

**The Internet and Social Interaction:
A Meta-analysis and Critique of Studies, 1995-2003**

Irina Shklovski, Sara Kiesler, and Robert Kraut

Carnegie Mellon University

Abstract

The Internet is first and foremost a communication technology, with the potential to change peoples' social interaction. This paper reviews 16 surveys that examine how Internet use can affect social interaction. Our meta-analysis shows that people's Internet use is not associated with their social interaction with family members. The evidence on interactions with friends is contradictory. Studies using cross-sectional designs suggest that more Internet use is sometimes associated with less interaction with friends. Studies using longitudinal repeated measures designs, which can reveal changes in interaction over time, suggest that more Internet use leads to a slight increase in interactions with friends. We discuss plausible interpretations of these findings and, more broadly, how the choice of research design changes what we learn about technology and social change.

Internet adoption in homes has grown rapidly since the early 1990s. By 2003, 63% of Americans had used the Internet (Pew Internet & American Life Project, 2003). The Internet has been hailed as a revolutionary social technology, in part because its predominant use has been informal communication (Kraut, Mukhopadhyay, Szczypula, Kiesler, & Scherlis, 1999). Even as new services, such as downloading music and movies become available and easier to accomplish, communication remains the public's principle use of the Internet (Pew Internet and American Life Project, 2002; U. S. Department of Commerce, 2002).

One important implication of the Internet's migration to homes and its predominant use for communication is that it could change people's social interaction with their closest ties. Social interaction with family and friends is one of life's most pleasant experiences (Robinson & Godbey, 1999). It helps fulfill people's need to belong and often leads to feelings of closeness (Baumeister & Leary, 1995), to perceptions of social support (Gottlieb & Green, 1984; Peirce, Frone, Russell, Cooper, & Mudar, 2000), and to increases in the likelihood of receiving social support (Cohen & Wills, 1985; Wellman & Wortley, 1990). Social interaction is also associated with people's commitment to groups, neighborhoods, and organizations (Mirowsky & Ross, 1989; Schachter, 1951), with their sense of meaning in life (Thoits, 1983), and with their adherence to social norms (Srole, 1956).

Some researchers have argued that the Internet improves people's ability to form new close relationships, especially if they are otherwise isolated (McKenna & Bargh, 2000). Early studies suggested the Internet facilitated the development of group ties (Sproull, 1991), information exchange in organizations (Kraut & Attewell, 1997), and the creation of new groups and organizations (Sproull, 1995). Overall, do such changes add up to an increase or reduction in people's social interaction with the most important people in their lives—their family and friends? In this article, we examine what is now known about the effects of using the Internet on people's social interaction with these close ties.

The social impact debate

In 1995, Katz & Aspden conducted the first national survey of the public's use of the Internet. They reported that Internet users had more total contact with family members than non-users, and that they made more new friends, including those they talked with or met on the Internet. The authors concluded that using the Internet augments traditional communication and adds to people's social ties.

About the same time, Kraut, Lundmark, Patterson, Kiesler, Mukopadhyay & Scherlis (1998) launched a longitudinal study of Internet use in Pittsburgh, Pennsylvania. In 1995 and 1996, they recruited 96 families, and provided each family with a computer and dial-up Internet access. The researchers followed these novice Internet users for three years. After 18 months, controlling for initial

levels of the outcome variables, participants who used the Internet more showed declines in face-to-face communication with family, smaller social circles, and higher levels of loneliness, stress, and depressive symptoms. The data, the authors suggested, indicated that Internet use can displace valuable time that people spend with family and friends (Nie, Hillygus, & Erbring, 2002).

The Kraut et al. and Katz & Aspden studies framed a debate about the Internet's social impact that led to subsequent surveys examining how Internet use affects people's self-reported socializing and social involvement with others (Cole & Robinson, 2002; Gershuny, 2002; Jackson et al., (in press); Katz & Rice, 2002; Kestnbaum, Robinson, Neustadtl, & Alvarez, 2002; Kraut et al., 2002; Lee & Zhu, 2002; Lee & Kuo, 2002; Mesch, 2001; Mikami, 2002; Neustadtl & Robinson, 2002; Nie & Hillygus, 2002; Pronovost, 2002; Shklovski, Kraut, & Rainie, (in press)). As these survey studies emerged in the literature, it became apparent that the debate over the Internet's social impact had not been decided. For example, Nie and Hillygus (2002) concluded from a cross-sectional diary survey that Internet use damages social interaction with family members, whereas Kraut et al. (2002) claimed just the reverse, based on a longitudinal study. Our examination of the relationship of Internet use and social interaction represents an attempt to resolve the debate by drawing from the accumulated evidence from 16 surveys completed by 2003. All of these surveys address whether Internet use is associated with more or less social interaction with family or friends.

How the emerging Internet shaped discovery

When Katz and Aspden conducted their national sample survey in 1995 only eight percent of their sample were Internet users. Not surprisingly, these authors asked few detailed questions about Internet use (for example, “Have you heard of the Internet”), and their measure of Internet use was dichotomous: “Do you use the Internet [scored yes or no]?” Few people at the time imagined a time when a national sample survey would show over half of the nation to be Internet users.

Over the next decade, with the spread of the Internet and the huge growth in its services, researchers began to measure differences among Internet users. By the end of the 1990s, almost all researchers were measuring the independent variable “Internet use,” using continuous self report measures of Internet use—the amount of use, in minutes per week (or the amount of use yesterday); the frequency of Internet use per week (or yesterday), the frequency of email use, the frequency of Web and email use, the breadth of use (i.e., number of purposes), or years since respondents first went online.

Authors who studied the impact of these differences in Internet use measured the dependent variable, “social interaction,” by asking people to report on their behaviors such as how frequently they went out with friends. Comparison across studies assumes similarity of the conceptual dependent variable across studies (e.g. Albarracin, Johnson, Fishbein, & Muellerleile, 2001; Lepper, Henderlong, &

Gingras, 1999). The measures of social interaction in our corpus included questions about communication and going out with family and friends (e.g., time with family per week), community involvement and organizational memberships (e.g., attendance at community events), breadth of social networks (e.g., number of acquaintances or friends), and individual psychosocial well-being related to social interaction (e.g. loneliness). These concepts have different empirical and theoretical implications. For instance, perceived social support, which is critical in health and well-being, derives primarily from close ties rather than from involvement in community or acquaintanceships (Bolger, Zuckerman, & Kessler, 2000; Cohen, Underwood, & Gottlieb, 2000; Wellman & Wortley, 1990). Furthermore, some research suggests the presence of social interaction tradeoffs, where weak tie relationships can interfere with strong ties (e.g., Helgeson, Cohen, Schulz, & Yasko, 2000). If true, then we could be obscuring important phenomena if we were to compare studies across very diverse measures of “social interaction.”

The authors of the 16 studies that we reviewed had one common focus that permitted us to go forward with a comparative analysis: all have an interest in how the Internet affects people’s close relationships and all asked respondents about their interpersonal interactions with family and/or friends. Some authors asked respondents about their interactions with family and friends separately, whereas some used aggregated measures, with out differentiating between interaction with friends and interaction with family. Allan argued that interaction

with friends is more sensitive to distance and other factors that influence frequency of communication, compared to interaction with family, which is often more obligatory and less voluntary and opportunistic (Allan, 1979, p. 122-123). Thus one would expect that Internet use might have a larger influence on interaction with friends than with family. Hence our review includes an examination of effects of Internet use on social interaction with family versus friends.

Choices of method

The Internet's potential social impact draws research interest across the social sciences and beyond. Authors of the 16 studies we reviewed work in departments of psychology, sociology, communication, political science, information systems, human-computer interaction, computer science, and journalism. The disciplinary diversity of authors may be in part responsible for the methodological diversity of the 16 survey studies in our dataset. For example, whereas all of the sociologists used national sample surveys (Gershuny, 2002; Kestnbaum et al., 2002; Neustadtl & Robinson, 2002; Pronovost, 2002), two groups of social psychologists drew comparatively small community samples (Jackson et al., (in press); Kraut et al., 1998). In two of the social psychologists' studies (Jackson et al., (in press); Kraut et al., 1998), the researchers provided Internet connections to volunteer households. These samples differed from the national samples in other ways; for example, because the authors were interested in social class effects, they over-sampled Internet users with low household income.

Diversity of method is generally good for research because it improves the reliability of findings. In this area of research, though, diversity makes it difficult to compare results across studies. Authors of half of the studies used single or repeated cross-sectional (correlation) designs; authors of the other half used longitudinal designs with repeated measures within respondents.¹ Although all of these researchers have the purpose of understanding the Internet's social impact, the cross-sectional studies can only show if levels of Internet use were associated with levels of social interaction, whereas the longitudinal studies can show whether levels of Internet use at one time predicted changes in social interaction later.

In view of these differences, our research goal was to compare these studies statistically to reveal evidence on whether people's use of the Internet has an impact on their social interaction with family and friends. Since we claim that study methods can influence results, we coded the studies for methodological attributes. For example, we coded whether the studies used cross-sectional or longitudinal methods, and for the type of social interaction they examined. We examine how these factors affect survey results.

Meta-Analysis

Study retrieval

The main criterion to include a particular study was whether it examined Internet use and interactions with respondents' close ties. We located relevant studies by searching computerized reference databases including PsychInfo, FirstSearch, ArticleFirst, and CiteSeer, by examining reference lists of studies on the effects of Internet use on social involvement, social relationships, socializing, etc., and through personal contacts. To be included in the analysis, the researchers had to have selected participants from a real-world community or from a population that included both Internet users and non-users. Some of these studies examine people's close relationships with family members as compared with their relationships with friends. Others do not differentiate between the two. We did not include laboratory experiments, because they typically examine the impact of very short term Internet use on interaction, generally with strangers. Nor do we include surveys that solicited participants exclusively online because these studies lacked base rate and comparison data with nonusers, and were highly susceptible to self-selection bias. Table 1 provides descriptive information on the 16 surveys in our analysis.

[Insert Table 1 about here]

Variables and coding

We examined relationships reported between measures of Internet use (the independent variable) and social interaction with close ties (the dependent variable). Many authors measure more than one type of social interaction. We treat each finding as a separate result. We include any measure of interaction with

family, friends, or both, even if the question asks about a particular activity, such as “going out” or “socializing” with these people.

Based on our claims about how differences in measurement and study design can affect findings, we created the following moderator variables.

Type of relationship. Twelve studies include measures of interaction (time or frequency) with friends; 11 studies include measures of interaction (time or frequency) with family or household members; 10 others ask about interaction with “family and friends” or do not explicitly specify the type of relationship. Because family relationships and friendships may differentially be sensitive to Internet use, we created dummy variables to represent whether the measure of interaction asked about family (or household), about friends, or unspecified (which includes questions asking about “friends or family,” and “friends and family.”) These dummy variables are moderator variables in our analysis.

Study design. In the cross-sectional studies, researchers customarily attempt to statistically control for pre-existing differences among respondents through regression techniques. However, with or without controls, these studies do not permit causal conclusions. The longitudinal studies offer more convincing, though still imperfect, ground for causal claims. We expect that if Internet use has an impact on interpersonal relationships, longitudinal studies would produce smaller

but more consistent, homogeneous effect sizes. Study design was a moderator variable in our analysis.

Other potential moderator variables. Internet use was the independent variable in all of these survey studies. Based on the literature on survey methods, we coded for differences in how authors measured Internet use, and conducted preliminary analyses to examine whether these differences may have affected the results of the studies. For example, Catania et al. (1990) show that asking people direct questions about socially desirable or undesirable behavior can bias their responses in the socially desirable direction. This work is relevant because Internet use is generally a socially desirable behavior (e.g., Kraut, Scherlis, Mukhopadhyay, Manning, & Kiesler, 1996). In two studies, authors collected unobtrusive automated logs of Internet use, as well as self-report measures (Jackson et al., in press; Kraut et al., 1998); in all of the other studies, authors collected only self-report measures of Internet use. Automated measurements of Internet use correlate fairly well with the self report measures and do not show differential effects on dependent variables. Also whether authors used discrete (use vs. nonuse) or continuous measures of Internet use did not affect the results. Based on these preliminary analyses, we exclude from the final analysis moderator variables reflecting coded measurement differences that did not affect the results.

Preliminary examination of the effects of year of study was also not significant in any of the analyses and failed to illustrate a significant change in the impact of

Internet use on social interaction over time. We omit year from all subsequent analyses.

Computation of effect sizes

Each suitable study in the sample contributes at least one effect size for the meta-analysis. Each effect size represents a value that quantifies the statistical relationship between Internet use and interpersonal interaction. There are several possible measures of effect size (Rosenthal, 1994). We select the Pearson product-moment correlation coefficient, r , because it best describes the relationship of interest and is understandable by most social scientists. In most cases, r is not reported directly within a study, but it can be obtained either from available raw data or by transforming other reported statistics (e.g., t , eta) that test for a relationship between Internet use and interpersonal interaction. We use formulas recommended by Rosenthal (1994, p.236-240) to conduct the necessary transformations. In some cases, studies do not provide enough information to calculate appropriate effect sizes. In those cases, we omitted the studies from the analysis². From the 16 studies in the analysis, we were able to obtain 48 effect sizes. Prior to analysis, we transformed all effect sizes using the Fisher's Z transformation suggested by Rosenthal & Rosnow (1991, p. 491-501). Table 1 reports the transformed effect sizes.

Once the dataset was obtained and the effect sizes properly transformed, we performed a sensitivity analysis (Greenhouse & Iyengar, 1994) to identify the proper method of analysis and to identify outliers in the data. Because many of the studies provide more than one test of relationship between Internet use and interpersonal interaction, we used a hierarchical linear regression (Bryk & Raudenbush, 1992) as the method to control for non-independence of effect sizes (i.e., multiple effect sizes could be nested within a single study). This method is similar to a regression model for stochastically dependent effect sizes suggested by Gleser & Olkin (1994). Because the use of hierarchical linear models is not well documented in the methodological literature of meta analysis, we also conducted our meta-analysis using a combination of the more commonly used fixed-effects procedure, following the weighted-variance method in Shadish and Haddock (1994).

In our model, we use the transformed effect sizes as the dependent variable, and various combinations of predictor variables as independent variables. Each transformed effect size is weighted by an inverse of its variance (as suggested in Rosenthal & Rosnow, 1991, and Shaddish & Haddock, 1994). Studies with larger sample sizes, therefore, contribute more weight to the analysis than those with a small sample size, because the large sample sizes provide effect size estimates that are closer to the true effect size of the population.

Results

The 16 studies included a total of 35,578 participants and yielded 48 effect sizes. Preliminary analysis showed a mean weighted effect size of $r = -.02$ with a 95% confidence interval of $-.03$ to $-.01$, indicating that overall, there is a slightly negative association of Internet use with social interaction. Figure 1a shows the histograms for the weighted effect sizes. This histogram clearly shows several outliers. These outliers are effect sizes from one large-sample study (Nie & Hillygus, 2002). Sensitivity analysis (Greenhouse & Iyengar, 1994) was performed to identify severe outliers and to examine them separately. Figure 1b shows normally distributed histograms for weighted effect sizes with the single outlier study removed (3 effect sizes). The mean effect size with outliers removed was $.01$ with a 95% confidence interval of $.00$ to $.02$, suggesting no observed association of Internet use and social interaction.

[Insert figure 1a and 1b about here]

The study with outliers had some unique methodological characteristics. The data collection method used was an augmented diary study, in which respondents were asked to recount their primary activities over the previous 6 hours, including their offline social interaction. This short reporting interval limited the number of primary activities that would fit within such a short time frame. Assuming people

cannot simultaneously do two primary activities, such as both surfing the Web and socializing offline with friends, this short time interval for the sampling period could have led to biased estimates of the association of Internet use and social interaction. For example, by limiting the sampling period to 6 hours, this method excluded cases where the Internet was used to schedule an offline social interaction for the next day. We concluded that this study method is biased to produce negative Internet effects and is sufficiently different from all other studies to warrant its exclusion from the analysis. We report only the analyses that were performed without this study.

We analyze the effects of Internet use on social interaction across the remaining 15 survey studies by entering the type of relationship studied and the study design method into a hierarchical mixed linear model that predicts effect size. We treated study as a random effect, with effect size nested within study. Table 2 shows the results. The marginally significant impact of the Friends variable shows that, across all study methods, effects of Internet use were smaller or less likely to be positive when authors measured social interaction with friends as compared with an unspecified close relationships ($b=65.3$, $p<.09$, $t=-1.79$).

[Insert Table 2 about here]

Overall, study design (cross-sectional vs. longitudinal studies) did not have a significant impact on effect sizes, but design did affect results when the type of relationship measured was considered. Table 2 shows a marginally significant interaction effect of study design with the dummy variable measuring social interaction with friends versus unspecified relationships ($b=98.2$, $p<0.07$, $t=1.86$). This interaction effect reflects the fact that cross-sectional studies tended to show positive effects of Internet use on interaction with unspecified others, and negative effects on interaction with friends specifically, whereas longitudinal studies tended to show positive effects of Internet use on interaction with friends, and no effect on unspecified others. As also shown in Table 2, study design did not lead to different effect sizes when contrasting family interactions with unspecified social interactions ($b = 52.9$, $p > 0.2$, $t = -.99$). Figure 2 illustrates these effects.

[Insert Figure 2 about here]

To investigate these trends further, we also conduct a more traditional fixed effects regression analysis. This analysis does not control for the correlations among effect sizes within a study. Within-study correlated effects can be produced when a single investigator uses more than one measure of the same variable. In our corpus, the mean number of measures of social interaction with friends within any study that measured this variable was 1.1; the mean number of measures of social interaction with family within any study that measured this variable was 1.3, and the mean number of measures of social interaction with

unspecified close ties was 2.2. Hence, any threats to validity mainly rest with the measures of social interaction among unspecified close ties.

Table 3 shows the results of this analysis. The table shows that cross-sectional studies (all measures) and measures of social interaction with unspecified others (in both cross sectional and longitudinal studies) tend to produce significantly variable, heterogeneous effects. The only homogeneous effect sizes emerge from longitudinal studies of social interaction with family and with friends. However, the confidence limits for family include negative effects. The strongest trend corresponds with the finding from the hierarchical model, showing that Internet use predicts slight increases in social interaction with friends (CL=.004 to .103). These effects are small and, furthermore, there are too few studies to be sure that new studies would not change the effect.

[Insert Table 3 about here]

Discussion

Our meta-analysis of 16 studies of the association of Internet use with social interaction in close relationships showed the association is very small. Once we removed an outlier study for substantive and statistical reasons, the effect was close to zero ($r = .01$, CI=.00 to .03). The other primary finding was that study design influenced outcomes for different types of personal relationships. Cross-sectional studies produce highly variable effects that, on average, indicate use of

the Internet to be positively correlated with interaction in unspecified close relationships, but negatively related to social interaction in friendships.

Longitudinal studies, fewer in number but more stable in their results, show that more Internet use predicts slight positive increases in social interaction in friendships. Again, all of the effect sizes were very small.

What might account for the finding from longitudinal studies of a more positive impact of Internet use on social interaction with friends than with unspecified close ties? Assuming that unspecified close ties include family, household, relatives, and romantic partners, it seems possible that people's interactions with their friends would be somewhat less stable than their relationships with family, household, relatives, and romantic partners. Using the Internet might reduce the costs and increase the convenience of communicating with friends, and in doing so, make other types of social interaction, such as phone calls or spontaneous outings, more likely (see also Cummings, Lee & Kraut, this volume). These effects do not hold, however, for family and relatives, especially those in the same household, because family communication already has low costs. Consistent with a possible shift to more social interaction outside the household, Gershuny (2002) reports from his longitudinal study that more time on the Internet has a positive effect on his British respondents' saying they "go out" with friends.

A related possibility is that Internet communication may function as an extra source of friendship-related stimulus at home or at work, a source of reminders

that friends (people outside the home) need or want attention. Friendships require consistent maintenance (Duck, 1998) and, sometimes, serious time commitment. This maintenance might be enhanced by the exchange of e-mail and instant messenger messages. Family ties, on the other hand, are much more stable, partly because they are not voluntary.

These effects would be apparent in longitudinal studies and not in cross-sectional studies, because longitudinal studies are more likely to detect changes in social interaction over time. Cross-sectional studies can only detect whether a positive or negative relationship exists. The cross-sectional studies that find a negative relationship of Internet use and social interaction in friendships may be explained by a desire of those without many friends to seek friends on the Internet (see McKenna & Bargh, 1998; 2000), or to a personality trait such as introversion that causes people to prefer the Internet over face-to-face contact. Unfortunately, there are comparatively few results from longitudinal studies with items that examine the effects of Internet use on social interaction in different relationships. Furthermore, the studies we reviewed were not designed to investigate factors that cause people to use the Internet more or less, and few studies measured personality traits.

The need for an improved paradigm

Our results point to the need for investigators to invest their time and effort in longitudinal studies. The outcomes of our meta-analysis suggest that cross-sectional designs produce not just ambiguous results, but results that contradict those of longitudinal studies. If investigators wish to learn the social impact of the Internet, or of any new technology, longitudinal studies are far more credible. The ability to evaluate the same people over time mitigates several major threats to causal inference; first, that pre-existing differences among individuals account for differences in the outcome variable; second, that the purported outcome variable affects changes in the purported independent variable; third, that an unmeasured variable changes the relationship between the independent and dependent variables. When the survey examines the same people two or more often, these participants bring the same demographic and other cross-sectional differences to both surveys, effectively controlling for their own cross-sectional variation.

Many statistical techniques have been developed to aid analysis and inference from longitudinal data. The best of these allow investigators to separate the variability in the data that can be attributed to “before” factors (i.e., how much social interaction a person has when the study starts) and “after” factors (i.e., how much social interaction the same person had when the study ends). In our review, the longitudinal study designs may determine whether levels of Internet use

predict changes in social interaction with family or friends whereas the cross-sectional studies cannot.

Longitudinal designs remain subject to some threats to validity. Other events that change with time may drive change in Internet use and, simultaneously, change in outcomes. These extraneous events can be internal to the individuals, such as learning or maturation, or external, such as the business cycle or change in popular culture. Also, because of errors of measures, pre-existing differences among participants are never fully statistically controlled in longitudinal designs. Hence we recommend longitudinal studies with the caveat that they will never resolve all ambiguities.

Our findings also point to the need to study how people use the Internet and particularly how they communicate offline and online within different types of social relationships (Coget, Yamauchi, & Suman, 2002; Shklovski et al., (in press)). Few authors in our corpus differentiate the relationships within which Internet interactions take place, for instance, whether someone used the Internet to send e-mail to family members, to close friends or to meet new people in chat rooms (cf. Boneva, Kraut, & Frohlich, 2001). If the Internet does have differential social effects depending on who communicates with whom, these effects would be obscured in aggregate studies of "Internet use." Theories of social interaction in different relationships would help researchers to formulate questions and would advance the state of the literature.

Finally, variables that can moderate the effects of Internet use on social involvement and psychological well-being, such as extraversion and other comparatively stable predispositions toward social behavior, were rarely measured in the reviewed studies of the Internet and therefore were unavailable for statistical control. McKenna and her colleagues have argued that the Internet has differentially positive effects on those who are socially stigmatized or isolated and find new relationships online (McKenna & Bargh, 2000, McKenna and Seidman, this volume; McKenna & Bargh, 1998). Online relationships, however, were rarely measured in the studies reviewed here. It seems possible that people who are (or feel) isolated can successfully seek out new relationships online, whereas the same behavior would be counter-productive for those who already have strong ties that should be maintained (Bessiere, Kraut, & Kiesler, 2004). Internet effects moderated by people's social context or personality could be detected if studies included these variables.

Conclusion.

One decade ago, in an early proposal, we argued for studies of the social impact of the Internet.

We lack information about the personal effects of
electronic services on families and the community—

and about the effects of not having such services. The answers to these questions are important if we are to spend public and private resources efficiently and effectively, if we are to understand the barriers to serving many people, and many kinds of people, and if we are to measure outcomes objectively, in a manner that informs policy (Kraut, 1994).

Our argument, and the sentiments of many others, resulted in research supported by foundations, businesses, and the National Science Foundation and other government agencies. Researchers in the U.S. and in other countries studied the effects of the Internet. The outcome of this program of work is mixed. These studies did serve policy. For example, early researchers documented the superior income and education characteristics of Internet users as compared with nonusers, and catalogued economic (Anderson, Bikson, Law, & Mitchell, 1995) and technical (Kiesler, Zdaniuk, Lundmark, & Kraut, 2000) barriers to Internet use. This work helped bring about and justify major federal and state programs to support library Internet access and access in schools.

On the other hand, as our analysis shows, the burgeoning literature on the social impact of the Internet has identified few consistent effects across people, relationships, and settings. Our overall finding is that the Internet has not had any broad effect on social interactionm but this finding must be tempered by the

nature of the research we reviewed: survey studies looking at gross Internet use (for any purpose and within any relationship) and social interaction within broad types of relationships. The hype and expectations surrounding the Internet also may have blinded researchers to the stability of people's lives, and the changes that have to take place before a technology is incorporated into, and adapted to, home, work, and everyday life (Cummings, Butler, & Kraut, 2002). The number of insignificant effects in the literature suggest that some of the most important parts of life—how people use major blocks of time, their closest relationships, and their emotional lives—are comparatively stable over time and resist change. Thus, even though the Internet may have changed many habits, the effects of those changes on fundamental relationships and psychological well-being would likely be small, or at least, slow in emerging. More recent research, especially theoretically-driven studies, that are targeted to understand particular uses of the Internet for particular relationships will be more likely to discover how using the Internet in these ways affects our social interactions and other important aspects of our lives. The current review of the literature has shown that it is time to focus on developing a more differentiated view of the Internet and its social outcomes. The Internet is a malleable and diverse technology, and its effects must differ, dependent on the purpose of its use.

References

- Albarracin, D., Johnson, B. T., Fishbein, M., & Muellerleile, P. A. (2001). Theories of Reasoned Action and Planned Behavior as Models of Condom Use: A Meta-analysis. *Psychological Bulletin, 127*, 142-161.
- Allan, G. (1979). *A sociology of friendship and kinship*. London: George Allen & Unwin.
- Anderson, R., Bikson, T., Law, S., & Mitchell, B. (1995). *Universal access to E-mail*. Santa Monica, CA: RAND.
- Baumeister, R. F., & Leary, M. R. (1995). The Need to Belong: Desire for Interpersonal Attachments as a Fundamental Human Motivation. *Psychological Bulletin, 117*(3), 497-529.
- Bessiere, K., Kraut, R., & Kiesler, S. (2004). *Effects of using the Internet to meet people on changes in depression as a function of initial social involvement*. Unpublished manuscript, Pittsburgh, PA.
- Bolger, N., Zuckerman, A., & Kessler, R. C. (2000). Invisible support and adjustment to stress. *Journal of Personality & Social Psychology, 79*, 953-961.
- Boneva, B., Kraut, R., & Frohlich, D. (2001). Using e-mail for personal relationships: The difference gender makes. *American Behavioral Scientist, 45*(3), 530-549.

- Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models: Applications and data analysis methods*. Thousand Oaks, CA, US: Sage Publications, Inc.
- Catania, J. A., Gibson, D. R., Chitwood, D. D., & Coates, T. J. (1990). Methodological problems in AIDS behavioral research: Influences on measurement error and participation bias in studies of sexual behavior. *Psychological Bulletin*, *108*, 339-362.
- Coget, J. F., Yamauchi, Y., & Suman, M. (2002). The Internet, Social Networks, and Loneliness. *IT&Society*, *1*(1), 180-201.
- Cohen, S., Underwood, L. G., & Gottlieb, B. (2000). Social relationships and health. In S. Cohen & L. G. Underwood & B. Gottlieb (Eds.), *Social support measurement and interventions: A guide for health and social scientists* (pp. 3-25). New York: Oxford.
- Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, *98*(2), 310-357.
- Cole, J. I., & Robinson, J. P. (2002). Internet Use and Sociability in the UCLA Data: A Simplified MCA Analysis. *IT&Society*, *1*(1), 202-218.
- Cummings, J., Butler, B., & Kraut, R. (2002). The quality of online social relationships. *Communications of the ACM*, *45*(7), 103-108.
- Duck, S. (1998). *Human relationships* (3rd ed.). Thousand Oaks, CA: Sage Publications.

- Gershuny, J. I. (2002). *Web-use and Net-nerds: A Neo-Functionalist Analysis of the Impact of Information Technology in the Home*. Unpublished manuscript, Colchester: University of Essex.
- Gleser, L. J., & Olkin, I. (1994). Stochastically Dependent Effect Sizes. In H. Cooper & L. Hedges (Eds.), *The Handbook of Research Synthesis* (pp. 339-356): Russel Sage Foundation.
- Gottlieb, N. H., & Green, L. W. (1984). Life events, social network, life-style, and health: An analysis of the 1979 national survey of personal health practices and consequences. *Health Education Quarterly*, *11*, 91-105.
- Greenhouse, J., & Iyengar, S. (1994). Sensitivity Analysis and Diagnostics. In H. Cooper & L. Hedges (Eds.), *The Handbook of Research Synthesis* (pp. 383-398): Russel Sage Foundation.
- Helgeson, V., Cohen, S., Schulz, R., & Yasko, J. (2000). Group support interventions for people with cancer: Who benefits from what? *Health Psychology*, *19*, 107-114.
- Jackson, L. A., von Eye, A., Barbatsis, G., Biocca, F., Fitzgerald, H. E., & Zhao, Y. ((in press)). The Social Impact of Internet Use on the Other Side of the Digital Divide.
- Jackson, L. A., von Eye, A., Barbatsis, G., Biocca, F., Fitzgerald, H. E., & Zhao, Y. (in press). The Social Impact of Internet Use on the Other Side of the Digital Divide.
- Katz, J., & Aspden, P. (1997). A nation of strangers? *Communications of the ACM*, *40*(12), 81-86.

- Katz, J. E., & Rice, R. E. (2002). *Social consequences of Internet use: Access, involvement, and interaction*. Cambridge, MA: MIT Press.
- Kestnbaum, M., Robinson, J. P., Neustadt, A., & Alvarez, A. (2002). Information Technology and Social Time Displacement. *IT & Society, 1*(1), 21-37.
- Kiesler, S., Zdaniuk, B., Lundmark, V., & Kraut, R. (2000). Troubles with the Internet: The dynamics of help at home. *Human-Computer Interaction Special Issue, 15*(4), 323-351.
- Kraut, R. (1994). HomeNet: A field trial of residential Internet services. Unpublished proposal to the National Telecommunications and Information Administration. Pittsburgh, PA: Carnegie Mellon University.
- Kraut, R., Kiesler, S., Boneva, B., Cummings, J. N., Helgeson, V., & Crawford, A. M. (2002). Internet paradox revisited. *Journal of Social Issues, 58*(1), 49-74.
- Kraut, R., Mukhopadhyay, T., Szczypula, J., Kiesler, S., & Scherlis, B. (1999). Information and communication: Alternative uses of the Internet in households. *Information Systems Research Special Issue, 10*(4), 287-303.
- Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukhopadhyay, T., & Scherlis, W. (1998). Internet paradox: A social technology that reduces social involvement and psychological well-being? *American Psychologist, 53*(9), 1017-1031.
- Kraut, R. E., & Attewell, P. (1997). Media use and organizational knowledge: Electronic mail in global corporation. In S. Kiesler (Ed.), *Research milestone on the information highway*. Mahwah, NJ: Lawrence Erlbaum Associates.

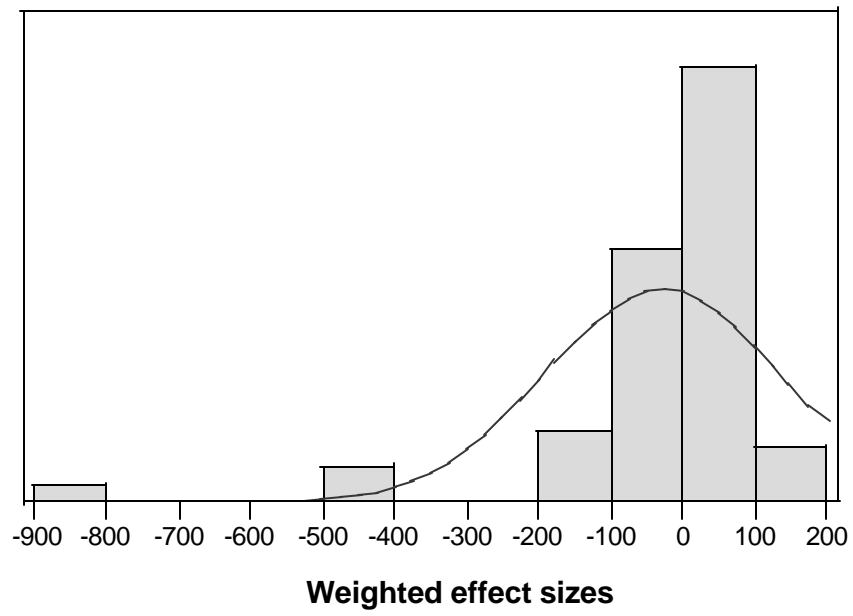
- Kraut, R. E., Scherlis, W., Mukhopadhyay, T., Manning, J., & Kiesler, S. (1996). HomeNet: A field trial of residential internet services. *Communications of the ACM*.
- Lee, B., & Zhu, J. (2002). Internet Use and Sociability in Mainland China and Hong Kong. *IT & Society*, 1(1).
- Lee, W., & Kuo, E. C. Y. (2002). Internet and displacement effect: Children's media use and activities in Singapore. *Journal of Computer-Mediated Communication*, 7(2), NP.
- Lepper, M., Henderlong, J., & Gingras, I. (1999). Understanding the effects of extrinsic rewards on intrinsic motivation: Uses and abuses of meta-analysis. *Psychological Bulletin*, 125, 669-676.
- McKenna, K., & Bargh, J. A. (2000). Plan 9 from cyberspace: The implications of the Internet for personality and social psychology. *Personality & Social Psychology Review*, 4(1), 57-75.
- McKenna, K. Y. A., & Bargh, J. A. (1998). Coming out in the age of the Internet: Identity "demarginalization" through virtual group participation. *Journal of Personality & Social Psychology*, 75(3), 681-694.
- Mesch, G. (2001). Social Relationships and Internet Use Among Adolescents in Israel. *Social Science Quarterly*, 82(2), 329-339.
- Mikami, S. (2002). Internet Use and Sociability in Japan. *IT & Society*, 1(1), 242-250.
- Mirowsky, J., & Ross, C. E. (1989). *Social Causes of Psychological Distress*. Hawthorne, NY: Aldine De Gruyter.

- Neustadt, A., & Robinson, J. P. (2002). Social contact Differences Between Internet Users and Nonusers in the General Social Survey. *IT & Society, 1*(1), 73-102.
- Nie, N., & Hillygus, D. S. (2002). The Impact of Internet Use on Sociability: Time Diary Findings. *IT & Society, 1*(1), 1-20.
- Nie, N., Hillygus, S., & Erbring, L. (2002). Internet Use, Interpersonal Relations and Sociability: Findings from a Detailed Time Diary Study. In B. Wellman (Ed.), *The Internet in Everyday Life*.
- Peirce, R. S., Frone, M. R., Russell, M., Cooper, M. L., & Mudar, P. (2000). A Longitudinal Model of Social Contact, Social Support, Depression, and Alcohol Use. *Health Psychology, 19*(1), 28-38.
- Pew Internet & American Life Project. (2003, December 22, 2003). *The changing picture of who's online and what they do*. Retrieved March 24, 2004, 2004, from the World Wide Web:
<http://www.pewinternet.org/reports/toc.asp?Report=106>
- Pew Internet and American Life Project. (2002). *Daily Internet Activities*. Retrieved October 25, 2002, 2002, from the World Wide Web:
http://www.pewinternet.org/reports/chart.asp?img=Daily_A1.htm
- Postmes, T., Tanis, M., & de Wit, B. (2001). Communication and commitment in organizations: A social identity approach. *Group Processes & Intergroup Relations, 4*(3), 227-246.
- Pronovost, G. (2002). The Internet and time displacement: A Canadian Perspective. *IT & Society, 1*(1), 44-53.

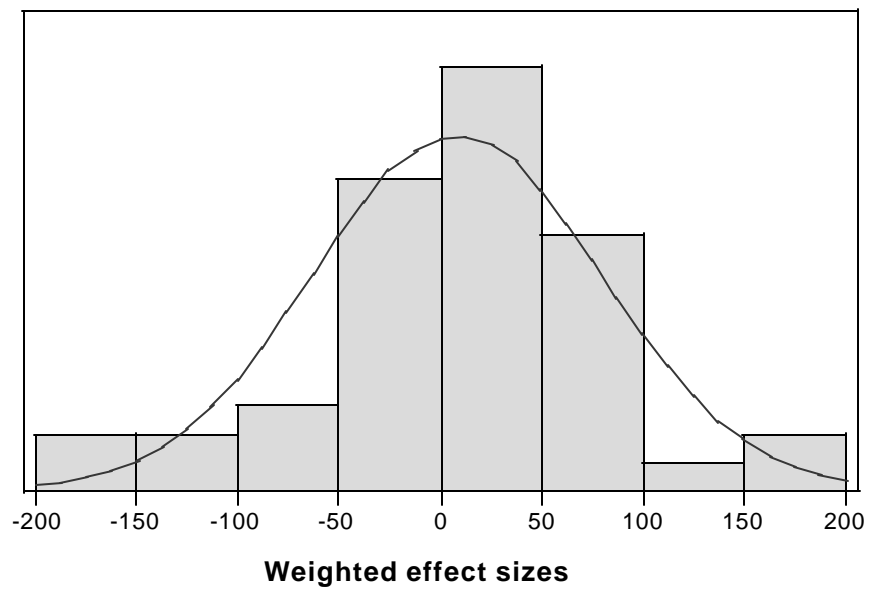
- Robinson, J., & Godbey, G. (1999). *Time for Life: The Surprising Ways Americans Use Their Time*. (2nd ed.). University Park, PA: Penn State University Press.
- Rosenthal, R. (1994). Parametric Measures of Effect Size. In H. Cooper & L. Hedges (Eds.), *The Handbook of Research Synthesis* (pp. 231-244): Russel Sage Foundation.
- Rosenthal, R., & Rosnow, R. L. (1991). *Essentials of Behavioral Research: Methods and data analysis* (2nd ed.). Boston: McGraw-Hill.
- Schachter, S. (1951). Deviation, Refection, and Communication. *Journal of Abnormal and Social Psychology*, 46, 190-207.
- Shadish, W. R., & Haddock, C. K. (1994). Combining Estimates of Effect Size. In H. Cooper & L. Hedges (Eds.), *The Handbook of Research Synthesis* (pp. 261-283): Russel Sage Foundation.
- Shklovski, I., Kraut, R., & Rainie, L. ((in press)). The Internet and Social Relationships: Contrasting Cross-Sectional and Longitudinal Analyses.
- Sproull, L., & Faraj, S. (1995). Public access to the Internet
Atheism, sex, and databases: The net as a social technology. In B. Kahin, & Keller, J. (Ed.) (pp. 62-81). Cambridge, MA: MIT Press.
- Sproull, L., & Kiesler, S. (1991). *Connections: New ways of working in the networked organization*: MIT Press.
- Srole, L. (1956). Social Integration and Certain Corollaries. *American Sociological Review*, 21, 709-716.

- Thoits, P. A. (1983). Multiple identities and psychological well-being: A reformulation and test of the social isolation hypothesis. *American Sociological Review*, 48(2), 174-187.
- U. S. Department of Commerce. (2002). *A nation online : How americans are expanding their use of the Internet*. Washington, DC: U. S. Government Printing Office.
- Wellman, B., & Wortley, S. (1990). Different strokes from different folks: Community ties and social support. *American Journal of Sociology*, 96(3), 558-588.

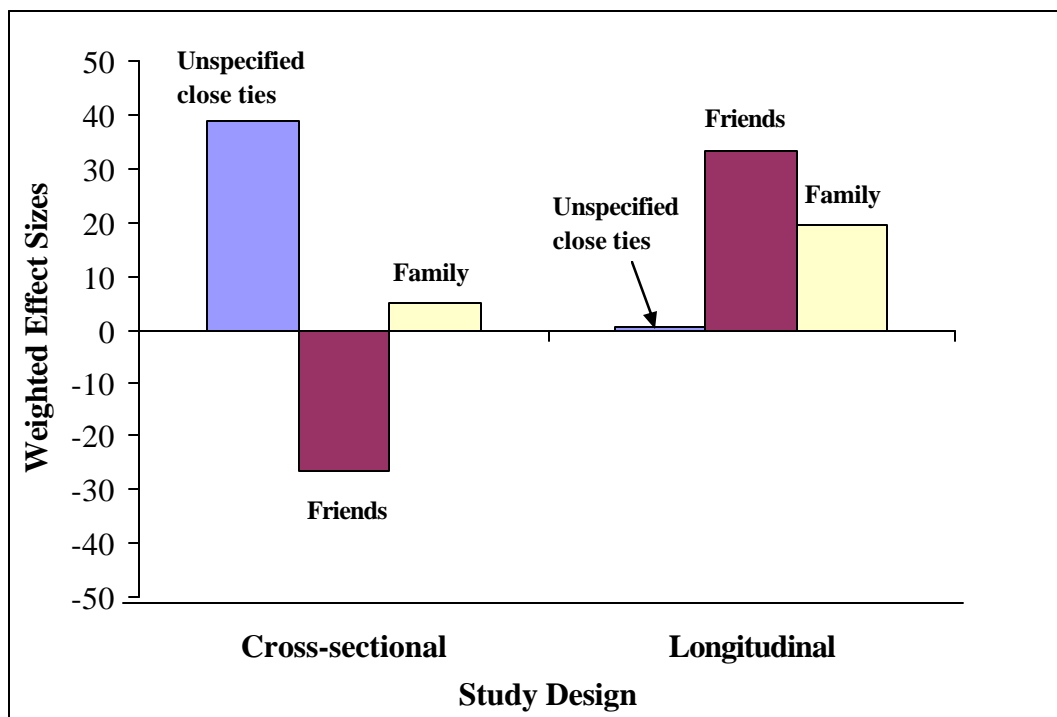
Chapter 17 Figure 1a



Chapter 17 Figure 1b



Chapter 17 Figure 2



Chapter 17 Table 1

#	Researcher	Study	Year	D/S	C/L	N	Research question	Internet Use	Social Involvement	Cat	Zr
1	Katz, J. & Aspden, P. ^N	A Nation of Strangers	1995	S	C	2500	Considering the relationship of Internet usage with off-line interaction, online social interaction, and online expression	Use/non-use	phone calls per week ²³	UCT ^a	0.051
2	Kraut R., Patterson, M., Lundmark, V., Kiesler, S., Mukhopadhyay, T., & Scherlis, W.	The Internet Paradox	1996	S	L	261	Investigating impact of Internet use on social involvement and psychological well-being	Amount (min/week)	local social circle ¹²³ distant social circle ¹²³ time w/family (min) ¹²	UCT UCT Family	-0.150 -0.150 -0.070
3	Kraut R., Kiesler, S., Boneva, B., Cummings, J., Helgeson, V. & Crawford, A. ^{P^O}	Internet Paradox Revisited (Internet Paradox Sample)	1997	S	L	208	Investigating impact of Internet use on social involvement and psychological well-being	Amount (min/week)	family communication ¹²³⁴ local social circle ¹²³⁴ distant social circle ¹²³⁴	Family UCT UCT	0.120 -0.009 0.038
4		Internet Paradox Revisited (TV-buyers sample)	1998	S	L	403		Internet use (freq)	local social circle ¹²³ distant social circle ¹²³ phone communication ¹²³ FtF communication ¹²³ family communication ¹²³	UCT UCT UCT Friends Family	0.155 0.159 0.063 0.113 0.005
5	Mesch, G., ^{P^N}	Social Relationships and Internet Use Among Adolescents in Israel	1998	S	C	927	To examine the relationship between youth leisure activities, and peer relations and the frequency of Internet use among adolescents.	Use/non-use	out to parties w/friends ¹²³ going out to discotheques ¹²³ going out to the movies ¹²³ going out to performances ¹²³	Friends UCT UCT UCT	-0.028 0.018 0.012 0.003
6	Lee, W. & Kuo, E. ^{P^O}	Internet and Displacement Effect: Children's Media Use and Activities in Singapore	1999	S	L	817	Examine the relationship between Internet use and activities that are important to childhood development.	Amount (min/week)	time w/family (min) time w/friends (min)	Family Friends	0.054 0.079

#	Researcher	Study	Year	D/S	C/L	N	Research question	Internet Use	Social Involvement	Cat	Zr
7	Gershuny, J. ^N	Web-use and Net-nerds: A Neo-Functionalist Analysis of the Impact of Information Technology in the Home	1999	D	L	2294	Investigating the impact of use of various facilities of the World Wide Web on patterns of sociability	Amount (min) (past 24 hrs)	going out with friends(min) ¹² visits w/fam & friends(min) ¹² phone fam & friends(min) ¹²	Friends UCT UCT	0.051 -0.037 -0.019
8	Cole, J. & Robinson, J. ^N	Internet Use and Sociability in the UCLA Data: A Simplified MCA Analysis	2000	S	C	1774	Testing relation between Internet use and sociability using both relational and attitudinal data	Amount (min)	household socializing(min) ¹²³⁴ friends socializing (min) ¹²³⁴ number of friends ¹²³⁴	Family Friends Friends	-0.042 -0.064 0.020
9	Lee, B. & Zhu, J. ^N	Internet Use and Sociability in Mainland China	2000	S	C	1798 China	Analyzing the impact of Internet use on socializing with friends, household socializing and family interactions	Amount (min)	time w/family (freq) ¹²³⁴ time w/friends (min) ¹²³⁴ talking w/family (min) ¹²³⁴	Family Friends Family	0.042 0.042 -0.020
10		Internet Use and Sociability in Hong Kong	2000	S	C	1007 HK		Amount (min)	time w/family (freq) ¹²³⁴ time w/friends (min) ¹²³⁴ talking w/family (min) ¹²³⁴	Family Friends Family	0.053 -0.042 0.140
11	Mikami, S.,	Internet Use and Sociability in Japan	2000	S	C	2393	Assessing relationship of Internet use and household socializing and socializing with family and friends	Amount (min)	household socializing ¹²³⁴ friends socializing ¹²³⁴	Family Friends	0.042 -0.075
12	Neustadt, A. & Robinson, J. ^N	Social Contact Differences Between Internet Users and Nonusers in the General Social Survey	2000	S	C	1815	Looking for reduced incidence of other forms of comm. particularly among those who use the Internet for social communication purposes	Use/non-use	social evening w/friends ¹²³⁴ social evening w/family ¹²³⁴ social evening w/neighbors ¹²³⁴ going to bars/taverns ¹²³⁴ social circle ¹²³⁴ # of people u phone ¹²³⁴ # of people u see Ft ¹²³⁴	Friends Family Friends UCT UCT UCT UCT	0.087 -0.087 -0.075 -0.031 0.064 0.193 0.124
13	Shklovski, I., Kraut, R., Rainie, L., ^{p N}	The Internet and Social Relationships: Contrasting Cross-Sectional and Longitudinal Analyses	2000	S	L	1501	Examine the influence of Internet use on communication and on social involvement	Breadth (scale)	visit family or friends ¹²⁴ telephone family/friends ¹²⁴	UCT UCT	-0.057 0.009

#	Researcher	Study	Year	D/S	C/L	N	Research question	Internet Use	Social Involvement	Cat	Zr
14	Nie, N. & Hilligus, S. ^N	The Impact of Internet Use on Sociability: Time Diary Findings	2002	D	C	5738	When & where does Internet use impact face-to-face interactions - hydraulic theory of IT impact	Amount @ home (min) (past 6 hrs)	time w/fam (min) ¹²⁴ time w/friends (min) ¹²⁴ social activities (min) ¹²⁴	Family Friends UCT	-0.144 -0.075 -0.076
15	Kraut, R., Kiesler, S., Boneva, B., Bessiere, K. & Shklovski, I. ^N	HomeNet 3	2002	S	L	1072	Impact of internet use on sociability and pscyhological well-being	Internet use (freq)	interpersonal com ¹²⁴ spending time with family ¹²⁴ spending time w/friends ¹²⁴	UCT Family Friends	0.023 0.043 0.022
16	Jackson, L., Eye, A., Barbatsis, G., Biocca, F., Fitzgerald, H. & Zhao, Y. ^O	The Social Impact of Internet Use on the Other Side of the Digital Divide	2003	S	L	117	Investigating whether Internet use in the home undermines psychological well-being and social involvement for low-income African Americans.	Amount (min)	# of close friends ²	Friends	-0.029

^a – UCT = Unspecified close ties.

^P – Indicates a peer-reviewed article.

^N – Indicates a national sample.

^O – Indicates an opportunity sample.

Control demographics included in the analysis model: ¹ – gender, ² – age, ³ – income, ⁴ – education

Chapter 17 Table 2

Effect	Estimate	df	t Value
Intercept	38.75	13	1.52
Study method (0=cross sectional, 1=longitudinal)	-38.21	13	-1.16
Social interaction with friends (0=Unspecified close ties, 1=Friends)	-65.27	26	-1.81 ^t
Social interaction with family (0=Unspecified close ties, 1=Family)	-33.80	26	-0.91
Study method*Friends	98.15	26	1.86 ^t
Study method*Family	52.91	26	0.99

Note. - ^tp < .1

Chapter 17 Table 3

Variable and class	Between-classes effect (Q_B)		k	Mean weighted effect size (\bar{Z}_i)	95% CI for Z_i		Homogeneity within class (Q_{wi}^a)	
					Lower	Upper		
Interpersonal Relationship Type	4.01							
Friends			13	-0.003	-0.02	0.014	62.5	***
Family			12	0.01	-0.01	0.028	39.64	***
Unspecified close ties			20	0.02	0.006	0.039	83.05	***
Study design type	1.78							
Cross-sectional			23	0.01	-0.005	0.018	135.02	***
Longitudinal			22	0.02	0.006	0.039	52.4	***
Relationship type by study design type								
Cross-sectional	14.22	***						
Friends			8	-0.02	-0.04	0.004	46.5	***
Family			7	0.003	-0.02	0.03	33.2	***
Unspecified close ties			8	0.04	0.012	0.065	41.1	***
Longitudinal	7	*						
Friends			5	0.05	0.004	0.103	3.7	
Family			5	0.037	-0.02	0.09	3.9	
Unspecified close ties			12	0.001	-0.02	0.026	37.8	***

Note: Q_B = between class effect, k = number of effect sizes; CI = confidence interval; Q_{wi} = homogeneity within each class
(significance indicates rejection of the hypothesis of homogeneity).

* $p < .05$ *** $p < .001$.

Endnotes

¹ No one has yet been able to conduct a true field experiment comparing users and nonusers (see, for instance, Kraut et al., 2002).

² Our database included 18 published and unpublished studies. Many authors reported their results in a form of a multivariate analysis with control variables that differed across studies. They often did not include information relevant to effect sizes. We contacted authors to obtain the needed information. We were unable to obtain relevant information for two of the selected studies, reducing our study sample to 16.

Captions

Chapter 17 Figure 1a: Distribution of weighted effect sizes for measures of the relationship between Internet use and interpersonal interaction with close ties, in 16 studies.

Chapter 17 Figure 1b: Distribution of weighted effect sizes removing outliers (Nie & Hillygus, 2002).

Chapter 17 Figure 2: Illustrating relationship between study design and measures of social interaction.

Chapter 17 Table 1: Study characteristics for studies of Internet use and social interaction

Chapter 17 Table 2: Hierarchical linear model weighted regression, testing the effects of study design and type of social interaction in studies of the effects of using the Internet on social interaction.

Chapter 17 Table 3: Fixed effects analysis of the effects of the Internet on social interaction, examining effects of type of social interaction and study design.