

Internet Paradox Revisited

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Jul 17, 2001

Version 15.0

In press

Journal of Social Issues

Abstract

Kraut et al. (1998) reported small but reliable negative effects of using the Internet on measures of social involvement and psychological well-being among new Internet users in 1995-1996. We called the effects a “paradox” because participants used the Internet heavily for communication, which generally has positive effects. A 3-year follow-up of the original sample found that negative effects dissipated. We also report findings from a longitudinal study in 1998-99 of new computer and television purchasers. This sample experienced overall positive effects of using the Internet on communication, social involvement, and well-being. Consistent with a “rich get richer” model, the Internet generally predicted better outcomes for extraverts and those with more social support but worse outcomes for introverts or those with less support.

Authors note. This research was funded by National Science Foundation (Grants IRI-9408271 and 9900449). In addition, initial data collection was supported through grants from Apple Computer Inc, AT&T Research, Bell Atlantic, Bellcore, CNET, Intel Corporation, Interval Research Corporation, Hewlett Packard Corporation, Lotus Development Corporation, the Markle Foundation, The NPD Group, Nippon Telegraph and Telephone Corporation (NTT), Panasonic Technologies, the U.S. Postal Service, and U S West Advanced Technologies. Tridas Mukophadhyay and William Scherlis participated in designing and carrying out the original HomeNet studies.

Internet Paradox Revisited

With the rapidly expanding reach of the Internet into everyday life, it is important to understand its social impact. One reason to expect significant social impact is the Internet's role in communication. From the early days of networked mainframe computers to the present, interpersonal communication has been the technology's most frequent use (Sproull & Kiesler, 1991). Over 90% of people who use the Internet users in a typical day in 2000, sent or received email (Pew Internet Report, 2000), far more than used any other online service. Using email leads people to spend more time online and discourages them from dropping Internet service (Kraut, Mukhopadhyay, Szczypula, Kiesler, & Scherlis, 2000). Other Internet communication services are increasingly popular—instant messaging, chat rooms, multi-user games, auctions, and myriad groups comprising “virtual social capital” on the Internet (Putnam, 2000, pg. 170).

If communication dominates Internet use for a majority of its users, there is good reason to expect that the Internet will have positive social impact. Communication, including contact with neighbors, friends, and family, and participation in social groups, affects people's level of social support, their probability of having fulfilling personal relationships, their sense of meaning in life, their commitment to social norms and to their communities, and their psychological and physical well-being (e.g., Cohen, 1988; Diener, Sul, Lucas, & Smith, 1999; Williams, Ware, & Donald, 1981).

Through its use for communication, the Internet could have important positive social effects on individuals (e.g., McKenna & Bargh, 2000), groups and organizations (e.g., Sproull & Kiesler, 1991), communities (e.g., Wellman, Quan, Witte & Hampton, 2001; Borgida, Sullivan, Oxendine, Jackson, Riedel, & Gang, this issue), and society at large (e.g., Hiltz & Turoff, 1978).

Because the Internet permits social contact across time, distance, and personal circumstances, it allows people to connect with distant as well as local family and friends, co-workers, business contacts, and with strangers who share similar interests. Broad social access could increase people's social involvement, as the telephone did in an early time (e.g., Fischer, 1992). It also could facilitate the formation of new relationships (Parks, & Roberts, 1998.), social identity and commitment among otherwise isolated persons (McKenna & Bargh, 1998), and participation in groups and organizations by distant or marginal members (Sproull & Kiesler, 1991).

Whether the Internet will have positive or negative social impact, however, may depend upon the quality of people's online relationships and upon what people give up to spend time online. Stronger social ties generally lead to better social outcomes than do weaker ties (e.g., Wellman & Wortley, 1990). Many writers have worried that the ease of Internet communication might encourage people to spend more time alone, talking online with strangers, or forming superficial "drive by" relationships, at the expense of deeper face-to-face discussion and companionship with friends and family (e.g., Putnam, 2000, pg. 179). Further, even if people use the Internet to talk with close ties, these online discussions might displace higher quality face-to-face and telephone conversation (e.g., Cummings, Butler & Kraut, in press; Thompson & Nadler, this issue).

Research has not yet led to consensus on either the nature of social interaction online or its effects on social involvement and personal well-being. Some survey research indicates that online social relationships are weaker than off-line relationships (Parks & Roberts, 1998), that people who use email regard it as less valuable than other modes of communication for maintaining social relationships (Cummings et al., in press; Kraut & Attewell, 1996), that people who use email heavily have weaker social relationships than those who do not (Riphagen &

Kanfer, 1997) and that people who use the Internet heavily report spending less time communicating with their families (Cole, 2000). In contrast, other survey research shows that people who use the Internet heavily report more social support and more in-person visits with family and friends than those who use it less (Pew Internet Report, 2000). Because this research has been conducted with different samples in different years, it is difficult to identify central tendencies and changes in these tendencies with time. Further, the cross-sectional nature of the research makes it impossible to distinguish self-selection (in which socially engaged and disengaged people use the Internet differently) from causation (in which use of the Internet encourages or discourages social engagement).

In a longitudinal study by Kraut, Patterson, Lundmark, Kiesler, Mukophadhyay and Scherlis (1998), the authors attempted to assess causal direction. The HomeNet field trial followed 93 households in their first 12-18 months online. Although the sample as a whole reported high well-being at the start of the study, those participants who used the Internet more became reliably less socially involved and more lonely and showed an increase in depressive symptoms. These changes occurred even though participants' dominant use of the Internet was communication.

These findings were controversial. Some critics argued that because the research design did not include a control group without access to the Internet, external events or statistical regression could have been responsible for participants' declines in social involvement and psychological well-being (e.g., Gross, Juvonen, & Gable, This issue ; Shapiro, 1999). However, these factors would have affected heavy and light Internet users similarly, so could not account for the differences in outcomes between them.

A more pertinent problem noted in the original HomeNet study is the unknown generalizability of the results over people and time. The participants in the original study were an opportunity sample of families in Pittsburgh initially with high social involvement and strong social ties, compared with the population as a whole. In 1995 and 1996, when they began the study, they had little experience online, and few of their family and friends had Internet access. One possibility is that using the Internet disrupted this group's existing social relationships. Had the study begun with a more socially deprived sample or more recently, when more of the population was online, their use of the Internet for social interaction might have lead to more positive effects.

The present article addresses these issues of generalizability in greater depth through a follow up of the original HomeNet sample and a new longitudinal study. The first study examines the longer-term impact of Internet use on those in the original HomeNet sample. Although following the same participants over time does not allow us to distinguish the effects of changes in the sample (e.g., acquisition of more online experience) from effects of changes in the Internet (e.g., more of one's social circle being online), this analysis provides a second look at a group for whom initial Internet use had poor effects. The second study follows a new sample of people in the Pittsburgh area who had recently purchased a new computer or television set. This study addresses the effects of Internet use in a more recent era. The sample was sufficiently large to permit an analysis of the impact of individual differences in sociability and social support on usage and outcomes and of the possible differences in use of the Internet that could explain different outcomes.

Study 1: Follow-up of the original HomeNet sample.

The data are from 208 members of 93 Pittsburgh families, to whom we provided a computer and access to the Internet in 1995 or 1996. The families were recruited through four high school journalism programs and four community development organizations in 8 Pittsburgh neighborhoods. The sample was more demographically diverse than was typical of Internet users at the time. Details of the sampling and research protocol are described in Kraut et al. (1996).

The analyses of social impact reported in Kraut et al. (1998) were drawn from Internet usage records and from surveys given just before participants began the study and again in May 1997. Server software recorded participants' use of the Internet— hours online, email volume, and Web sites visited per week. The surveys assessed demographic characteristics, the personality trait of extraversion (Bendig, 1962), four measures of social involvement (family communication, size of local social network, size of distant social network, and perceived social support [Cohen, Mermelstein, Kamarck, & Hoberman, 1984]), and three well-established measures of psychological well-being: the UCLA Loneliness Scale (Russell, Peplau, & Cutrona, 1980), the Daily Life Hassles Scale, a measure of daily-life stress (Kanner, Coyne, Schaefer, & Lazarus, 1981), and the Center for Epidemiological Studies' Depression Scale (Radloff, 1977).

In Kraut et al. (1998), we used a regression analysis of the effect of hours of Internet use on social involvement and psychological well-being in 1997 (Time 2), controlling for scores on these outcome measures at the pretest (Time 1). Demographic variables—age, gender, race, and income—and extraversion were also included in the models since these variables could be associated both with Internet use and with outcome variables. Our re-analysis re-examines the impact of use of the Internet by adding, a third survey administered in February 1998 (Time 3).

For about half the participants, the final survey came nearly 3 years after they first used the Internet; for the other half, the final survey came nearly 2 years later.

Method

All longitudinal research faces the potential of participant attrition. Our research was especially vulnerable because we had not planned initially to follow the participants for more than one year. Many of the high school students in the original sample graduated and moved to college. Further, technology changed rapidly during this period, and some participants changed Internet providers, ending our ability to monitor their Internet use. Of the 335 people who qualified for participation in the study, 261 returned a pretest survey at Time 1 (78%), 227 returned a survey at Time 2 (68%), and 154 returned a survey at Time 3 (46%). Because this research is fundamentally about changes in social and psychological outcomes, we limited analysis to participants who completed 2 out of 3 surveys ($n=208$).

We used a longitudinal panel design to examine the variables that influenced changes in social involvement and psychological well-being from Time 1 to Time 2, and from Time 2 to Time 3. The measure of Internet use is the average hours per week a participant spent online between any two surveys (i.e., weekly use between Times 1 and 2 and between Time 2 and 3). Because this variable was highly skewed, we used a log transformation. When assessing the impact of Internet use on social involvement and psychological well-being at one time, we statistically controlled for the prior level of social involvement and psychological well-being by including the lagged dependent variable as an independent variable in the model. For example, when examining the effect of Internet use on loneliness at Times 2 and 3, we included the lagged variable for loneliness at Times 1 and 2, respectively, in the model to control for the effects of prior loneliness on Internet use and on subsequent loneliness. Since this analysis controls for a

participants' demographic characteristics and the lagged outcome variable, one can interpret the coefficients associated with Internet use as the effect of Internet use on changes in these outcomes (Cohen & Cohen, 1983, p. 417-422).

The analyses were conducted using the xtreg procedure in Stata (StataCorp, 2001) for cross-sectional time series analyses with independent variables as modeled as a fixed effects and participant modeled as a random effect. For the outcome measures listed in Table 1, the basic model is $Outcome_{Tn} = Intercept + Generation_{T1} + Gender_{T1} + Household\ Income_{Tn-1} + Outcome_{Tn-1} + Log\ Internet\ Hours_{Tn-1} + Time\ Period + Log\ Internet\ Hours_{Tn-1} \times Time\ Period + Log\ Internet\ Hours_{Tn-1} \times Generation_{T1}$.

The analyses of particular interest are the main effects of hours of Internet use on subsequent measures of social involvement and psychological well-being and the statistical interactions of Internet use and time period on these outcomes. The main effect of Internet use assesses the cumulative impact of Internet use over the two or three years of the study, and the interaction of Internet use with time period assesses whether this impact is the same in the early period (previously reported in Kraut et al., 1998) and in the more recent period.

Results

Table 1 shows results from the analyses. Kraut et al (1998) showed Internet use was associated with declines in family communication, numbers of people in local and distant social circles and increases in loneliness, depressive symptoms, and daily-life stress. Of these, Internet use remains associated only with increases in stress over the full duration of the study. Two significant Internet use X time period interactions suggest that Internet use had different effects early and late in the study. In particular, depressive symptoms significantly increased with Internet use during the first period but significantly declined with Internet use during the second

period. Loneliness significantly increased with Internet use during the first period but was not associated with Internet use during the second period ($p < .01$). Because teenagers use the Internet more than their parents and because teens and adults differed on several of the outcomes reported in Table 1, we tested the differential effects of Internet use with age. There was only one marginally significant interaction: Adults' stress increased more than teens' stress with more Internet use ($p < .10$).

Insert Table 1 about here

Study 2: A longitudinal study of computer and television purchasers

In this study, we attempted to replicate the original HomeNet research design in a sample of households that had recently purchased a new personal computer. We added controls to the design and new measures. First, we attempted to manipulate Internet use to create a true experiment, with participants randomly assigned to condition. We randomly offered free Internet service to half of those households purchasing a computer and arranged with an Internet service provider to monitor their usage of the Internet; households in the control condition received an equivalent amount of money (\$225) to participate. Unfortunately, this experimental procedure failed when, by the end of 6 months, 83% of the control households obtained Internet access on their own (versus 95% of the experimental households).¹ Because this attempt to conduct a true experiment failed, we combined the groups for analyses of the effects of using the Internet.

Another design change was to add a comparison group—recent purchasers of a new television set. Study 1 compared heavier and lighter users of the Internet, all of whom had access

¹ Although all households in the experimental group were offered Internet access, three of 65 households failed to have Internet service installed.

to it. The addition of a TV-purchaser comparison group (of whom 29% had Internet access after 6 months) provides a sample that will not use the Internet. In analyses of the effects of Internet use, we include participants from the television purchaser group, but control for sample selection bias by creating a dummy variable indicating whether participants were in the television or computer purchaser group.

A third change was to expand the set of dependent variables. The previous study had included four measures of personal social involvement and three of psychological well-being. We added four additional measures of personal social involvement (spending time with family and friends, use of the telephone, perceived closeness to a random sample from of the respondents' local and distant social networks). In response to Putnam's (2000) concerns that the Internet might undercut community participation as well as interpersonal contact, we added four measures of involvement with and attitudes toward the community at large, including a measure of local community involvement, commitment to reside in the local area, perceived trust in other people, and an anomie scale. We expanded the measures of psychological well-being by adding scales measuring the experience of negative and positive affect, perceived time pressure and self-esteem to the measures of psychological well being included in study one. Because the Internet is a source of information as well as social contact, we added knowledge tests and a scale to measure computing skill. To test whether the distance-minimizing properties of the Internet blur traditional distinctions between geographically close and distant regions, our measures of social involvement and knowledge differentiated between these, for example, asking separately about local and distant social circles and about knowledge of the Pittsburgh region and broader areas.

Finally, we extended the HomeNet study conceptually by examining the differential effects of individual differences in extraversion and perceived social support on the effects of Internet use. Extraversion is the tendency to like people, to be outgoing, and to enjoy social interaction; it is a highly stable personality trait, predictive of social support, social integration, well-being, and positive life events (e.g., Von Dras & Siegler, 1997; Magnus, Diener, Fujita, Payot, 1993). The perception of social support refers to feelings that others are available to provide comfort, esteem, assistance, and information or advice; perceived social support buffers the effects of stress (e.g., Cohen, 1988).

We offer two opposing models of the relationship between extraversion and social support and Internet use. A “rich get richer” model predicts that those who are highly sociable and have existing social support will get more social benefit from using the Internet. Highly sociable people may reach out to others on the Internet and be especially likely to use the Internet for communication. Those who already have social support can use the Internet to reinforce ties with those in their support networks. If so, these groups would gain more social involvement and well-being from using the Internet than those who are introverted or have limited network networks.

By contrast, a “social compensation” model predicts that those who are introverted or lack social support would profit most from using the Internet (see McKenna, Green, & Gleason, this issue). People with fewer social resources could use the new communication opportunities online to form connections with people and obtain supportive communications and useful information otherwise missing locally (McKenna & Bargh, 1998). At the same time, for those who already have satisfactory relationships, using the Internet might interfere with their real-world relationships, if they swap, real world strong ties for weaker ones online. Analogous to the

finding that cancer patients with emotionally-supportive spouses can be harmed by participation in peer-discussion support groups (Helgeson, Cohen, Schulz, & Yasko, 2000), it is possible that people with strong local relationships might turn away from family and friends if they used the Internet for social interaction.

Method

Sample. We recruited participants through advertisements placed in local newspapers, soliciting people for a study of household technology who purchased a new computer or new television within the past six months. We obtained agreement from all adults and children in the family above age 10 to complete surveys. Half of the computer purchaser households were randomly offered free Internet access to participate in the study; other participants were offered payments to complete surveys. After the initial telephone contact, we mailed consent forms and pretest surveys with return envelopes. Unlike the procedures used in Study 1, we did not encourage Internet use or provide technology support.

Measures. We administered surveys 3 times during the study, in February 1998, 6 months later, and a year later, February 1999. We used an index of self-reported Internet use from all participants rather than automated measures of usage as in Study 1 ($\alpha = .86$; see Table 2). Automated usage records were available for the computer-experimental group but not for participants in the computer-control group and for TV-purchasers. Within the computer-purchaser group, the correlations between the self report index of Internet use and an automated count of the number of sessions logged into the Internet in the 8 weeks prior to the questionnaire was $r = .55$ at Time 2 ($n = 114$) and $r = .42$ at Time 3 ($n = 106$). These analyses reflect moderate validity of the self-report measure, although there is error in both the self-reports and in the

server data (e.g., the usage records do not include Internet use at work or one family member using another account).

Insert Table 2 about here

We used self-report measures to assess demographic characteristics of the participants, and measures from the original HomeNet study, including perceived social support (Cohen et al., 1984), size of local and distant social circles, and time talking with other family members. We used the same measure of extraversion (Bendig, 1962). We added new measures of anomie (Srole, 1956), trust in people (Rosenberg, 1957, revised from Survey Research Center, 1969), community involvement (adapted from Mowday and Speers' 1979 measure of organizational commitment), and intentions to stay in the Pittsburgh area. We also assessed respondents' peer relationships with 10 specific family and friends by asking them to identify family members or friends (5 living in the Pittsburgh area and 5 living outside of the area) who were closest to them in age. Participants described their feelings of closeness to each nominee at each time period on a 5-point Likert scale.

To assess well-being, we again used the CES-D to measure depressive symptoms (Radloff, 1977), the daily life stresses scale (Kanner, Coyne, Schaefer, & Lazarus, 1981), and the UCLA Loneliness Scale (Russell, Peplau, & Cutrona, 1980) from the original HomeNet study. We added measures of self-esteem (Heatherton & Polivy, 1991), positive and negative affect (Watson, Clark, & Tellegen, 1988), perceived time pressure (adapted from Kraut & Attewell, 1997) and physical health (subscale from the SF-36; Ware, Snow, Kosinski, & Gandek, 1993).

Finally, because the Internet is a source of information as well as communication, we added measures of knowledge. We included a self-report measure of skill using computers,

expanded from the original HomeNet study. We also added a test of knowledge, including multiple choice items on national current events, Pittsburgh current events, and general knowledge from a high school equivalency test (GED). The knowledge measures contained different items at different time periods. Table 2 describes the unpublished scales used in the study.

Analyses. Data come from 216 households, including 406 respondents who completed at least two surveys. Of the 446 household members who were eligible to be in sample, 96% completed survey 1, 83% completed survey 2 and 83.2% completed survey 3. The analyses were similar to the analyses for Study 1. We used Stata statistical software (StataCorp, 2001) to conduct longitudinal panel design analyses with participant as a random effect. In the Study 2 models, social involvement, well-being, and knowledge outcomes at the second and third time period were regressed on self-reported Internet use during that period, controlling for demographic characteristics and the lagged dependent variables. The models control for whether the respondent came from the TV purchaser or computer purchaser subsample and whether the dependent variables were collected at the second or third time period. To test whether levels of extraversion and social support moderated the effects of using the Internet, we included the main effects for the Bendig (1962) measure of extraversion and Cohen et al.'s (1984) measure of social support and the interaction of these variables with Internet use. Because teenagers use the Internet quite differently from adults, we also included the interaction of generation with Internet use.

Results

Table 3 shows descriptive statistics for computer and television purchasers in February 1998, August 1998, and February 1999, and the correlations among all variables, averaged across the time periods. (The correlations did not differ across time periods.)

Insert Table 3 about here

Effects on interpersonal and community social involvement. Models testing the effects of using the Internet on interpersonal communication and community involvement are shown in Tables 4 and 5, respectively. The main effects of Internet use on these measures of social involvement generally were generally positive. As Table 4 shows, participants who used the Internet more had larger increases in the sizes of their local ($p < .01$) and distant social circles ($p < .01$) and their face-to-face interaction with friends and family ($p < .05$), increased. As Table 5 shows, they also became more involved in community activities ($p < .10$) and felt greater trust in people ($p < .05$). The only significant reversal to the positive trend is that those who used the Internet more became less committed living in the Pittsburgh area ($p < .05$).

The interaction with extraversion shows that the association of Internet use with increases in community involvement was greater for extraverts ($p < .05$). Interactions of Internet use with social support show that the association of Internet use with increases in family communication was larger for those who initially had more social support ($p < .01$). Each of these interaction effects supports the “rich get richer” hypothesis.

Finally, interactions of age with Internet use suggest different positive effects for adults and teens. Teens, as compared with adults, increased their social support ($p < .10$) and family communication ($p < .10$) with more Internet use, whereas adults increased their face-to-face

interaction with family and friends ($p < .05$) and their closeness to distant relatives and friends ($p < .05$) with more Internet use.

Insert Table 4 and 5 about here

Effects on psychological and physical well-being. Table 6 shows the effects of Internet use on psychological well-being. These results are mixed, showing that, overall, both stress ($p < .05$) and positive affect ($p < .001$) increased with more Internet use. The several interactions of Internet use with extraversion indicate that Internet use was associated with better outcomes for extraverts than for introverts. In particular, extraverts who used the Internet more reported increased well-being, including decreased levels of loneliness, decreased negative affect, decreased time pressure, and increased self-esteem. In contrast, these same variable showed declines in well-being for introverts. Figure 1 illustrates these effects in , showing the joint effects of extraversion and Internet use on loneliness. There were no interactions with social support or with age, and no effects on measures of physical health (not shown in the table).

Insert Figure 1 and Tables 6 and 7 about Here

Effects on skill and knowledge. Table 7 shows the effects of Internet use on self-reported computer skill and multiple choices tests of worldly knowledge. Computer skill increased with more Internet use ($p < .001$); this increase was larger among those with more social support ($p < .05$). Knowledge of national current events and general knowledge (not shown in table) did not change with Internet use. In contrast, those who used the Internet more became less knowledgeable about the local Pittsburgh area ($p < .05$).

Different uses of the Internet. Because the way people choose to use the Internet could strongly influence its effects, we had asked participants to report how often they used the Internet for various purposes. We conducted an exploratory factor analysis of these items to create four scales reflecting different uses of the Internet: (a) for acquiring information for school, work, news, and other instrumental purposes such as shopping; (b) for communication with friends and family; (c) for meeting new people or socializing in chat rooms, and (d) for entertainment such as playing games and downloading music, and escape. These uses of the Internet were moderately interrelated (mean $r=.51$). Using the Internet for communication with family and friends ($r = .69$) and for information ($r = .62$) had the highest association with overall Internet use, followed by use for entertainment ($r=.51$) and meeting new people ($r=.38$). Extraverts were somewhat more likely than introverts to use the Internet to keep up with friends and family ($r = .10, p < .05$) and to meet new people or frequent chat rooms ($r = .12, p < .05$). Those with stronger initial social support were less likely than those with weaker support to use the Internet to meet new people or use chat rooms online ($r = .11, p < .05$) or for entertainment ($r = -.14, p < .05$). Teens were especially more likely to use the Internet for meeting new people (adults vs. teens, $r = -.41, p < .001$) and for entertainment (adults vs. teens, $r = -.29, p < .001$). However, adding the measures of specific Internet use to the models in Tables 3-6 did not significantly affect the overall interactions between Internet use and extraversion or social support. \

Discussion

The original HomeNet sample began using the Internet in 1995 or 1996. Our follow-up of participants remaining in the sample in 1998 showed that, overall, the previously-reported negative outcomes associated with more use of the Internet had all but disappeared, except for the association with increased stress. The statistical interactions of loneliness and depressive

symptoms with time period, however, suggest that use of the Internet led to negative outcomes during the first phase of the study and more positive outcomes later.

In study 2, conducted from 1998 to 1999, more use of the Internet was associated with mainly positive outcomes over a range of dependent variables measuring social involvement and psychological well-being—local and distant social circle, face-to-face communication, community involvement, trust in people, positive affect, and unsurprisingly, computer skill. On the other hand, heavier Internet use also was associated with greater stress, less local knowledge, and lower desire to live in the local area. In general, having more social resources amplified the benefits that people got from using the Internet. Among extraverts as compared with introverts, using the Internet was associated with larger increases in community involvement and self-esteem, and larger declines in loneliness, negative affect, and time pressure. Similarly, among people with more rather than less social support, using the Internet was associated with more family communication and greater increases in computer skill. Adults and teens gained slightly different benefits from more Internet use, with adults more likely to increase their face-to-face interactions locally, and their closeness to geographically distant relatives and friends.

What accounts for the differences between the original HomeNet research, showing generally negative consequences of using the Internet, and the follow-up, showing primarily generally positive consequences? Maturation of participants between the early and late phases of study 1, differences in samples between studies 1 and 2, and changes in the Internet itself are all potential explanations for this shift in results. Although our research cannot definitely choose among these explanations, a change in the nature of the Internet is the most parsimonious explanation.

Maturation of participants and changes in the way they used the Internet may partially account for the shift in results between the early and later phases of study 1. For example, as the novelty of using the Internet wore off, participants may have jettisoned unrewarding uses and concentrated on personally rewarding ones. The first phase of Study 1, with its negative outcomes, occurred during participants' first year on line. Study 2, with its positive outcomes, also occurred during a one-year period, when most participants' were new to the Internet. Thus, while maturation could account for differences between the early and late phases of Study 1, it cannot account for differences between Studies 1 and 2.

Participants in the original HomeNet study and in Study 2 came from separate opportunities samples. These sample differences make comparisons between the two studies problematic and might account for differences in results between Study 1 and 2. For example, the original sample included a larger proportion of teens and minorities. Although Table 4 showed that teenagers and adults benefited from using the Internet on different measures of social involvement, teenagers on average did not fare worse from using the Internet than adults. Similarly, supplementary analyses (not shown in Tables 4-7) reveal only one racial difference in outcomes: whites gained more computer skill from using the Internet than did nonwhites. Participants in Study 1 had more social support and were more extraverted than those in Study 2, probably because they were recruited from families with organizational memberships. However, the statistical interactions with extraversion and social support reported in Study 2 would lead one to expect that outcomes would be more positive in Study 1 than Study 2, but this was not the case. While other, unmeasured differences in the samples might account for the differences in results between Study 1 and Study 2, differences in age, race, and social resources do not appear to do so.

The similarity of findings comparing the early and later phases of Study 1 and comparing Study 1 and Study 2 suggest that changes in the Internet environment might be more important to understanding the observed effects than maturation or differences between samples. Simply put, the Internet may have become a more hospitable place over time. From 1995 to 1998, the number of Americans with access to the Internet at home more than quadrupled. As a result, many more of participants' close family and friends were likely to have obtained Internet access. Similarly, the services offered online changed over this period, increasing the ease with which people could communicate with strong ties. For example, new synchronous communication services, such as instant messaging allowed its users to subscribe to a list of family and friends and be notified when members of their "buddy lists" came online. In addition to these changes to the online social environment, over the duration of this research, the Internet provided a richer supply of information, with more news, health, financial, hobby, work, community, and consumer information available. It began to support financial and commercial transactions. Together, these changes could have promoted better integration of participants' online behavior and Internet use into their lives.

Our finding from Study 2, that extraverts and those with more support benefited more from their Internet use, is consistent with this idea. That is, the Internet may be more beneficial to individuals to the extent they can leverage its opportunities to enhance their everyday lives. Those who are already effective in using social and informational resources in the world are likely to be well positioned to take advantage of a powerful new technology like the Internet. While people with few social resources can form deep relationships online (see McKenna, Green, & Gleason, this issue), people who feel socially anxious and/or lonely are more likely to communicate online with people with whom they do not feel close (Gross,

Juvonen, & Gable, This issue). In general, online relationships are weaker on average than those formed and maintained off-line (Cummings, Butler, & Kraut, In press; Parks, & Roberts, 1998).

Although the impact of using the Internet across the two studies was generally positive, some negative outcomes remained. Across both studies, as people used the Internet more, they reported increases in their daily life stress or hassles. In addition, they reported less commitment to the local area and knew less about it.

The mechanisms by which the Internet has its impact on social involvement and psychological well-being remain unclear. One possibility is that all uses of the Internet are equivalent in this regard, and that the important factor is not how people use the Internet, but what they forego to spend time online. Thus the effects of using the Internet might be very different if it substituted for time spent watching TV or time spent conversing with close friends. Another possibility is that the effects of using the Internet depend upon what people do online. For example, one might expect that interpersonal communication with friends and family would have more beneficial effects than using the Internet for downloading music, playing computer games or communicating with strangers. No research to date, however, including our own, can distinguish between these two possibilities. Our attempts to identify the unique effects of using the Internet in different ways were unsuccessful.

Understanding the mechanisms for the Internet's impact is essential for informing policy decisions. People need better information to know whether to ration their time online or to decide which uses of the Internet are in their long-term interests. As experience with television suggests, enjoyable uses of new technology may be harmful in the long term (e.g., Huston et al, 1992; Putnam, 2000). School and libraries need to decide whether to offer email and chat

capabilities along with their information-oriented services. Service providers need to decide what applications to offer online.

If we are understand how the Internet affect people, we need better studies of these what people do online along with comparisons to their real-world counterparts. Unfortunately, it is probably late in the evolution of the Internet to carry out true experiments, at least in North America. We tried to conduct an experiment on Internet use for Study 2, but in less than 6 months, 83% of the households in the control group had acquired Internet access on their own. Nonetheless, researchers should continue to attempt to discern how using the Internet is affecting people's lives with the best designs possible. As the technology, users, and applications change, the impact the Internet will have on personal lives is likely to change as well. We believe longitudinal research methods are need to advance understanding of these effects. In addition, better and more detailed descriptions of how people spend their time both online and offline relate these detailed descriptions to changes in important domains of life.

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Table 1. Analysis of the original HomeNet study after 3 years ($n = 208$).

Independent variables	Social Support ^a			Local social circle ^b			Distant social circle ^c			Family Communication (log) ^d			Stress ^e			Depression ^f			Loneliness ^g		
	beta	se	p	beta	se	p	beta	se	p	beta	se	p	beta	se	p	beta	se	p	beta	se	p
Intercept	0.00	0.04		3.76	3.37		8.85	6.74		-0.03	0.05		0.01	0.01		-0.01	0.03		0.03	0.04	
Adult (1=adult; 0=teen)	-0.13	0.09		-19.37	7.41	**	-49.02	14.70	***	0.34	0.11	**	0.00	0.02		-0.14	0.06	*	0.04	0.09	
Male (1=male; 0=female)	-0.16	0.08	*	-2.74	6.89		6.57	13.70		-0.08	0.10		0.00	0.02		0.02	0.05		0.27	0.08	**
Household income	0.00	0.00		-0.20	0.15		0.14	0.29		0.00	0.00		0.00	0.00	*	0.00	0.00		0.00	0.00	
White (1=white;0=other)	0.15	0.09		-8.26	8.23		-6.74	16.38		0.11	0.13		0.04	0.02	+	-0.14	0.07	*	-0.22	0.10	*
Time period ^h	0.10	0.06		0.97	2.52		-4.04	4.66		-0.34	0.10	***	0.06	0.01	***	0.01	0.04		0.12	0.06	+
Stress ^e																0.61	0.17	***			
Extraversion ^f	0.07	0.05		1.04	2.74		-5.28	5.21													
Lagged dependent variable	0.45	0.07	***	0.21	0.06	***	0.33	0.10	***	0.37	0.08	***	0.54	0.06	***	0.18	0.06	***	0.44	0.05	***
Internet hours (log)	0.02	0.05		-1.15	3.29		-5.14	6.27		0.05	0.07		0.03	0.01	*	-0.01	0.03		0.00	0.05	
Internet * period	0.10	0.08		-0.37	3.06		2.88	5.62		0.16	0.12		-0.01	0.02		-0.13	0.05	*	-0.21	0.08	**
Internet * adult	0.06	0.09		5.44	6.08		7.52	11.57		-0.02	0.13		0.04	0.02	+	-0.08	0.06		-0.09	0.10	
n	189			189			187			177			195			187			186		
R^2	0.29			0.26			0.17			0.15			0.46			0.20			0.36		

Note. + $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

^aCohen, et al, 1984; ^b Number kept up with monthly, living in the Pittsburgh area; ^c Number kept up with annually, living outside of the Pittsburgh area; ^d Minutes communicating per day; ^e Kanner et al., 1981; ^f Radloff, 1977; ^g Russell, et al, 1980; ^h Period 1 is 12-18 months, from 1995 or 1996 to 1997 and period 2 is from the first posttest in 1997 to the second posttest in 1998.

Table 2: Unpublished scales used in Study 2.

	Average
	Alpha
Internet use	.86
I use the world wide web very frequently. I use email very frequently. I hardly ever use computers. (R) I hardly ever use the WWW. (R) I hardly ever use email. (R) I hardly ever use MUDs. (R) Time per day spent using computers at home. Time per day spent using WWW. Time per day spent using email. Frequency per month of using se a computer at home. Frequency per month sending an email message at home.	
Time pressure	.82
I often feel under stress because I don't have enough time. I spend enough time with my family and friends. [R] I have plenty of time for fun these days. [R] I never seem to have enough time to do what's necessary around the house. I am frequently interrupted.	
Closeness to local and distant friends	NA
How close do you feel to this person?	
Face-to-face communication	.55
Time spent with friends. Time spent with family. Communication with friends. Frequency visiting friends and relatives.	
Telephone communication	.83
Frequency making phone calls Frequency receiving phone calls	
Community involvement	.90
In the past three months, I have spent a lot of time working with others in my local community or school to solve problems of concern to us. I feel like I know what's going on in my neighborhood or community. In the past three months, I have spent a lot of time working with others outside of my local community to solve problems of concern to us. I don't feel I really belong in my local community. [R] I feel part of the community in Pittsburgh. I spend a lot of time participating in community activities. I feel I belong to the community. [R]	
Commitment to the local area	NA

Even if I had a chance to move to another city, I would very much want to stay in the Pittsburgh area.	
Computer skills	.83
Computers do not scare me.	
Using computers is fun.	
I am afraid of using a computer. (R)	
I am not threatened by computers.	
I am very skilled at using computers.	
I know a computer language.	
I would be at ease at computer class.	
I am self-confident about computers.	
I feel comfortable using computers.	
I don't know much about using computers. (R)	
U.S. knowledge (Examples. Items were changed for each wave)	.41
The Chief Justice of the Supreme Court is (William Rehnquist; Clarence Thomas; Kenneth Starr; Ruth Bader-Ginsberg).	
Which of the following movies just won the Oscar for best picture (As Good As It Gets; L.A. Confidential; Titanic; The Full Monty).	
Local knowledge (Examples. Items were changed for each wave)	.34
What is the University of Pittsburgh best known for (educational school; business school; medical school; computer science department).	
What is the largest employer in the Pittsburgh area? (US Air; US Steel; Westinghouse; University of Pittsburgh).	
General knowledge (Examples. Items were changed for each wave)	.33
Civilization probably began in (North America; western Europe; New Guinea and Australia; Mesopotamia and the Nile Valley).	
When a river narrows, the water in the river flows (faster; slower; at varying rates; at the same rate).	

Note. R = reversed scoring

No	Variable	Period 1		Period 2		Period 3		Average		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30								
		Mean	Std	N	Mean	Std	N	Mean	Std	N	Mean	Std	N	Mean	Std	N	Mean	Std	N	Mean	Std	N	Mean	Std	N	Mean	Std	N	Mean	Std	N	Mean	Std	N	Mean	Std	N	Mean	Std	N							
1	Adult	.88	0.32	446	.88	0.32	446	.88	0.32	446	.88	.32	446	1.00																																	
2	Male	.47	0.5	446	.47	0.5	446	.47	0.5	446	.47	.50	446	-.03	1.00																																
3	White	.92	0.27	438	.92	0.27	438	.92	0.27	438	.92	.27	438	-.08	.07	1.00																															
4	Income	4.91	1.55	443	4.91	1.55	443	4.91	1.55	443	4.91	1.55	443	-.05	.02	.21	1.00																														
5	Education	4.06	1.23	446	4.06	1.23	446	4.06	1.23	446	4.06	1.23	446	.01	-.04	-.03	.46	1.00																													
6	Computer sample	.72	0.45	446	.72	0.45	446	.72	0.45	446	.72	.45	446	-.14	.02	.11	.26	.23	1.00																												
7	Extraversion	3.16	0.68	438	3.22	0.64	417	3.22	0.65	389	3.22	.65	389	-.23	.01	.04	.04	-.02	-.03	1.00																											
8	Social support	3.81	0.52	438	3.79	0.51	416	3.80	0.54	389	3.80	.54	389	.05	-.19	.10	.18	.10	.00	.32	1.00																										
9	Internet use	.00	0.7	438	.00	0.76	416	.00	0.78	406	.00	.78	406	-.19	-.01	-.01	.10	.20	.38	.09	.02	1.00																									
10	Local circle (log)	2.71	0.79	433	2.62	0.78	397	2.56	0.79	375	2.56	.79	375	-.15	-.02	.29	.11	.00	.15	.24	.22	.12	.22	.43	1.00																						
11	Distant circle (log)	2.21	1.19	427	2.28	1.07	382	2.21	1.05	361	2.21	1.05	361	.10	-.14	.15	.21	.26	.19	.13	.16	.22	.43	1.00																							
12	Family communication (log)	4.57	0.96	408	4.35	1.17	391	4.10	1.63	389	4.10	1.63	389	.04	-.09	.10	.10	.10	-.06	.04	.11	-.14	.03	.08	1.00																						
13	Face-to-face communication	.00	0.97	438	-.01	0.97	417	-.01	1	406	-.01	1.00	406	-.27	-.17	-.06	.00	-.02	-.14	.30	.25	.07	.28	.18	.06	1.00																					
14	Phone communication	4.75	1.11	438	4.64	1.16	401	4.69	1.17	387	4.69	1.15	387	.03	-.29	-.01	.10	.05	-.04	.27	.29	.06	.16	.15	.09	.34	1.00																				
15	Closeness near friends	3.54	0.76	434	3.33	1	358	3.54	0.76	434	3.54	.76	434	.01	-.20	-.13	-.06	-.04	-.05	.14	.29	.06	.05	.03	-.05	.17	.20	.14	.20	.14	.20	.14	.20	.14	.20	.14	.20	.14	.20	.14	.20						
16	Closeness distant friends	3.06	0.92	395	3.02	1.03	290	2.94	1.1	286	2.94	1.10	286	.20	-.09	-.16	.03	.08	-.05	.09	.19	.08	-.03	.15	.09	.04	.13	.20	.14	.20	.14	.20	.14	.20	.14	.20	.14	.20	.14	.20							
17	Community involvement	2.87	0.71	437	2.85	0.72	413	2.83	0.75	390	2.83	.75	390	-.02	-.17	-.06	-.04	.16	.08	.29	.30	.17	.17	.20	.02	.24	.23	.20	.14	.20	.14	.20	.14	.20	.14	.20	.14	.20	.14	.20							
18	Stay in Pittsburgh	3.63	1.38	437	3.71	1.36	412	3.69	1.38	388	3.69	1.38	388	-.06	.06	.18	-.02	-.02	.02	.19	.17	-.14	.18	.10	-.03	.16	.02	.05	.02	.22	.19	.19	.19	.19	.19	.19	.19	.19	.19	.19	.19						
19	Trust	3.04	0.84	438	3.14	0.8	416	3.17	0.83	391	3.17	.83	391	.17	-.09	.19	.05	.13	.07	.18	.34	.06	.12	.16	.07	.00	.05	.02	.14	.24	.19	.19	.19	.19	.19	.19	.19	.19	.19	.19	.19						
20	Anomie	2.72	0.6	438	2.65	0.57	416	2.66	0.63	391	2.66	.63	391	-.19	.13	-.12	-.22	-.24	-.15	-.18	-.43	-.12	-.20	-.30	-.07	.01	-.11	-.03	-.21	-.28	-.20	-.60	1.00														
21	Stress	.25	0.15	431	.22	0.15	410	.22	0.14	382	.22	.14	382	.16	-.07	-.06	-.08	.06	-.07	-.12	-.09	.09	-.02	.07	-.05	.05	.02	.16	-.03	-.07	-.15	-.22	.10	.20	.14	.20	.14	.20	.14	.20							
22	Loneliness	2.14	0.67	435	2.14	0.67	416	2.10	0.66	389	2.10	.66	389	.08	.11	-.10	-.14	-.05	-.01	-.49	-.71	-.05	-.26	-.15	-.08	-.27	-.31	-.13	-.20	-.38	-.22	-.33	.40	.20	.14	.20	.14	.20	.14	.20							
23	Depression	.54	0.48	437	.54	0.47	416	.50	0.47	389	.53	.47	389	-.05	.10	-.05	-.20	-.13	-.01	-.12	-.42	.03	-.06	-.06	-.10	.03	-.13	-.03	-.11	-.13	-.15	-.24	.24	.34	.50	1.00											
24	Negative affect	1.79	0.67	436	1.73	0.65	416	1.67	0.64	390	1.67	.64	390	-.13	-.01	-.01	-.12	.03	.01	-.08	-.35	.11	-.01	.02	-.08	.09	-.03	.01	-.08	-.03	-.15	-.25	.20	.40	.41	.70	1.00										
25	Positive affect	3.50	0.71	436	3.45	0.71	416	3.49	0.72	388	3.49	.72	388	.01	-.02	-.03	.14	.11	.02	.31	.49	.21	.16	.15	.08	.20	.23	.21	.19	.31	.12	.20	-.25	.03	-.49	-.41	-.21	1.00									
26	Time pressure	3.12	0.74	438	3.07	0.75	417	3.02	0.76	390	3.02	.76	390	.18	-.11	-.01	.00	.00	.04	-.28	-.18	.07	-.13	-.03	-.17	-.14	-.02	.04	-.08	-.08	-.17	-.19	.12	.40	.31	.35	.32	-.15	1.00								
27	Self-esteem	3.61	0.58	435	3.65	0.61	416	3.70	0.62	389	3.70	.62	389	.00	.08	.06	.11	.05	.03	.27	.49	.06	.03	-.04	.05	.01	.12	-.02	.14	.13	.09	.22	-.23	-.27	-.61	-.54	-.50	-.46	-.33	1.00							
28	Computer skill	3.15	0.89	436	3.21	0.9	411	3.26	0.93	389	3.26	.93	389	-.22	.06	-.01	.09	.18	.18	.11	.06	.62	.03	.07	-.04	.01	-.06	.03	-.04	.09	-.10	.00	-.04	.08	-.06	-.06	.04	.16	.07	.11	1.00						
29	US knowledge	.68	0.26	438	.74	0.24	414	.71	0.33	388	.71	.33	388	.30	.03	.01	.11	.23	.06	-.02	.10	.02	-.03	.19	-.03	-.15	.01	-.03	.20	.13	.08	.26	-.28	-.03	-.06	-.19	-.15	.10	-.03	.12	-.05	1.00					
30	Local knowledge	.81	0.23	438	.78	0.21	414	.68	0.26	388	.68	.26	388	.22	-.03	.11	.07	.14	.01	.00	.07	-.09	.03	.08	.00	-.03	.10	-.02	.09	.15	.00	.17	-.17	-.07	-.07	-.11	-.12	.06	-.09	.05	-.07	.39	1.00				

Table 3. Descriptive statistics and correlations among the variables in Study 2.

Note. Scales for Internet use and face-to-face communication are an average of standardized scores

Table 4. Predicting interpersonal social involvement as a function of use of the Internet over time and individual difference variables. Study 2.

Independent variables	Social support ^a			Local social circle (log) ^b			Distant social circle (log) ^c			Family communication (log) ^d			Face-to-face communication ^e			Phone communication ^e			Closeness to local friends ^e			Closeness to distant friends ^e		
	beta	se	p	beta	se	p	beta	se	p	beta	se	P	beta	se	p	beta	se	p	beta	se	p	beta	se	p
Intercept	-0.01	0.02		-0.02	0.03		0.01	0.04		0.29	0.01	***	0.02	0.03		-0.02	0.03		-0.01	0.06		-0.01	0.04	
Adult (1=adult; 0=teen)	0.18	0.05	***	-0.04	0.10		0.31	0.12	*	0.00	0.03		-0.55	0.11	***	0.12	0.10		0.27	0.17		0.15	0.16	
Male (1=male; 0=female)	-0.09	0.03	**	0.03	0.06		-0.08	0.07		-0.01	0.02		-0.19	0.07	**	-0.30	0.07	***	-0.29	0.12	*	-0.02	0.09	
Household income	0.15	0.06	*	0.37	0.12	**	0.28	0.15	+	-0.03	0.04		-0.11	0.13		-0.04	0.13		-0.41	0.25	+	-0.16	0.20	
White (1=white;0=other)	0.02	0.01	*	-0.01	0.02		0.01	0.03		-0.01	0.01		-0.01	0.02		0.03	0.02		-0.09	0.04	*	0.01	0.03	
Education	0.01	0.01		0.00	0.03		0.06	0.03	+	0.00	0.01		-0.04	0.03		-0.02	0.03		0.00	0.05		-0.01	0.04	
Computer sample	0.02	0.04		0.12	0.07		0.07	0.09		-0.01	0.02		-0.22	0.08	**	-0.03	0.08		-0.10	0.13		-0.10	0.10	
Time period (0=early; 1=late)	0.01	0.02		-0.05	0.04		-0.12	0.05	*	0.00	0.01		0.03	0.05		0.08	0.04	+	0.00	0.00		-0.04	0.06	
Lagged DV	0.53	0.03	***	0.33	0.04	***	0.46	0.03	***	3.86	0.04	***	0.28	0.03	***	0.50	0.03	***	-0.99	0.00	***	0.50	0.04	***
Extraversion ^f	0.15	0.03	***	0.09	0.05	*	0.09	0.06		0.02	0.01		0.14	0.05	**	0.16	0.05	**	0.00	0.00		0.01	0.07	
Social support ^g				0.17	0.05	***	0.13	0.07	+	0.04	0.02	*	0.28	0.07	***	0.11	0.06	+	0.00	0.00		0.30	0.08	***
Internet use ^e	-0.01	0.02		0.12	0.04	**	0.15	0.05	**	0.00	0.01		0.09	0.04	*	0.05	0.04		0.00	0.00		0.07	0.06	
Internet * extraversion	0.01	0.03		0.02	0.06		-0.05	0.07		-0.01	0.02		-0.02	0.07		0.10	0.06		0.00	0.00		0.01	0.08	
Internet * support				0.01	0.07		0.02	0.09		0.05	0.02	**	-0.11	0.08		-0.08	0.07		0.00	0.00		0.15	0.10	
Internet * adult	-0.11	0.06	+	-0.13	0.11		-0.02	0.15		-0.06	0.03	+	0.30	0.13	*	0.04	0.12		0.00	0.00		0.35	0.18	*
<u>n</u>	406			385			365			373			406			391			351			285		
<u>R²</u>	.51			.42			.47			.95			.31			.51			.16			.44		

Note. + $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$; Variables were centered before analyses.

^aCohen, et al, 1984; ^b Number kept up with monthly, living in the Pittsburgh area; ^c Number kept up with annually, living outside of the Pittsburgh area; ^d Minutes communicating per day; ^esee Table 2; ^f Bendig, 1962; ^g Cohen et al, 1984..

Table 5. Predicting community social involvement as a function of use of the Internet over time and individual difference variables. Study 2.

Independent variables	Community involvement ^a			Stay in Pittsburgh ^b			Trust ^c			Anomie ^d		
	beta	se	p	beta	se	p	beta	se	p	beta	se	p
Intercept	0.00	0.02		-0.02	0.04		-0.01	0.02		0.00	0.02	
Adult (1=adult; 0=teen)	0.11	0.07		-0.01	0.14		0.30	0.08	***	-0.24	0.06	***
Male (1=male; 0=female)	-0.09	0.04	*	0.11	0.08		-0.01	0.05		0.07	0.04	*
Household income	-0.10	0.09		0.47	0.18	**	0.22	0.10	*	-0.12	0.08	
White (1=white;0=other)	-0.05	0.02	**	-0.06	0.03	*	-0.02	0.02		-0.03	0.01	+
Education	0.05	0.02	**	0.01	0.04		0.04	0.02	+	-0.03	0.02	*
Computer sample	0.09	0.05	+	0.11	0.10		0.07	0.06		-0.07	0.05	
Time period (0=early; 1=late)	0.01	0.04		-0.07	0.06		-0.01	0.04		0.04	0.03	
Lagged DV	0.51	0.03	***	0.55	0.03	***	0.51	0.03	***	0.43	0.03	***
Extraversion ^e	0.17	0.04	***	0.13	0.07	*	0.07	0.04	+	-0.06	0.03	+
Social support ^f	0.17	0.04	***	0.19	0.08	*	0.21	0.05	***	-0.16	0.04	***
Internet use ^e	0.05	0.03	+	-0.13	0.06	*	0.07	0.03	*	-0.01	0.03	
Internet * extraversion	0.10	0.05	*	0.09	0.09		0.00	0.05		-0.01	0.04	
Internet * support	0.02	0.05		-0.08	0.10		0.02	0.06		0.02	0.05	
Internet * adult	-0.01	0.09		0.10	0.17		-0.12	0.10		-0.04	0.08	
<u>n</u>	403			402			405			405		
<u>R</u> ²	.50			.49			.48			.47		

Note. + p < .10, *p < .05, **p < .01, ***p < .001; Variables were centered before analyses.

^a see Table 2; ^b see Table 2; ^c Srole, 1956; ^d Rosenberg, 1957; ^e Bendig, 1962; ^f Cohen et al, 1984...

Table 6. Predicting psychological well being as a function of use of the Internet over time and individual difference variables.

Study 2.

Independent variables	Stress ^a			Loneliness ^b			Depression ^c			Negative affect ^d			Positive affect ^e			Time pressure ^f			Self-esteem ^g		
	beta	se	p	beta	se	p	beta	se	p	beta	se	p	beta	se	p	beta	se	p	beta	se	p
Intercept	0.00	0.00		0.00	0.02		0.01	0.01		0.01	0.02		0.00	0.02		0.00	0.02		-0.01	0.02	
Adult (1=adult; 0=teen)	0.04	0.02	**	0.08	0.06		0.01	0.05		-0.12	0.07	+	0.05	0.08		0.23	0.09	**	0.06	0.05	
Male (1=male; 0=female)	-0.01	0.01		-0.01	0.03		0.02	0.03		-0.02	0.04		0.07	0.05		-0.18	0.05	***	0.11	0.03	***
Household income	0.00	0.02		-0.10	0.07		0.01	0.06		-0.03	0.09	+	-0.15	0.09	+	0.12	0.10		-0.01	0.07	
White (1=white;0=other)	0.00	0.00		-0.01	0.01		-0.02	0.01	+	-0.03	0.02	*	0.02	0.02		0.03	0.02		0.01	0.01	
Education	0.01	0.00		0.01	0.02		-0.01	0.01		0.03	0.02		0.00	0.02		-0.02	0.02		-0.01	0.01	
Computer sample	-0.02	0.01	+	-0.06	0.04		-0.03	0.04		-0.08	0.05		-0.02	0.06		-0.03	0.06		0.07	0.04	+
Time period (0=early; 1=late)	0.01	0.01		-0.04	0.03		-0.04	0.02	+	-0.04	0.03		0.07	0.03	*	-0.06	0.04	+	0.03	0.02	
Lagged DV	0.54	0.03	***	0.27	0.03	***	0.48	0.03	***	0.39	0.03	***	0.32	0.03	***	0.41	0.03	***	0.58	0.03	***
Extraversion ^h	0.00	0.01		-0.21	0.03	***	0.03	0.02		0.01	0.04		0.09	0.04	*	-0.15	0.04	***	0.05	0.03	+
Social support ⁱ	-0.02	0.01	*	-0.59	0.04	***	-0.21	0.03	***	-0.23	0.04	***	0.41	0.05	***	-0.12	0.05	*	0.28	0.03	***
Internet use ^e	0.01	0.01	*	0.03	0.02		0.01	0.02		0.04	0.03		0.14	0.03	***	0.05	0.03		0.02	0.02	
Internet * extraversion	-0.01	0.01		-0.08	0.03	*	-0.05	0.03		-0.12	0.04	**	0.04	0.05		-0.14	0.05	**	0.09	0.03	**
Internet * support	0.01	0.01		0.01	0.04		0.01	0.04		-0.08	0.05		-0.08	0.06		0.06	0.06		0.04	0.04	
Internet * adult	-0.02	0.02		-0.10	0.07		-0.09	0.06		-0.13	0.09		0.10	0.09		-0.06	0.10		0.01	0.07	
<u>n</u>	398			406			405			405			405			406			406		
<u>R</u> ²	.51			.66			.48			.40			.43			.42			.63		

Note. + p < .10, *p < .05, **p < .01, ***p < .001; Variables were centered before analyses.

^a Kanner, Coyne, Schaefer, & Lazarus, 1981; ^b Russell, Peplau, & Cutrona, 1980; ^c Radloff, 1977; ^d Watson, Clark, & Tellegen, 1988; ^e Watson, et al, 1988; ^f see Table 2; ^g Heatherton & Polivy, 1991; ^h Bendig, 1962; ⁱ Cohen et al, 1984

Table 7. Predicting knowledge as a function of use of the Internet over time and individual difference variables. Study 2.

Independent variables	Computer skill ^a			U. S. knowledge ^a			Local knowledge ^a		
	beta	se	p	beta	se	p	beta	se	p
Intercept	0.02	0.02		0.00	0.01		0.00	0.01	
Adult (1=adult; 0=teen)	-0.11	0.07		0.18	0.04	***	0.13	0.03	***
Male (1=male; 0=female)	0.05	0.04		0.04	0.02	+	0.04	0.02	*
Household income	-0.01	0.08		0.09	0.04	*	0.06	0.04	
White (1=white;0=other)	-0.01	0.02		0.00	0.01		0.00	0.01	
Education	0.03	0.02		0.03	0.01	***	0.03	0.01	***
Computer sample	-0.10	0.05	+	0.01	0.03		0.02	0.02	
Time period (0=early; 1=late)	0.04	0.03		-0.04	0.02	*	-0.09	0.01	***
Lagged DV	0.65	0.03	***	0.22	0.04	***	0.11	0.04	**
Extraversion ^h	0.02	0.03		-0.02	0.02		0.00	0.01	
Social support ⁱ	0.03	0.04		0.05	0.02	*	0.01	0.02	
Internet use ^e	0.31	0.03	***	0.00	0.01		-0.03	0.01	*
Internet * extraversion	-0.02	0.04		0.01	0.02		0.03	0.02	
Internet * support	0.10	0.05	*	0.00	0.03		0.00	0.02	
Internet * adult	0.14	0.08		-0.01	0.04		0.01	0.04	
<u>n</u>	400			403			403		
<u>R</u> ²	.71			.15			.15		

Note. + $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$; Variables were centered before analyses.

^a See Table 2; ^b Russell, Peplau, & Cutrona, 1980; ^c Radloff, 1977; ^d Watson, Clark, & Tellegen, 1988; ^e Watson, et al, 1988; ^f see Table 2; ^g Heatherton & Polivy, 1991; ^h Bendig, 1962; ⁱ Cohen et al, 1984

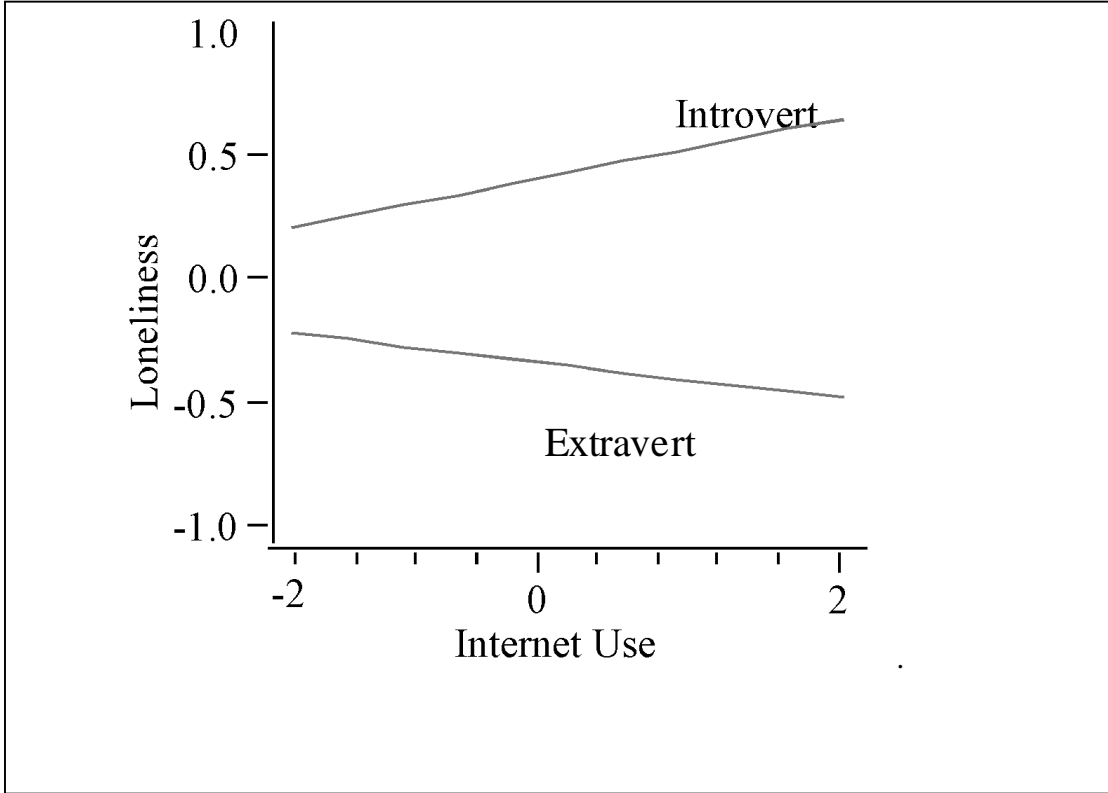


Figure 1. Interaction of Internet Use and Extraversion on Loneliness

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