships. First, it becomes difficult to communicate with the people in the original location. Second, building relationships in the new location consumes some of the time and attention the person would need to maintain the old relationships. As a result, friendships change after a move: one may drop a friend altogether or shift that person from the active list to the list of those whom one sends holiday greetings.

Communication technology and social relationships

Telecommunications technologies—literally communications at a distance—can change the amount and type of communication between people who are located remotely from each other, and thus can allow them to maintain friendships at a distance. If friendships are enacted and maintained through communication, as Duck proposed, then friendships among those who live far from each other are less likely to decline the more they communicate. This hypothesis—that communication regardless of the modality leads to the maintenance of friendships at a distance— is over simplistic, and needs elaboration. In the section below we

discuss the evidence for how telecommunications affects friendship and features of the relationships and the technology that moderate the link between communication and friendship.

Differences among communication modalities. Phone, e-mail, and IM are the three main telecommunication technologies used by American consumers. In 1876 the phone was invented, and in 1915 the first U.S. transcontinental phone call was placed. According to AT&T, in 1945, a 10 minute evening phone call between New York and Los Angeles cost $56.80 in 1995 dollars. By 1995, the cost of this same call dropped to $1.50. At such a price, pre-World War II conversations required good reasons to call. With today's pricing, however, people call anytime, just to talk. This drop in costs influences the extent to which friendships can be sustained at a distance (Fischer, 1992). The first e-mail message was sent in 1971 (Leiner et al., 2002) and the first of the IM programs, ICQ (I seek you), was released in 1996 by Mirabilis (*History of IM*).

Scholars have argued that these media are not equally useful for building and maintaining social relationships. In this section, we briefly review the empirical evidence that suggests that these technologies differ in their usefulness for starting and maintaining social relationship. We also identify three reasons why they differ: (1) intrinsic properties of the media that influence both social presence and how much information is exchanged during a communication session, (2) cost structures that change how frequently people communicate over them, and (3)

features of the technologies and communication genres associated with them that change the content of the communication.

A growing empirical literature examines the hypothesis that communication modalities differ in their ability to support social relationships. Most of this research compares text-based, computer-mediated communication with face-to-face communication (e.g., Walther, 1995), although sometimes comparisons are made to the phone as well. Cross-sectional research by Parks and Roberts (1998) and by Cummings, Butler and Kraut (2002) have suggested that ties created or primarily maintained online are of lower quality than those sustained through other means. For example, Parks and Roberts (1998) surveyed respondents in an electronic group about their relationships with another member of the group, as well as with a matched person in their social network outside of the electronic group. The authors found that respondents spent less time, were less interdependent with, and were less committed to their on-line partner compared to the off-line one. Cummings, Butler, and Kraut (2002) reported similar results. They asked respondents to indicate how close they felt toward two different people outside of the household. The first was the individual with whom they communicated most often by e-mail, and the second was the person with whom they reported communicating most using other modalities, including personal visits and the phone. Respondents reported feeling significantly less close to the e-mail partner.

In contrast to these survey studies, experimental studies suggest that social relationships through computer-mediated communication can be as strong as those that develop face-to-face, if participants are allowed to communicate for enough time (Walther, 2002). McKenna (this volume) reports research showing that cross-sex undergraduate pairs who met each another for the first time in an Internet chat room tended to like one another more compared to those who met face-to-face.

As these conflicting results demonstrate, social relationships that are maintained using different communication media do not necessarily grow at the same rate or to the same depth. Research currently presents no clear consensus about whether one communication modality is better than another for the maintenance of social relationships. The reason for these conflicting results may be that the communication media themselves may inconsistently influence fundamental communication variables; these variables may then mediate their influence on the social relationships. In particular, the communication media may influence both the frequency of communication sessions and the quality of communication during a communication session.

Cost structures and the frequency of communication. Different communication modalities impose both financial and behavioral costs, which are likely to affect how frequently people use one or the other modality to communicate. For example, telecommunication providers typically charge for each long distance

phone call based on distance and duration, while Internet service providers' rates

for e-mail or instant message sessions are independent of distance and duration.

Previous research has shown that communication volume is highly sensitive to

these costs, and that people communicate substantially more when these costs are

reduced (e.g., see Mayer, 1977, Figure 7). The medium's design affects the

behavioral cost of communication as well; for example, phones require

communicators to be simultaneously available before they can converse. To

overcome these limitations, people play "phone tag," use answering machines to

convert synchronous to asynchronous communication, or they may restrict their

calling to known times of availability (Lacohee & Anderson, 2001). In contrast, e-

mail is asynchronous and does not require simultaneous availability. Yet another

medium, IM, requires simultaneous availability. Many IM applications (IM)

provide awareness services, which inform users when a potential partner is online

and available. In contrast to phone calls, however, the awareness services in IM

software help to synchronize the simultaneous availability of partners, and are

therefore likely to increase the frequency of communication.

Quality of communication. Communication media differ on the amount of

information they transmit and their interactivity, among other features (Clark &

Brennan, 1991). These features have implications for relationships that are

maintained using these media (Sproull, 1991). Social presence theory suggests

that media differ on the social presence that they afford; for example, face-to-face

communication provides more social presence than the phone, which in turn

provides more than text-based communication. The thesis is that media with more social presence should be better at supporting social relationships (Short, 1976). Although many scholars contrast computer-mediated communication to face-to-face communication without differentiating among the varieties of text-based communication, the degree of interactivity is likely to be especially important both for language understanding in general (Clark & Brennan, 1991) and for companionship (Rafaeli & Sudweeks, 1997). In contrast to the relatively contemplative style of composing and reading e-mail messages, the conversational style of an IM session makes the event more engaging and analogous to "being with" a communication partner; i.e., IM offers more social presence than e-mail. This interactivity encourages users to tailor messages to particular recipients (Kraut, Lewis, & Swezey, 1982) and to use an informal of communication style, making it easier for communicators to quickly repair mistakes.

Media richness theory suggests that media can be differentiated on the number of social cues that they convey, and their level of interactivity (Daft, 1984; Dennis & Kinney, 1998). IM is richer than e-mail because it is more interactive. Among the interactive media, face-to-face communication is richer than the phone, which in turn is richer than IM, because both face-to-face and phone communications offer more affective and interpretive cues such as tone of voice. These richer media are better at reducing 'uncertainty' and 'equivocality' than leaner media such as IM and e-mail; hence richer media are better suited to maintain relationships. Walther

(Walther & Parks, 2002) argues that because writing is slower than talking, less information per unit time is conveyed in computer-mediated communication than in face-to-face and phone conversations. As a result, people need more time to develop relationships conducted over the Internet, although he argues that given enough time, people can develop and maintain strong social relationships online.

In contrast to research suggesting that more social cues, social presence, and interactivity are better for supporting social relationships, other researchers have identified conditions under which fewer social cues, reduced social presence, and less interactivity may be better. For example, Postmes and his colleague (Postmes, Spears, & Lea, 1998, 2000) propose that the individuating information available in rich communication media interferes with identification with a group as a source of social influence. McKenna and colleagues (this volume) argue that the lack of social presence and superficial social cues that are available in text-based, computer-mediated communication allows individuals a better opportunity to display and learn about each others' true selves, and may be especially useful for introverts or socially awkward individuals to slowly form social relationships, without the pressures of face-to-face meetings.

Method

Overview

To examine the role of communication technologies in sustaining friendships, we tracked high school students as they moved to college, a situation that places

existing social relationships at risk. As they move from high school to college, students go from a secure world populated with high school friends who often attend the same school and lived in the same town, to a world where these relationships disperse as both the student and friends relocate. Relationships that were once supported by geographic proximity are threatened. On the other hand, new relationships form at the beginning of college, which are supported by physical proximity; these new relationships may squeeze out the old ones. By following the course of old high school and new college friendships, we evaluate how communication in general, and different media in particular, facilitate the development and maintenance of relationships.

This study had two samples, representing two different high school graduation years. In both samples, we asked respondents at the end of high school to identify up to 20 friends and acquaintances from high school; at end of their first semester in college, those same respondents again identified up to 20 friendships that they formed in college. Out of these, in the first group, we sampled 4 high school friends and 4 college friends in the first sample; in the second group we sampled 3 high school friends and 3 college friends. Respondents reported on the frequency of their communication with each relationship partner in-person as well as by phone, e-mail, and IM, and their psychological closeness to that partner. We followed these relationships for up to three years. We use hierarchical linear growth models to examine the influence of time and communication frequency on changes in psychological closeness.

Sampling respondents

We collected data from two samples of high school students. Sample 1 included 500 high school students who were admitted to Carnegie Mellon University (Pittsburgh, PA) in the Spring of 2000, stratified by distance from home: 100 were students randomly selected within 15 miles of Pittsburgh, 100 were foreign residents, and 300 were students randomly selected by U.S. zip code. Sample 2 included 500 high school students who were admitted to Carnegie Mellon in the Spring of 2001, also stratified by distance from home: 100 students randomly selected within 15 miles of Pittsburgh, 100 students randomly selected between 100-200 miles from Pittsburgh, 100 students randomly selected between 400-800 miles from Pittsburgh, 100 students randomly selected between 1700-5000 miles from Pittsburgh, and 100 randomly selected international students. Participants were sent a $2 bill before each survey was administered, and were entered into a lottery for prizes after they completed the survey.

In each sample, survey data were collected during the spring of the students' senior year in high school (June), at the end of their first freshman semester in college (December), at the end of their freshman year (May), at the end of their sophomore year (May), and for sample 1, the end of their Junior year (May). Of the 1000 students initially invited to participate, 62.9% completed the first survey, 48.2% completed the second survey, 39.6% completed the third survey, 31.3%

completed the fourth survey, and 22.8% completed the fifth survey (sample 1 only).

Sampling relationships

We used name generators to sample the respondents' high school and college relationships. The purpose of the name generators was to elicit a wide variety of social ties, from which we randomly selected individual relationships to follow. We used this procedure rather than allowing respondents to nominate relationships on their own, because the self-nomination would have restricted variance on the outcomes of interest (i.e., psychological closeness). People tend to select individuals who are emotionally close and currently provide support in their lives (Burt, 1986). This selection on the dependent variable would either have lead to regression towards the mean or made differences in changes in closeness difficult to observe.

The name generators were phrased, "Think about relationships with specific people in your (high school | college) social circle…(a) who provide you with practical assistance, (b) with whom you discuss hobbies, sports, movies, and other spare-time activities, (c) with whom you socialize, (d) who give you advice about important issues, and (e) who are in the same organizations as you." For each of the 5 types of relationships, respondents entered up to 4 names along with the gender and age of the tie.

Respondents used a web-based survey to complete the name generators; the software then randomly selected a subset of the relationships that students identified, stratified by gender. In Sample 1 were 4 high school relationships (two males and two females) and 4 college relationships (two males and two females). Sample 2 included 3 high school relationships (at least one male and at least one female) and 3 college relationships (at least one male and at least one female). We wanted to balance the gender of partners in order to broaden the kinds of relationships studied, and again, to create variance on the outcome measures since people, in general, feel closer to women than to men (e.g., Duck, Rutt, Hurst, & Strejc, 1991; Wheeler & Nezlek, 1977). For the high school and college relationships, respondents were asked whether each tie was a relative, romantic partner, acquaintance, friend, close friend, or other. In the analyses reported below, only acquaintances, friends, and close friends are included as "friends" to avoid idiosyncrasies associated with relatives and romantic partner.

Measures

Psychological closeness. Though both samples used the same questions, response options in Sample 1 during the first three time periods are slightly different than those used in Sample 2 and the final two time periods in Sample 1. Closeness was measured on a 5-pt scale with the question "How close do you feel to…". In the first sample (during Spring 2000, Fall 2000, and Spring 2001), the response options only included (1) not very and (5) very, while in the second sample (and during Spring 2002 and Spring 2003 in the first sample) the response options

included (1) Not at all, (2) Not too much, (3) Neutral, (4) Somewhat, and (5) Very.

Time. The purpose of this paper is to examine how the relationship between respondents and their partners change over time. We code time in months as the interval between questionnaires: six months between the first three questionnaires and 12 months thereafter. Time is 0 when a partner first appears in the data set, i.e., at the initial questionnaire for high school friends and at the second questionnaire for college friends.

Communication frequency. For each time period, respondents reported the frequency with which they communicated with each partner (a) in-person, (b) by phone, (c) by e-mail, and (d) by IM. They answered on 7-point Likert scales, ranging from never to multiple times per day. For ease of interpretation, we transformed the Likert scales to days per months of communication[1]. Overall communication was the sum of communication across the four modalities. Since our goal is to predict changes in psychological closeness among respondents and their partners based on communication frequency, we use lagged communication frequency to reduce ambiguity in making causal claims. That is, in the analyses below, communication in the preceding time period predicts communication at the subsequent time period, and changes in psychological closeness between the two periods.

Analysis

In order to examine how communication using different technologies influences

changes in social relationships, we used hierarchical linear growth modeling, also

known as multi-level modeling (Bryk & Raudenbush, 1992; Singer & Willett,

2003). Multi-level modeling takes into account the non-independence of the data,

with each respondent describing multiple partners during multiple questionnaire

administrations. For the data described above, a 3-level model is required. In this

model, level 1 represents the respondent (e.g., the respondent's sex, age, and

race), level 2 represents the relationship (e.g., partner's sex and age,

communication frequency, and closeness with that partner), and level 3 represents

time (e.g., repeated observations).

In these analyses, the coefficients for time-invariant level 1 variables (e.g.,

respondents' gender, age at the first time period, and race) and time-invariant

level 2 variables (e.g., partner's gender and age at the first time period) represent

cross-sectional associations. The coefficients indicate whether, for example,

women report closer relationships with their partners on average than men, or

whether respondents report closer relationships on average with women partners

than males. The coefficients for time-varying level 2 variables (e.g., prior

frequency of communication with a partner) test whether communication predicts

subsequent psychological closeness. We can do this because, as shown below,

both the communication variables and the closeness variable are moderately

stable over time. The association of communication frequency with subsequent

closeness primarily represents the cross-sectional association of communication and closeness.

The main effects and interactions with time represent the variables that predict change in psychological closeness. The coefficient for the main effect of time indicates the degree to which a participant's closeness with a particular partner changes over twelve months. A negative coefficient indicates a decline in psychological closeness. The time X communication interactions indicate how frequency of communication moderates the effects of time on changes in the relationship. A positive coefficient for the interaction of time with communication indicates that partners who communicate more have a slower decline in closeness. We test the effects of communication frequency both for overall communication and for the four modes of communication.

<div align="center">Results</div>

Preliminary statistics. Combined descriptive statistics for respondents from Sample 1 and Sample 2 are shown in Table 1. Approximately 51% of the respondents were males; 30% were Caucasian, 30% were Asian, and they were 18 years old at the time of the first questionnaire. Of the friends and acquaintances they described, 65% were from the high school years and 35% were added during the first semester in college. All matched the respondents in gender and age.

At the time of the initial questionnaire, when friends and acquaintances were initially described, respondents were communicating with them approximately 60 times per month or roughly twice a day. Participants communicated most with those they felt closest to. The contemporaneous Pearson correlation between overall communication with a partner and closeness to that partner, measured on the same questionnaire was .41, p < .001.

[Insert Table 1 about here]

About half of this communication was conducted in-person (28 times per month), with phone (15 times per month) and IM (15 times per month) occurring more frequently than e-mail communication (9 episodes per month). Surprisingly, face-to-face communication predicted closeness less well than phone, e-mail, or IM communication: the contemporaneous correlation between closeness and communication frequency was .10 for in-person communication, .41 for phone communication, .35 for electronic mail, and .39 for IM. Presumably, this is because phone, e-mail, and IM communication is primarily volitional (i.e., at least one party intended the communication to occur), while in-person communication is to a degree involuntary. Whether they wanted to or not, participants talked to each other when they were in the same place (possibly to avoid being perceived as rude).

All communication dropped over time, with the largest declines for face-to-face communication. This supports our hypothesis that geographic distance affects the patterns of communication in relationships (see Figure 1).

[Insert Figure 1 about here]

Table 1 also shows the inter-temporal stability of the time-varying measures: communication frequency and psychological closeness. These were computed by taking the Pearson correlation between the same variable measured on adjacent questionnaires. The inter-temporal stability is moderate. Correlations for the communication measures range from .44 to .49. Since the response rate to the questionnaires dropped over time, this stability measure is most heavily influenced by questionnaires early in the study. Because one might expect most change in communication and relationships to occur during this period, this was also the period that we sampled at 6-month intervals rather than yearly intervals.

The closeness that respondents expressed towards their partners also declined across time (see Figure 2). Table 2 shows moderate stability in the measure of psychological closeness, with the test/retest correlations being .65.

[Insert Figure 2 and Table 2 about here]

Predicting psychological closeness. Table 2 describes hierarchical linear growth models, predicting psychological closeness with a partner from respondent characteristics, partner characteristics, time, and overall communication frequency. In these models, we standardized the psychological closeness variable, with a mean of zero and a standard deviation of one. Thus we interpret the coefficients as the extent to which a unit increase in an independent variable is associated with psychological closeness, as measured in standard deviation units.

Model 1 examines the associations of psychological closeness with stable characteristics of respondents and partners, and time. Older respondents reported feeling less close to their partners than younger respondents felt to their partners (and older respondents felt less close to older partners). In addition, respondents reported feeling moderately closer to their high school friends than the ones they met in college (by .3 standard deviation units). The highly reliable negative coefficient for time confirms the pattern seen in Figure 2; respondents' closeness to their partners declines with time. On average, closeness to these friends and acquaintances declines a fifth of a standard deviation per year. The non-significant coefficient for the Time X Partner that was added in college indicates that closeness diminishes approximately equally with time both for high school and college friends, even though participants felt moderately closer to their high school than college friends.

Model 2 in Table 2 adds the overall frequency of communication to the model.

The coefficient for lagged communication indicates that respondents felt closer to

partners with whom they had more communication in the previous time period.

Because communication frequency is measured on a log scale, the coefficient

means that respondents report feeling approximately 7% of a standard deviation

unit closer to partners with whom they communicate twice as frequently. The

positive Time X communication frequency interaction indicates that the decline in

psychological closeness is less for partners with whom respondents communicate

with more. Doubling communication with a partner reduces the decline in

closeness to that person by about 13% (ratio of the coefficients .026/.206).

[Insert Table 3 about here]

To predict psychological closeness, Table 3 decomposes the overall frequency of

communication into the modalities through which it occurs. We use the same

analysis framework as in Table 2 (Model 2), except that we include the

communication frequency for the four communication modalities in place of

overall communication frequency. The coefficients for the main effects of the

communication are in Table 3, Model 3; all are positive and significantly greater

than zero. This pattern indicates that respondents feel closer to friends with whom

they communicate using each of the four modalities. Differences in the size of the

coefficients are instructive. The coefficient for phone communication is twice is

high as the coefficients for e-mail and IM, the two computer-mediated

communication modalities. These results suggest that respondents are more likely to talk by phone to those with whom they feel closer, than to communicate to those same partners with either e-mail or IM. The two computer-mediated communication coefficients in turn are twice as high as that for in-person communication, again reflecting the frequent non-volitional nature of in-person communication.

Model 4 in Table 3 adds the Time X Communication interactions to examine the association of communication with changes in closeness. The positive coefficients for both e-mail and IM suggest that communication using these modalities reduces the decline in closeness. Doubling e-mail communication with a partner is associated with a 34% reduction in the decline in closeness with that partner (.036/.104). Similarly, doubling IM communication with a partner is associated with an 18% reduction in the decline in closeness with that partner (.020/.104).

Predicting communication. The longitudinal results in Tables 2 and 3 are consistent with the claim that communication prevents declines in psychological closeness. However, to examine the causal direction in more detail, we conducted supplementary analyses predicting changes in communication from closeness. Table 4 presents results from hierarchical linear growth models that predict frequency of communication (in the log scale) based on time, psychological closeness at the prior time period, and their interactions. Stable characteristics of the respondents and their partners were included as control variables. Overall,

during their college years, respondents communicated 175% more with partners whom they added during college than with their high school friends. This difference depended on the media that respondents selected. The gap was largest for in-person communication and phone communication than for e-mail and IM.

[Insert Table 4 about here]

Consistent with Figure 2, the analyses show that overall communication drops with time by about 43%, and that this effect is larger for in-person than for other types of communication. Consistent with the correlations between closeness and communication frequency that were reported previously, the multivariate analyses show that students communicate more across all modalities with partners with whom they felt closer in the previous time period.

The interactions between time and psychological closeness are the most interesting results to assess the direction of the causal link between communication and closeness. The non-significant interaction between time and psychological closeness for overall communication suggests that respondents' preexisting closeness with a partner does not mitigate the drop in communication. The time and psychological closeness interactions were non-significant for both e-mail and IM, again suggesting that respondents' preexisting closeness with a partner does not mitigate the drop in computer-mediated communication. The positive time and psychological closeness interaction for in-person communication suggests that prior closeness mitigates the drop in face-to-face

communication. We speculate that this result occurs because students make an effort to see only their closest friends when they return from school for breaks or summer vacation. In contrast, the negative interaction for phone communication suggests that the drop in calls is especially steep for partners with whom the respondent had previously felt very close. We speculate that financial costs force students to refrain from calling once-close friends; people whom they called frequently when they lived in the same town and attended the same school.

Discussion

Our findings indicate that when students move from home to college, they reduce both their communication with their high school friends and their closeness, that sense of psychological connection. This same effect occurs with new friends that students make during their first semester in college as they get further into their college career. The purpose of this paper was to see how these factors were causally related, and to assess whether modern telecommunication technologies change the risk to relationships that distance and time can introduce.

To summarize the main results, longitudinal analyses show that although psychological closeness to high school and college friends declines with time, this decline is less steep among pairs who communicate more. This pattern is consistent with Duck's hypothesis (1998) that communication can mitigate the centripetal forces causing social relationships to split apart. Surprisingly, when we looked at the influence of different communication modalities, communication by

e-mail and IM seem to retard the drop in closeness, but communication in-person and by phone do not. This pattern of interactions occurs even though phone communication is the technology that best predicts psychological closeness at any given time.

Why do computer-mediated communications seem to guard against the disruption of social relationships more than in-person and phone communication for these students? This finding is inconsistent with some of the literature reviewed in the introduction which focused on the media's respective intrinsic properties. Both its media richness and social presence suggest that communicating by phone would be most useful for guarding against threats to relationships.

Why does closeness drop least among partners who regularly use e-mail and IM? One possibility is that frequency of communication for computer-mediated media is less affected by distance than communication by phone. The technological advantages of computer-mediated communications are irrelevant in mitigating distance as a factor; rather, this advantage is simply the result of government regulations and corporate marketing decisions. Unlike traditional long distance phone providers, Internet service providers do not charge more to send data packets across town or across the country. Moreover, pricing schemes used by long distance carriers are not fixed. This may change, however, if Internet phone technologies become more popular since the Internet is regulated less by the

Federal Communications Commission and state agencies than are conventional phone services (E.g., Federal Communications Commission, 2003).

One strength of our research is the use of longitudinal data, which enabled us to follow relationships over time. As a result, we were not constrained by the ambiguities inherent in cross-sectional analyses of how strong ties were at a single point in time. For example, the cross-sectional results suggest that communication by phone is the strongest predictor of psychological closeness with a communication partner. This result is consistent with predictions from media richness and social presence theories; i.e., that richer and more interactive media will better support social relationships. However, the cross-sectional results are also consistent with an alternative explanation: students primarily call people with whom they feel close, while they are more careless with their computer-mediated communication. The longitudinal results tell a different story. They show that communication over a computer is associated with less erosion in social relationships, while communication by phone is not. Our conclusion from this pattern of results is that communication frequency, not communication quality, is the important element that sustains relationships; we also conclude that for economic reasons, the frequency of communication by phone is especially sensitive to distance, while communication by computer is not.

One weakness in this research is the lack of an identifiable mechanism for why different communication technologies had varied effects on relationship

maintenance. It is likely that norms of communication technology use contribute to how a change in that communication will influence the relationship. For example, the norm among some high school students is to congregate on IM at specified times in the evening to "hang out" with friends, whereas college students tend to make themselves available whenever their computers are connected to a network. These norms of availability can shape how just one computer-mediated communication, IM, influences relationship maintenance. Future research would benefit from measuring communication norms. Students may believe that regular use of a particular media, regardless of content, can sustain a relationship at the desired level of closeness and support.

Equally important, the communication content that is exchanged over different media will undoubted influence how a communication change influences relationships. As Lacohee and Anderson (2001) note, phone conversations are often used to exchange social support, especially among women (see also Boneva & Kraut, 2003). In contrast, as Boneva and colleagues (this volume) note, much of IM communication is used for exchanging chitchat, and social support is rare.

An obvious issue raised by the discussion of maintaining personal relationships during the transition from high school to college is whether or not there are academic consequences. Are students more likely to stay in college when relationships are maintained successfully? Do students perform better in their courses? Is college more satisfying for them than high school? We do not have

answers to these questions, but would speculate that personal relationships contribute to a positive quality of life for students in college.

Summary. For students who move off to college, the ties with their high school friends and the friends that they make their first semester in college are fragile. On average, these relationships decline with time. Consistent with an enactment model of relationship, however, communicating with these friends prevents the relationships from declining as swiftly as they otherwise would. Communication seems to inject energy into a relationship and prevents it from going dormant. In contrast, simply feeling close to these friends does not prevent the communication from declining.

E-mail and IM seem to be the telecommunication technologies that are especially useful for maintaining friendships among young adults. The utility of these technologies may not stem from their intrinsic features, for example, their interactivity, media richness, the effort needed to type messages, or their ability to convey social presence. Rather, we suspect that arbitrary economic decisions may be more important. Unlike the phone, which costs more when talking longer to someone farther away, pricing for the computer-mediated communication technologies does not depend upon either the length of a message or the distance it must travel.

Chapter 18 Table 1

Variable	Mean	Std	N	Test-retest reliability (Pearson r)
Respondent gender[1] (% male)	51.1	49.5	585	N/A
Respondent age[1]	18.8	.79	585	N/A
Respondent race[1] (% white)	53.8	50.0	585	N/A
Respondent race[1] (% Asian)	31.4	45.3	585	N/A
Partner age[2]	19.2	14.5	2533	N/A
Partner gender[2] (% male)	51.2	42.9	2533	N/A
Added friend in college[2] (%)	35.2	47.9	2533	N/A
Frequency of communication overall[2,3]	60.7	47.3	2526	.49
Frequency of communication in-person[2,3]	28.1	21.6	2526	.47
Frequency of communication by phone[2,3]	15.2	19.1	2526	.46
Frequency of communication by e-mail[2,3]	9.1	14.8	2526	.46
Frequency of communication by IM [2,3]	15.4	21.0	2526	.44
Psychological closeness[2]	3.99	1.00	2526	.65

[1] Measured at the initial questionnaire

[2] Measured when a partner first enters the dataset (questionnaire 1 for high school

partners and questionnaire 2 for college partners)

[3] Communication episodes per month

[4] For time-varying variables, communication and closeness

Chapter 18 Table 2

Effect	Model 1				Model 2			
	Estimate	**Stderr**	**DF**	**Pr > |t|**	**Estimate**	**Stderr**	**DF**	**Pr > |t|**
Intercept	-.058	.099	435		-.506	.120	435	***
Respondent gender (0=female; 1=male)	-.050	.061	435		-.061	.059	435	
Respondent age	-.070	.032	435	*	-.072	.031	435	*
Respondent white	.057	.091	435		.049	.088	435	
Respondent Asian	.129	.097	435		.101	.094	435	
Partner added in college (0=no; 1=year)	-.365	.067	2672	***	-.354	.065	2662	***
Partner gender (0=female; 1=male)	-.058	.042	2672		-.040	.040	2662	
Partner & respondent are same gender	.416	.084	2672	***	.424	.080	2662	***
Partner age	-.008	.004	2672	t	-.004	.004	2662	
Time (years since partner entered analysis)	-.223	.025	2672	***	-.205	.056	2662	***
Time X Partner added in college	.056	.056	2672		.046	.056	2662	
Overall communication frequency, previous period (log)					.079	.015	2662	***
Time X Communication frequency (lagged)					.027	.013	2662	*

Chapter 18 Table 3

| Effect	Model 1				Model 2			
	Estimate	**Stderr**	**DF**	**Pr > |t|**	**Estimate**	**Stderr**	**DF**	**Pr >**
Intercept	-.465	.106	420	***	-.448	.109	420	***
Respondent gender (% male)	-.030	.063	420		-.029	.063	420	
Respondent age	-.080	.033	420	*	-.080	.033	420	*
Respondent white	.078	.094	420		.075	.094	420	
Respondent Asian	.104	.101	420		.105	.101	420	
Partner added in college (0=no; 1=year)	-.446	.081	2109	***	-.475	.085	2105	***
Partner gender (0=female; 1=male)	-.028	.041	2109		-.025	.041	2105	
Partner & respondent are same gender	.443	.083	2109	***	.426	.083	2105	***
Partner age	.000	.004	2109		.000	.004	2105	
Time (years since partner entered analysis)	-.079	.031	2109	*	-.107	.036	2105	**
Time x Partner added in college	.091	.061	2109	t	.134	.067	2105	*
In-person communication frequency (log)	.017	.010	2109	***	.035	.017	2105	*
Phone communication frequency (log)	.074	.010	2109	***	.082	.017	2105	***
E-mail communication frequency (log)	.038	.009	2109	***	.009	.016	2105	
Instant messaging communication frequency (log)	.039	.008	2109	***	.022	.013	2105	t
Time x In-person communication frequency (log)					-.027	.016	2105	
Time x Phone communication frequency (log)					-.010	.018	2105	
Time x E-mail communication frequency (log)					.037	.015	2105	*
Time x Instant messaging communication frequency (log)					.020	.011	2105	t

Chapter 18 Table 4

Effect	Overall Communication (log)			In-person Communicaiton (log)			Phone Communicaiton (log)			Email Communicaiton (log)			Instant Messaging Communicaiton (log)		
	Estimate	Stderr	DF P	Estimate	Stderr	DF P	Estimate	Stderr	DF P	Estimate	Stderr	DF P	Estimate	Stderr	DF P
Intercept	1.705	.246	436 ***	-.349	.248	435	-2.008	.249	436 ***	-.657	.272	436 *	-1.165	.329	435 ***
Respondent gender (% male)	.091	.093	436	.039	.091	435	-.043	.097	436	-.144	.112	436	.291	.128	435 *
Respondent age	.056	.049	436	-.005	.048	435	.092	.051	436 t	.195	.058	436 ***	-.038	.067	435
Respondent white	.276	.140	436 *	.280	.137	435 *	.073	.146	436	.165	.168	436	.446	.192	435 *
Respondent Asian	.034	.149	436	.129	.147	435	-.099	.155	436	-.091	.179	436	.461	.206	435 *
Partner added in college (0=no; 1=year)	1.756	.113	2969 ***	4.361	.124	2714 ***	1.176	.114	2954 ***	.404	.121	2961 ***	.547	.153	2842 ***
Partner gender (0=female; 1=male)	-.037	.064	2969	.070	.067	2714	-.074	.066	2954	-.254	.069	2961 ***	.013	.090	2842
Partner & respondent are same gender	-.109	.129	2969	-.129	.134	2714	-.045	.133	2954	.025	.139	2961	-.180	.181	2842
Partner age	-.021	.007	2969 **	-.002	.007	2714	-.006	.007	2954	-.006	.007	2961	-.060	.009	2842 ***
Time (years since partner entered analysis)	-.616	.127	2969 ***	-.435	.126	2714 ***	.375	.125	2954 **	-.231	.134	2961 t	-.509	.162	2842 **
Time x Partner added in college	-1.115	.090	2969 ***	-2.215	.094	2714 ***	-.778	.090	2954 ***	-.413	.096	2961 ***	-.524	.118	2842 ***
Psychological closeness (lagged)	.466	.050	2969 ***	.188	.051	2714 ***	.666	.050	2954 ***	.469	.053	2961 ***	.574	.066	2842 ***
Time x Psychological closeness	.035	.033	2969	.065	.033	2714 *	-.133	.033	2954 ***	-.044	.035	2961	.002	.043	2842

Chapter 18 Figure 1
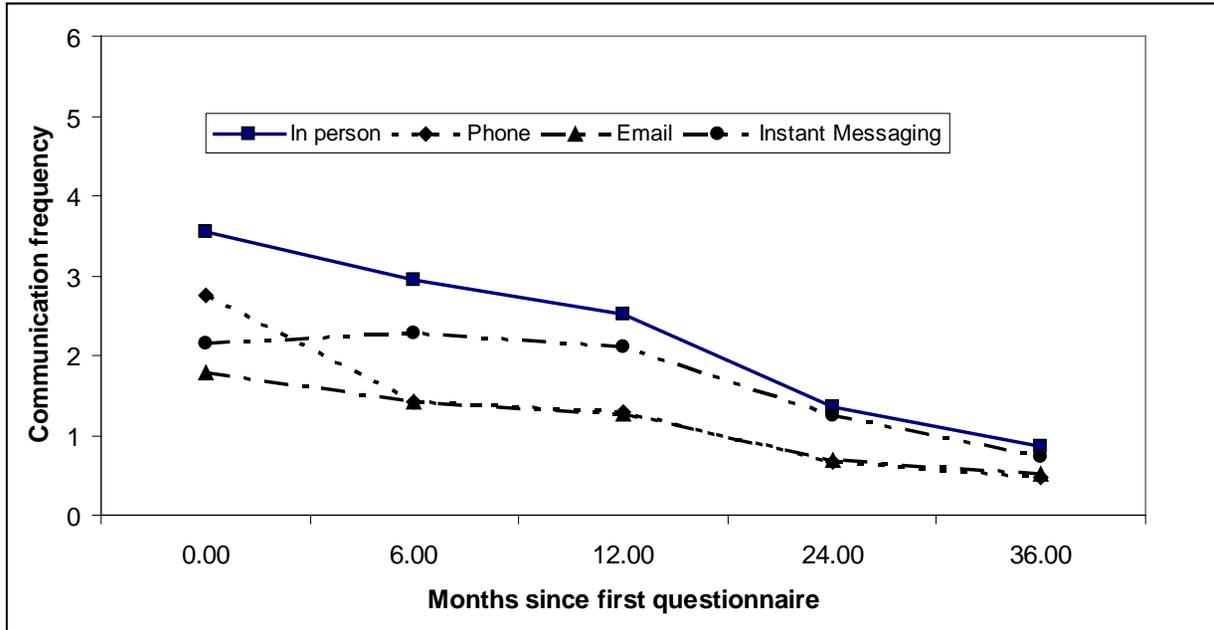
Chapter 18 Figure 2
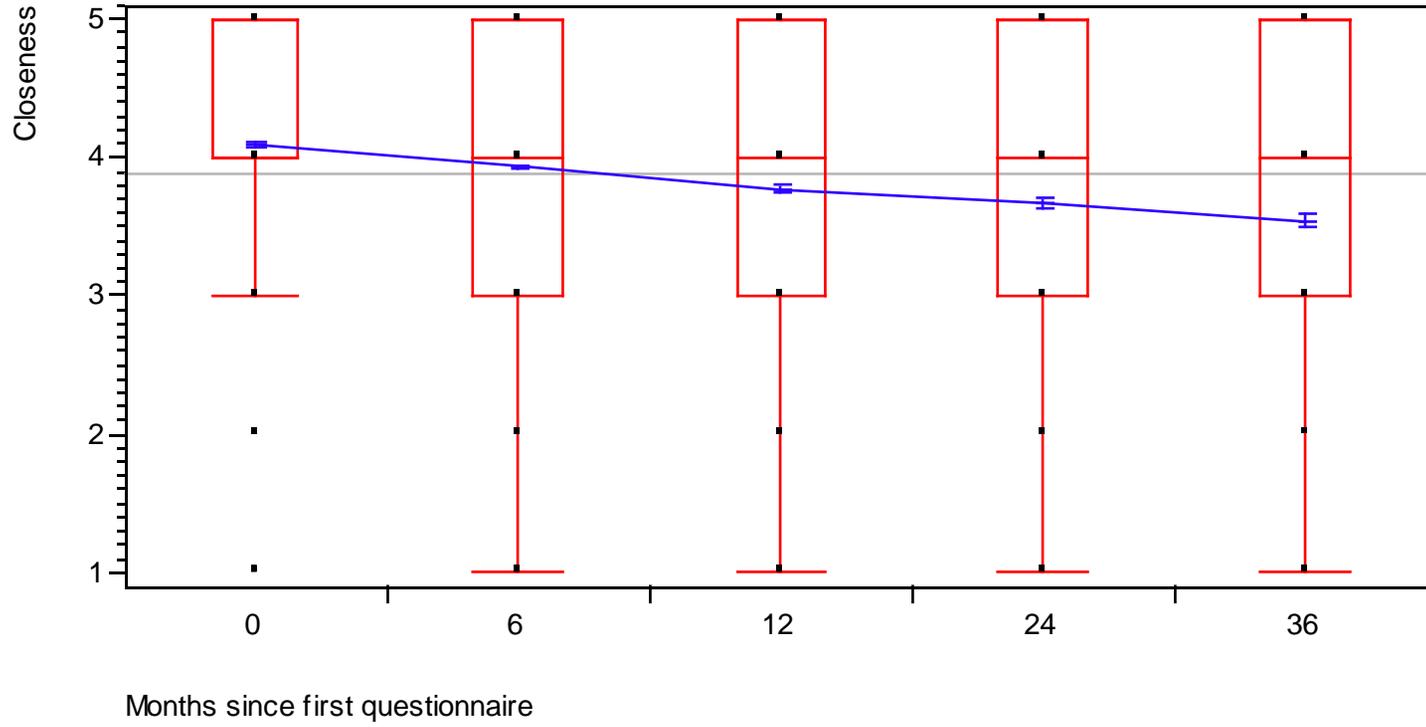
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Endnotes

[1] Response labels changed slightly across questionnaire administrations. In the first two administrations of Sample 1, the responses options were (0) never, (1) less often, (2) monthly, (3) bi-weekly, (4) weekly, (5) daily, (6) many times per day, while in all other administrations they were (0) never, (1) every few months, (2) every few weeks, (3) 1-2 days a week, (4) 3-5 days a week, (5) about once a day, (6) several times a day.

Captions

Chapter 18 Table 1: Variable means at initial time period

Chapter 18 Table 2: Predicting psychological closeness from respondent and partner characteristics, overall communication, and time

Chapter 18 Table 3: Predicting psychological closeness from respondent and partner characteristics, communication over different communication modalities, and time

Chapter 18 Table 4: Predicting communication frequency from respondent and partner characteristics, psychological closeness, and time

Chapter 18 Figure 1: Decline in communication over time by medium

Chapter 18 Figure 2: Decline in psychological closeness over time