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THE INTERNET, SOCIAL NETWORKS AND LONELINESS

JEAN-FRANCOIS COGET
YUTAKA YAMAUCHI
MICHAEL SUMAN

ABSTRACT

(Data Available)

As the Internet has rapidly become a mainstream medium, some studies have found that Internet use is associated with reduced social networks and increased loneliness, whereas other research has suggested virtually the opposite. Still other studies have found no associations at all between Internet use, social networks and level of loneliness. Some authors who have found that the Internet has a negative impact on social relationships and psychological well-being have hypothesized that Internet use encourages the creation of online relationships, which in turn replace face-to-face contacts (displacement). Since this results in an overall loss of depth that is more important than breadth for psychological well-being, Internet use consequently increases loneliness.

Using a sample of 2096 Americans surveyed in 2000 to test this theory produces results that are complex. There is no evidence of displacement of face-to-face relationships with online ones, and Internet use is slightly associated with a decreased level of loneliness. However, people who have online friends are more lonely than those who do not. In this way the Internet seems to have both positive and negative effects on psychological well-being. Some suggestions are offered to explain this paradoxical finding.

Jean-Francois Coget is a Ph.D. student in Human Resources and Organizational Behavior at the Anderson School of Management at UCLA. His research interests encompass the social impact of the Internet and intrinsic motivation at work.

Yutaka Yamauchi is a Ph.D. student in Management Information Systems at the Anderson School of Management at UCLA. His research interests encompass the social impact of the Internet and the ethnomethodology of work organizations.

Michael Suman is Research Director of the UCLA Center for Communication Policy and a Senior Lecturer of Sociology at UCLA. His research interests encompass the social impact of the Internet and the sociology of media.

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The Internet is becoming a mainstream medium that may soon be as pervasive as television, although the speed of its diffusion seems much faster. In 2000, about 67 percent of Americans were Internet users (Cole *et al.* 2000), while in 1995, only 8 percent were (Katz and Aspden 1997). Such rapid diffusion of a major mainstream innovation is bound to initiate considerable social change. Among the manifold social consequences of the Internet, this paper focuses on the affects of the Internet on people's relationships and loneliness.

Like any major innovation, the Internet has elicited both fear and enthusiasm. Large-scale innovations always elicit resistance to change and preference for the status quo (Schumpeter 1983). Many people still resist and resent the establishment of the Internet as a major communication tool in society. Others have embraced the Internet and have great expectations for it. In light of these opposing sentiments, one can delineate two grand scenarios about how the Internet will affect people's relationships.

The Internet pessimists fear the creation, or the accentuation, of a Kafkaian post-modern world plagued with anomie, neuroticism, loneliness and many other evils. This world resembles the scene in Nike TV ads, in which human beings ultimately become totally disconnected from their bodies and live only in virtual reality—the root scenario for many anti-technology movies like *The Matrix*. Along the same lines, critics of the Internet point out its paradoxical effect whereby the global village finally destroys local communities.

On the other hand, Internet optimists depict this technology as the ultimate connecting tool, enabling people living in isolated areas to communicate with the rest of the planet. It allows everybody to stay connected with their families and friends through email, chat, web cam technology, and other yet-to-be-developed technologies that will increase the realness of virtual communication. The Internet also provides new opportunities to meet people, and increases the efficiency and speed of so many transactions that it can save time for other activities—including face-to-face interaction.

These two scenarios describe, albeit in a somewhat exaggerated manner, two opposing paths for the possible affects of the Internet on people's relationships.

The pioneering work of researchers like Katz and Aspden (1997) and Kraut *et al.* (1998) has opened the avenue for research on the social impact of the Internet. However, it has failed to give a definitive answer to the question of how the Internet affects people's network of relationships and related level of loneliness. Does the Internet make people more or less connected to other people? Does the Internet make people more or less lonely? And how does it do so?

While some studies (Kraut *et al.* 1998; Nie 1999) find that Internet use is associated with increased loneliness and a reduction in both the number of friends people have and the time they spend with them, others (Katz and Aspden 1997) find no such correlations. Furthermore, the aforementioned studies do not clearly lay out models that explain their findings.

The purpose of this article is to revisit these issues and expand upon the findings of the studies of Kraut *et al.* (1998), Nie (1999), and Katz and Aspden (1997). A large dataset that includes both Internet users and nonusers and is representative of the American population in year 2000 is used. A correlational model based on Kraut's theories is tested with regression analyses.

THEORY

Computer-Mediated Communication: The present paper can be situated within a broad academic literature on computer-mediated communication. Even before the advent of the Internet, social researchers were interested in how computers affect communication between and among people. Research on computer-mediated communication has revealed both its negative and positive effects in comparison with face-to-face communication.

The "cues filtered-out perspective" (Culnan and Markus 1987) has generally focused on the negative aspects of computer-mediated communication. Nonverbal cues are generally filtered out in computer-mediated communication, which decreases its richness in comparison with face-to-face communication (Daft and Lengel 1984; Sproull and Kiesler 1986). This communication tends to be more task-oriented and impersonal (Hiltz *et al.* 1986), and it is generally not conducive to the development of close relationships (Kiesler *et al.* 1984; Kiesler *et al.* 1985).

Within the literature on computer-mediated communication, a new field of inquiry has emerged that focuses on the Internet. Within this field, some have pointed to the potential problem of Internet addiction (Young 1998; Young and Rogers 1998). Others have noted the possible development of different virtual identities, which create the risk of a detachment from and an increased dissatisfaction with (offline) reality (Turkle 1995).

Some of these Internet studies, on the other hand, have yielded a neutral or positive view of computer-mediated communication. Parks and Floyd (1996) surveyed people who developed online relationships on a newsgroup. They measured the characteristics of these relationships in terms of the level of interdependence, depth of the relationship, and commitment to the relationship. They found that online relationships were evaluated as rather normal (in the middle ranges of their measures). Other studies have found that online relationships can be rich (Rheingold 1994; Turkle 1995), but they might just take longer than face-to-face ones to develop as rich "connections" (Walther and Burgoon 1992). People might also engage in disclosure more easily because of the absence of physical cues (Sproull and Kiesler 1986, 1991), and this might enhance the richness of a relationship. Finally, the Internet can make communication easier and therefore increase the amount of communication overall (Malone and Rockart 1991).

The existing literature on computer-mediated communication suggests that the Internet can have complex affects on people's social networks, some of them positive, others negative.

Internet Use, Social Networks and Loneliness: With the advent of the Internet, a new field of investigation has emerged within computer-mediated communication research. It focuses on the Internet and how it affects people's social networks. The studies of Kraut *et al.* (1998), Katz and Aspden (1997), Nie (1999) and Cole *et al.* (2000) use largely quantitative survey research to identify, among other things, the affects of the Internet on people's relationships. This study uses a similar approach.

Kraut *et al.*'s (1998) first longitudinal study on the effects of the Internet on social involvement and psychological well-being showed that greater use of the Internet was significantly associated with decreased communication within the family, a decreased local social network, and increased loneliness and depression. The study was a quasi-experiment using a sample of 169 respondents from 93 families who had not previously been Internet users.[2] They were each given a free computer and free access to the Internet for one or two years in 1995 and 1996.

The "Internet and Society" report by the Stanford Institute for the Quantitative Study of Society (Nie 2000) documents negative consequences of the Internet that are consistent with the findings of the Kraut group. Nie surveyed 4113 Internet users within 2689 households in December 1999 and found that the more people used the Internet, the less time they spent talking to their families and friends, the less time they spent with them, and the less they attended events outside the household.[3]

Katz and Aspden (1997) conducted a survey in October 1995 using 2500 respondents, 8 percent of whom were Internet users. Comparing users with nonusers, they found no evidence of Internet use reducing people's membership in social and religious organizations. Among users, greater use of the Internet was associated with increased contact with family members and an increased participation in online communities.[4]

The results of these studies are contradictory, and it is still unclear whether the Internet reduces, increases, or leaves unchanged the number of face-to-face ties that people have and the time they spend with other people. It is also unclear whether the Internet makes people more or less lonely.

THE MODEL

The design of the studies by the Kraut, Katz, and Nie groups makes them more amenable to prediction than explanation. The survey format enables researchers to capture broad social impacts of the Internet, but makes it difficult for them to explain their results. Nevertheless, Kraut *et al.* (1998) have laid out a tentative theory that offers two main explanations for the negative

consequences observed. The first involves displacement of social activities; with time spent on the Internet unavailable for other activities, social activities suffer the most. However, Robinson *et al.* (2000) found no evidence of time displacement associated with the use of the Internet in a sample of 958 respondents who reported their daily time spent in various activities. No significant differences were found between users and nonusers in time spent in various social activities. Similarly, the UCLA Internet report of Cole *et al.* (2000), a survey of 2096 Americans (users and nonusers), found that while Internet users watch significantly less TV than nonusers, no other significant time displacement effects were found.

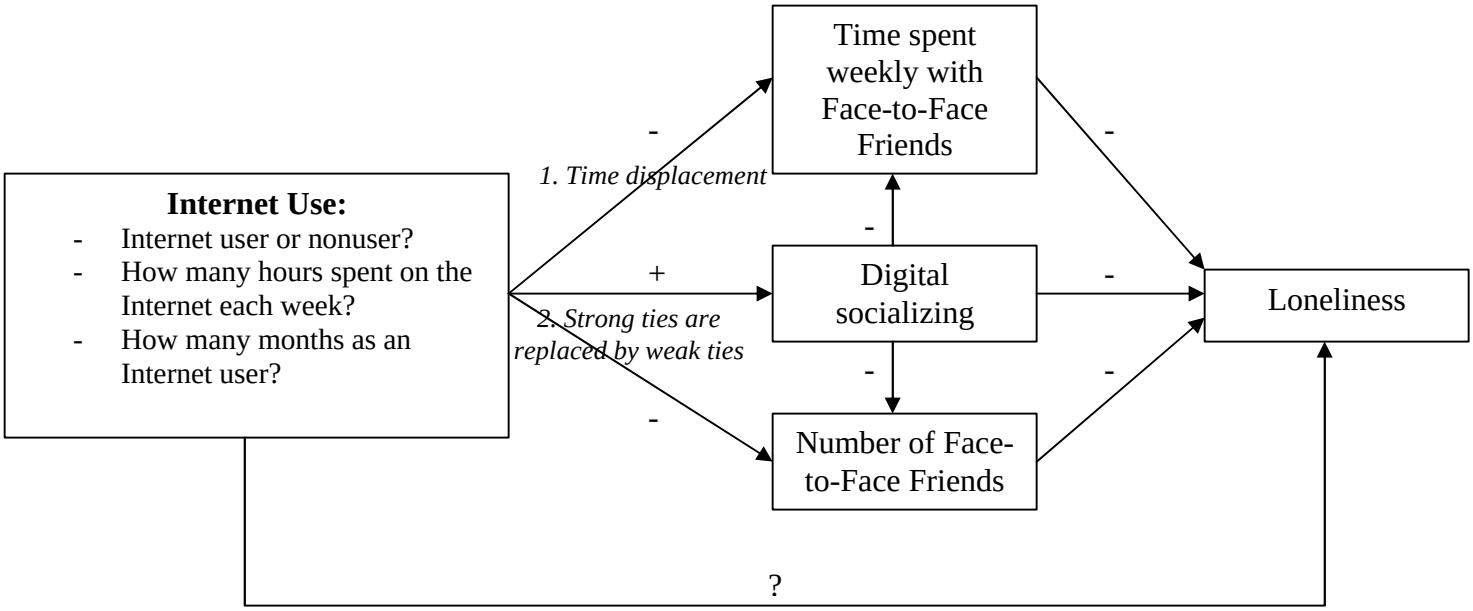
The second explanation advanced by Kraut is that Internet users replace strong face-to-face ties with weak online ties. In a sense, depth of social relationships is traded for breadth. This last explanation deserves elaboration because it is based on several basic assumptions that are not clearly stated in Kraut *et al.* (1998). These assumptions are:

1. As a new social space, the Internet is starting to replace tangible social spaces, with a number of people's face-to-face relationships being replaced by online relationships.
2. Those online relationships will be broader (a greater number of relationships) but less deep.
3. Therefore, people's aggregated relationships—both face-to-face and online—will tend to be broader, but less deep. Breadth here refers to the number of friends people have, the variety of types of relationships they are involved in (friendship, love, professional, etc.) and the diversity of the people they are in relationships with in terms of age, ethnic origin, social status, etc. Depth refers to the emotional and the intellectual strength of the relationship.

Provided that these assumptions are true, it would not necessarily follow that people feel lonelier or suffer decreased well-being.[5] One needs another assumption, which is that depth and breadth are not perfectly substitutable and that depth is more important than breadth in producing the emotional well-being that flows from relationships. Therefore, the Internet has a negative impact on people's relationships, because it decreases their quality. Another way to put it is that face-to-face ties are replaced by more numerous online ties. However, face-to-face ties are strong while online ties are weak. And the breadth of relationships gained in the process doesn't offset the loss in depth.

The problems revealed by the unpacking of Kraut's explanations are addressed by testing the model in Figure 1.

FIGURE 1: HOW THE INTERNET MAY AFFECT SOCIAL NETWORKS AND LONELINESS



Testing this model addresses two main gaps in the literature: (1) "Internet use" is not adequately defined or operationalized. (2) Third variables (Rosenberg 1968) that could intervene between Internet use and loneliness have not been considered.

The first gap is addressed by measuring Internet use in three different ways: (1) whether the respondent is an Internet user or not, (2) how many hours a week the users use the Internet, and (3) how many months users have been using the Internet.

The second gap is addressed by trying to detect whether the Internet has an effect on people's loneliness, controlling for the number of face-to-face friends people have and the time they spend with them.[6] If the Internet still affects people's loneliness, after controlling for the number of face-to-face friends people have and the time they spend with them, then it means that although the Internet is associated with loneliness, one does not know why or through which mechanisms.

The model presented in figure 1 gives rise to the following hypotheses.

Hypothesis 1—Time Displacement: (a) Internet users spend less time with face-to-face friends than nonusers. (b) Among Internet users, the time spent using the Internet weekly is associated with reduced time spent with face-to-face friends. (c) Among Internet users, the number of months since first use is associated with reduced time spent with face-to-face friends. (d) Among Internet

users, having online friends is associated with reduced time spent with face-to-face friends.

Hypothesis 2—Creation of Weak Ties: (a) Among Internet users, the time spent using the Internet weekly is associated with a higher probability of socializing online. (b) Among Internet users, the number of months since first use is associated with a higher probability of socializing online.

Hypothesis 3—Destruction of Strong Ties: (a) Using the Internet is associated with a reduced number of face-to-face friends. (b) Among Internet users, the time spent using the Internet weekly is associated with a reduced number of face-to-face friends. (c) Among Internet users, the number of months since first use is associated with a reduced number of face-to-face friends. (d) Among Internet users, socializing online is associated with a reduced number of face-to-face friends.

Hypothesis 4—Positive Impact of Social Interaction on Loneliness: (a) The more time one spends with face-to-face friends, the less lonely one is. (b) The more face-to-face friends one has, the less lonely one is. (c) Among Internet users, socializing online is associated with reduced loneliness.

Hypothesis 5—Importance of Depth vs. Breadth in Reducing Loneliness: Socializing online will be associated with a smaller decrease in loneliness than the number of face-to-face friends one has and the time one spends weekly with them.

Question 1—Controlling for demographic variables and measures of social connection, how does the Internet affect people's loneliness?: (a) Is using the Internet associated with a reduced, increased, or unchanged level of loneliness? (b) Among Internet users, is the time spent weekly using the Internet associated with a reduced, increased, or unchanged level of loneliness? (c) Among Internet users, is the number of months since first use associated with a reduced, increased, or unchanged level of loneliness?

METHODS

Sample: The UCLA Center for Communication Policy has been conducting a large-scale Internet survey to study Internet use and the impact it has on a variety of social and psychological factors. This paper uses data from the first year of the UCLA Internet Project, which is the longitudinal panel study described in Cole *et al.* (2000). The data were gathered by a telephone survey of 2096 randomly chosen individuals in the U.S. that took place in Spring 2000. The sample included both Internet users and nonusers age 12 and above, randomly chosen using a national Random Digital Dial (RDD) telephone sample

that employed an Equal Probability Selection Method (EPSEM). The interviews were conducted either in English or Spanish.

Dependent Variables of Loneliness and Social Interaction: The model outlined in Figure 1 features four dependent variables. The main dependent variable is level of loneliness. Three items from the UCLA loneliness scale (Perlman and Peplau 1982) were included in the questionnaire.[7] Seven additional questions (not excerpted from the loneliness scale) measured feelings of isolation.[8] All items were measured on a 5-point Likert scale (from strongly agree to strongly disagree). A reliability analysis of the three items of the loneliness scale, together with the additional seven items, yielded a Cronbach *alpha* of .72, which shows internal consistency (Nunnally 1967). Those ten items were therefore used to construct a scale to measure loneliness.

Independent Variables of Internet Use: One problem with previous research is that Internet use has been conceptualized and measured in different ways. While Kraut defines and measures Internet use as the number of hours spent on the Internet weekly (Kraut *et al.* 1998), Katz and Aspden (1997) simply identify use as opposed to nonuse. To be extensive, three measures of Internet use are included. The first makes use of the full sample of both users and nonusers and is a dummy variable for Internet user (user = 1, nonuser = 0). The second and third measures only make use of the subset of the sample composed of Internet users. They are the time spent each week using the Internet and the number of months since the respondent started to use the Internet, which is also called "Internet experience."

Intervening Variables of Digital Socializing and Face-to-Face Socializing: The model features three intervening variables that measure digital and face-to-face socializing by asking the respondents how many friends outside the household they saw or spoke to each week and how much time they spent with them. Those are two measures of face-to-face socializing.[9]

Digital socializing has been operationalized with a dummy variable measuring whether the respondent has formed online friendships or not (whether or not they subsequently met them face-to-face). The reason to restrict this to a dichotomous measure instead of a continuous variable indicating the number of online friends people have is twofold. First, among the people who have online friends, the variance is very high (standard deviation of 0.45), with some respondents mentioning they have several hundreds of online friends. Second, only 28 percent of Internet users actually have online friends. Therefore, the most statistically discriminating and substantive measure of online socializing is whether or not one has formed online friendships instead of the number of online friends one has.

Control Variables: In all of the regressions age, gender, education and income were included as control variables because all have been shown to relate to Internet use (Cole *et al.* 2000; Levy *et al.* 2000), and they might also be related to dependent variables. In the two sets of regressions with loneliness as the dependent variable, the natural logarithm of "number of friends" and "time spent with friends" were also included as control variables.

Regression Analyses: The first set of regression analyses included the whole sample and used "Internet user/nonuser" as the main independent variable. Regression with digital socializing was not included as a dependent variable because Internet nonusers cannot socialize online.

The second set of regressions only used the sub-sample of Internet users, with two measures of Internet use: the number of hours spent weekly using the Internet and the number of months since the respondent first started to use the Internet. For the regression with digital socializing as a dependent variable a binary logit regression was run because the dependent variable is binary.

Each set of regressions ran two nested models, with model I only featuring control variables and model II featuring both control and independent variables. This allows one to see whether there is a significant R^2 change between the models when adding covariates; in other words, does addition of the independent variable(s) lead to significant predictive improvement on the level of the dependent variable? The correlation matrixes used for the first and second type of regressions are shown respectively in Tables 1 and 2.

RESULTS

The results of the three sets of regressions using the full sample are presented in Table 3 and the results of the four sets of regressions using only the sub-sample of Internet users are presented in Table 4. The first hypothesis of time displacement—in which Internet use takes time away from face-to-face socializing—was not supported by the data. Hypothesis 1a, which predicted that Internet users would spend less time with their face-to-face friends than nonusers was also not supported.[10] Hypotheses 1 b, c, and d, which predicted that among Internet users, time spent weekly online, time since first use, and digital socializing would be associated with a reduced time spent with face-to-face friends, were also not supported.[11]

The second hypothesis, that Internet use fosters the creation of online ties (conceptualized as "weak" ties as opposed to "strong" face-to-face ties) was partly supported. Among Internet users, time spent weekly on the Internet

TABLE 1: CORRELATION MATRIX WITH BOTH INTERNET USERS AND NONUSERS

Correlations

Pearson Correlation

	Age	Education	Income	Gender	Nb of F-t-F friends	Time with F-t-F friends	User (0=non-user, 1=user)
Age	1.000	.309**	-.023	.070**	.003	-.128**	-.341**
Education	.309**	1.000	.410**	-.013	-.006	-.097**	.222**
Income	-.023	.410**	1.000	-.119**	.063**	-.027	.315**
Gender	.070**	-.013	-.119**	1.000	-.112**	-.055*	-.080**
Nb of F-t-F friends	.003	-.006	.063**	-.112**	1.000	.452**	.052*
Time with F-t-F friends	-.128**	-.097**	-.027	-.055*	.452**	1.000	.020
User (0=non-user, 1=user)	-.341**	.222**	.315**	-.080**	.052*	.020	1.000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Descriptive Statistics

	Age	Education	Income	Gender	Nb of F-t-F friends	Time with F-t-F friends	User (0=non-user, 1=user)
Mean	5.0343	5.87	5.56	.5507	2.1411	1.9866	.6694
Std. Deviation	1.8947	1.83	2.70	.4975	.9041	.9369	.4706
N	2096	2092	1799	2096	2071	2066	2096

(Hypothesis 2a) was associated with a higher probability of socializing online. However, experience (Hypothesis 2b) is not associated with a higher probability of socializing online.

The third hypothesis, that Internet use would destroy strong face-to-face ties, was not supported. Internet users do not have fewer face-to-face friends than nonusers (Hypothesis 3a). Among Internet users, time spent weekly online (Hypothesis 3b), experience (Hypothesis 3c) and digital socializing (Hypothesis 3d) are not associated with a reduced number of face-to-face friends.[12]

The fourth hypothesis seemed pretty straightforward: social interaction, whether in person or online, should reduce loneliness—and indeed that is found for face-to-face interaction. The more face-to-face friends people have and the more time they spend with them, the less lonely they are (Hypotheses 4a and 4b).[13] Surprisingly, however, digital socializing (Hypothesis 4c) is associated with increased loneliness, controlling for other possible effects of the Internet.

TABLE 2: CORRELATION MATRIX WITHOUT INTERNET NONUSERS

Descriptive Statistics

	Age	Education	Income	Gender	Nb of F-t-F friends	Time with F-t-F friend	Weekly hours use	Experience in Months	Digital socializatior
Mean	4.5808	6.16	6.16	.5229	2.1737	1.9997	9.4198	29.6188	.2755
Std. Deviatio	1.7592	1.91	2.65	.4997	.8736	.9120	10.8163	25.5263	.4469
N	1403	1400	1204	1403	1392	1393	1403	1398	1390

Correlations

Pearson Correlation

	Age	Education	Income	Gender	Nb of F-t-F friends	Time with F-t-F friends	Weekly hours use	Experience in Months	Digital socialization
Age	1.000	.489**	.158**	.003	-.074**	-.178**	.027	.070**	-.245**
Education	.489**	1.000	.352**	-.003	-.067*	-.148**	.139**	.260**	-.183**
Income	.158**	.352**	1.000	-.087**	.047	-.042	.059*	.232**	-.087**
Gender	.003	-.003	-.087**	1.000	-.129**	-.075**	-.059*	-.077**	-.080**
Nb of F-t-F friends	-.074**	-.067*	.047	-.129**	1.000	.429**	-.027	.050	.067*
Time with F-t-F frien	-.178**	-.148**	-.042	-.075**	.429**	1.000	.024	-.009	.095**
Weekly hours use	.027	.139**	.059*	-.059*	-.027	.024	1.000	.323**	.179**
Experience in Months	.070**	.260**	.232**	-.077**	.050	-.009	.323**	1.000	.055*
Digital socialization	-.245**	-.183**	-.087**	-.080**	.067*	.095**	.179**	.055*	1.000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Hypothesis 5 is therefore not supported: the decrease in loneliness associated with socializing online is not smaller than that associated with socializing face-to-face, because socializing online actually increases loneliness.

Might Internet use have an affect on loneliness, controlling for time displacement and exchange of strong ties by weak ties (questions a, b, and c: whether Internet users are more or less lonely than nonusers, and whether the amount of hours spent online and Internet experience are correlated with loneliness)? Indeed, Internet experience is associated with a decrease in loneliness, a result indicating that something in using the Internet positively impacts loneliness—but that it does not have to do with time displacement or with replacement of strong ties by weak ties. In other words, it is unclear why Internet experience is associated with reduced loneliness.

TABLE 3: REGRESSION ANALYSIS ASSESSING THE EFFECT OF INTERNET USE—MEASURED AS A DUMMY VARIABLE FOR USER/NONUSER—ON PEOPLE'S LONELINESS AND SOCIAL INTERACTION

Dependent Variables	**Time with F-t-F Friends**				**Num of F-t-F Friends**				**Loneliness**			
Used to answer:		**Hyp. 1a**				**Hyp. 3a**			**Hyp. 4a and 4b, Qu. 1a**			
Independent variables	**Model I**		**Model II**		**Model I**		**Model II**		**Model I**		**Model II**	
Intercept	2.577	***	2.585	***	1.874	***	1.823	***	3.752	***	3.822	***
Control variables												
Age	-.056	***	-.058	***	.049	***	.057	***	-.002		-.014	
Education	-.042	***	-.042	***	.008		.003		-.069	***	-.062	***
Income	.000		.000		.011		.009		-.051	***	-.047	***
Gender (0=male, 1=female)	-.101	*	-.101	*	-.230	***	-.228	***	-.112	***	-.115	***
Number of F-t-F friends									-.131	***	-.128	***
Time with F-t-F friends									-.024		-.026	
Internet use												
User (0=nonuser, 1=user)			-.013				.083				-.113	***
Interactions												
Age x Internet use												
Education x Internet use												
Income x Internet use												
Gender x Internet use												
Num of friends x Internet use												
Time friends x Internet use												
R^2	0.021		0.021		0.026		0.028		0.163		0.168	
R^2 change			0				0.002				0.005	
F	9.593	***	7.681	***	12.027	***	10.107	***	57.271	***	50.838	***
F change			0				3.650				10.557	***

Notes: *p<.05, **p<.01, ***p<.005; Univariate Analysis of Variance; all coefficients standardized.

TABLE 4: REGRESSION ANALYSIS ASSESSING THE EFFECT OF INTERNET USE—MEASURED AS TIME SPENT WEEKLY ONLINE AND INTERNET EXPERIENCE— ON PEOPLE'S LONELINESS AND SOCIAL INTERACTION

Dependent Variables	**Time with F-t-F Friends**		**Num of F-t-F Friends**	
Used to answer:	**Hyp. 1b, 1c and 1d**		**Hyp. 3b, 3c and 3d**	
Independent variables	**Model I**	**Model II**	**Model I**	**Model II**
Intercept	2.844 ***	2.788 ***	2.239 ***	2.193 ***
Control variables				
Age	-.090 ***	-.089 ***	.004	.004
Education	-.057 ***	-.057 ***	-.009	-.006
Income	.002	.002	.011	.010
Gender (0=male, 1=female)	-.135 **	-.127 *	-.245 ***	-.237 ***
Number of F-t-F friends				
Time with F-t-F friends				
Internet use				
Weekly hours use		.002		-.002
Experience (Num months since 1st use)		.000		.001
Digital socializing		.067		.071
R^2	0.047	0.051	0.021	0.024
R^2 change		0.004		0.003
F	15.332 ***	9.359 ***	6.773 ***	4.201 ***
F change		1.721		1.251

Notes: *p<.05, **p<.01, ***p<.005; Univariate Analysis of Variance; all coefficients standardized.

Dependent Variables	**Loneliness**		**Digital socializing**	
Used to answer:	**Hyp. 4c and 5, Qu. 1b and 1c**		**Hyp. 2a and 2b**	
Independent variables	**Model I**	**Model II**	**Model I**	**Model II**
Intercept	3.732 ***	3.653 ***	.687 ***	.620 ***
Control variables				
Age	-.010	-.007	-.047 ***	-.040 ***
Education	-.059 ***	-.048 ***	-.017 *	-.025 ***
Income	-.042 ***	-.036 ***	-.007	-.009
Gender (0=male, 1=female)	-.147 ***	-.141 ***	-.094 ***	-.082 ***
Number of F-t-F friends	-.146 ***	-.146 ***		
Time with F-t-F friends	-.046 *	-.044 *		
Internet use				
Weekly hours use		.000		.007 ***
Experience (Num months since 1st use)		-.003 ***		.001
Digital socializing		.157 ***		
R^2	0.144	0.169	0.052	0.092
R^2 change		0.025		0.040
F	34.495 ***	27.409 ***	16.783 ***	20.689 ***
F change		12.194 ***		18.062 ***

Notes: *p<.05, **p<.01, ***p<.005; Univariate Analysis of Variance; all coefficients standardized.

Overall, the results show a slightly different picture than the one proposed by Kraut. The Internet is indirectly associated with an increased loneliness (as predicted), but its affect is mediated by digital socializing (not studied by Kraut)—and not by time displacement or replacement of strong ties by weak ties (suggested, but not tested by Kraut).

Furthermore, Internet use is slightly associated with reduced loneliness, controlling for demographic variables and for face-to-face social interaction. Controlling for the number of face-to-face friends people have and the time they spend with them, the longer people have been Internet users, the less lonely they are.

Overall, the impact of the Internet on loneliness is unclear and complex. On the one hand, it increases loneliness, by encouraging digital socializing, which in turn increases loneliness. But at the same time, it is directly associated with a slightly lower level of loneliness. However, the indirect negative impact of digital socializing offsets the direct positive impact of Internet use, the former having a standardized coefficient of .157 and the latter one of -.003.[14] This lends some support to Kraut's findings, although the mechanisms are different from those hypothesized by Kraut.

The findings are summarized in Figure 2.

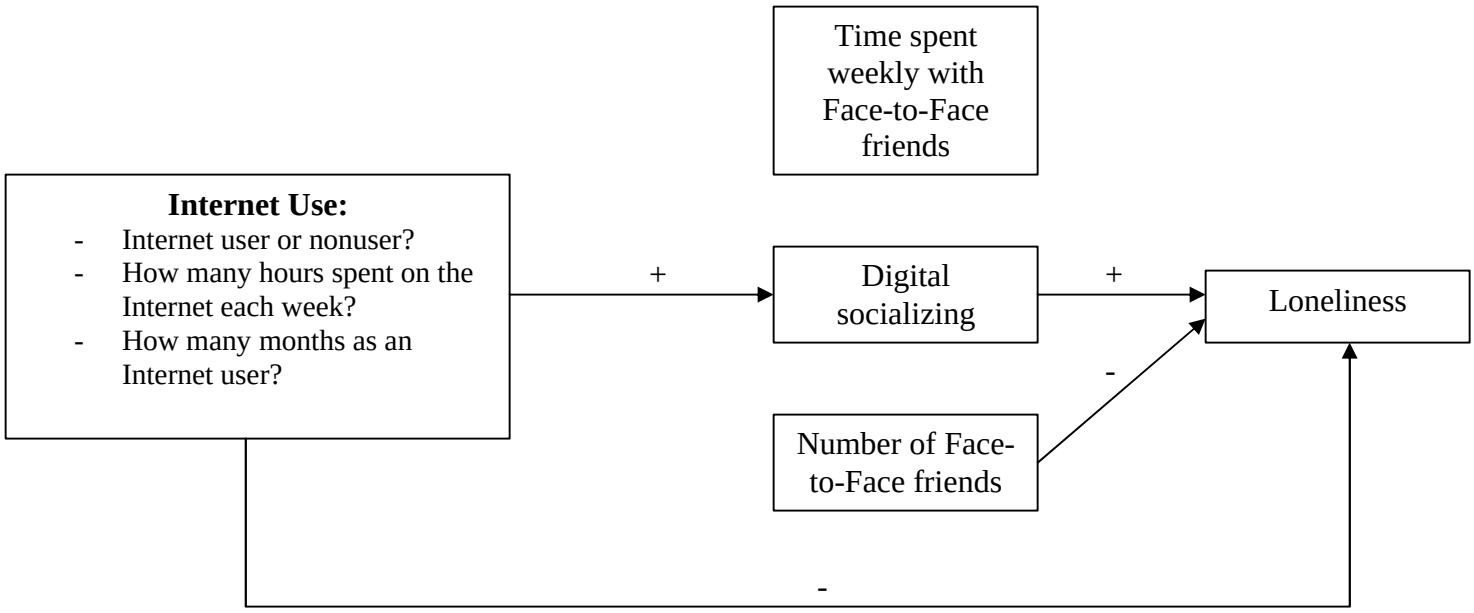
DISCUSSION

The results are somewhat counterintuitive, since it seems that Internet use is associated with a lower level of loneliness, independent of its impact on people's social networks. However, among Internet users, socializing online is associated with an increased level of loneliness, again independent of its impact on people's social networks. This last result is particularly surprising since it would be expected that the more friends people have (either face-to-face or online) the less lonely they are. This hypothesis is verified in the case of face-to-face friends, but there is a positive, significant correlation between online socializing and loneliness, which is very surprising.

These results are different from those of Kraut and Nie. Using the Internet does not change people's social networks, the number of face-to-face friends they have nor the time they spend with them. Therefore, these factors cannot be intervening variables between the use of Internet and psychological measures such as loneliness. Moreover, using the Internet is associated with reduced loneliness, which suggests a positive impact rather than a negative one, although the mechanisms through which this comes about are not clear. There is no general evidence of time displacement, which runs counter to the Kraut's first theoretical explanation.

Nevertheless, there are results that could support some of Kraut's notions. Thus, Internet users who socialize online are more lonely than those who do not, controlling for demographic variables and social interaction variables. This negative effect is stronger than the direct positive effect of

FIGURE 2: HOW THE INTERNET AFFECTS PEOPLE'S SOCIAL NETWORKS AND LONELINESS



Internet use. It could be the case that people who have online friends use Internet in a "social" way, although the hypothesis cannot be tested with these data. In other words, in order to have online friends one needs to envision the Internet as a social space rather than just an informational or basic communication tool. This pattern of use, which might become more common as the Internet becomes mainstream, could cause users to be more lonely. But why, since it does not alter their existing social networks?

A possible explanation could come from the literature on relationships in social psychology. Interdependence theory (Kelley and Thibaut 1978; Rusbult and Arriaga 1997) conceptualizes relationships in terms of rewards, costs, and outcomes. Within this framework, the cognitive evaluation of outcomes is hypothesized to affect the level of satisfaction of people involved in a relationship. One of the cognitive processes that people use to evaluate their current relationship consists of comparing it with other relationships that they are involved in—or past states of the same relationship. This Comparison Level (CL) (Rusbult 1980; Heider and Benesh-Weiner 1988) means that people are not only affected by the absolute outcomes (positive or negative) of their relationships, but also by the relative outcomes. To give an example, John might not be happy with the fact that his girlfriend Mary smokes because he is uncomfortable with addictive behaviors, which adversely affects his satisfaction with the relationship. However, he might be content because she has stopped

drinking. Hence, comparing the state of the relationship in two different time periods might have a positive or negative impact on the level of satisfaction.

Another type of comparison that people might perform is the Comparison Level for Alternatives (CL Alt) (Rusbult 1980; Heider and Benesh-Weiner 1988), which means that people not only compare their present relationships with past ones, but also with the potential relationships in which they could be involved. For example, Betty is dating Rob and is satisfied with her relationship. But she thinks that she could be dating George, with whom she would have a better relationship. This comparison decreases her level of satisfaction with her relationship with Rob. This mechanism could cause an observed higher level of loneliness among people who have online friends, controlling for social relations variables. Having online friends could decrease people's satisfaction with their current relationships by presenting them with several alternatives that might be more attractive than the ones they have around them—thus decreasing their satisfaction and possibly increasing their loneliness.

Limitations: The most important limitation of this analysis is its one-time correlational design, which does not allow for causal inferences. One cannot be sure of the direction of causality. It is possible that lonely people are more likely to have online friends, seeking a relief for their loneliness, instead of having online friends making people lonely.

Another limitation of the study involves the measures of loneliness. Although the measure was reliable, it was composite and did not include the full set of items of the UCLA loneliness scale. It might be measuring something other than loneliness.

This study was a partially exploratory effort to measure the social impact of the Internet. However, one is still not able to explain fully the mechanisms that cause what is observed. The Internet remains largely a "black box," and further research needs to identify with more precision what it is in the use of the Internet that causes people to be more or less lonely. Qualitative studies might be even more helpful for the formulation of theory.

Another limitation of this paper is that the fast pace at which the Internet is spreading and changing makes any results of studies done on its social impact at risk of becoming obsolete if the factors that caused them change or disappear. Without clear theories that carefully open the black box of the Internet, this risk will always be non-assessable and therefore great.

Finally, in this article the impact of the Internet on social relationships is assumed to be homogenous across all types of people. However, a forthcoming paper (Yamauchi and Coget 2002) calls this assumption into question. Although no correlation was found between Internet use and social interaction variables (number of face-to-face friends and time spent with them), entry of interaction terms between Internet use and demographic variables (to account for differential effects), yielded significant results for Internet use. That paper concluded that heterogeneous effects were canceling each other out, thus hiding

the impact of the Internet on social interaction variables. Such results refine the present analysis and point out the need to be careful when claiming to study the overall impact of the Internet on people. Not taking into account their individuality might give an overly simplistic picture of the impact of the Internet on society.

Further Research: Further research needs to test the model with a longitudinal dataset, and the UCLA Internet project involves a longitudinal panel design. Follow-up interviews will be conducted, making it possible to make causal inferences and to document whether lonely people are more likely to have online friends or whether having online friends makes one more lonely. Does the level of loneliness of people who were previously nonusers and then became users increase or decrease? Examining whether people who developed online friendships between the first and the second wave of data collection became more lonely would be an interesting test of the CL Alt hypothesis.

It would also be interesting to test more precisely the hypothesis about strong ties being replaced by weak ones. Online ties have been assumed to be weak and face-to-face ties to be strong, which in a way assumes the result in the definition. A definition of the strength of a tie that is independent of whether it is online or face-to-face is needed to observe the relationship between strength and loneliness.

Finally, since having online friends is associated with an increased level of loneliness, it would be interesting to study the determinants of "having online friends," in order to gain further insight into the phenomenon.

CONCLUSIONS

The contributions of this article mainly involve the new evidence to answer the key question: Does Internet use affect people's loneliness? How does it do so? More precisely, does it do so through affecting people's social networks? The results are different from those of Kraut, Nie, and Katz and Aspden. Consistent with Katz and Aspden, no effects of the Internet on people's social networks are found, but there is a mild positive effect of the Internet on people's loneliness (that is, it is associated with a reduced loneliness). However, consistent with the general idea of Kraut, the Internet has an indirect negative impact on people's loneliness through online socializing, and this negative effect is stronger than the positive direct effect of Internet use. This negative impact of the Internet happens through a very different channel than the ones hypothesized by Kraut. This constitutes an intriguing finding that deserves further research and attention.

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ENDNOTES

[1] Questions about this article should be directed to jcoget@anderson.ucla.edu
[2] In a subsequent note on this article (Kraut *et al.* 1998), Kraut acknowledges the limitations of sample that might not have been representative of the American population. Another limitation is inherent to the design of quasi-experiments: a variety of concurrent phenomena that happen during the time of the study might cause the observed results, creating a risk of misspecification in the model.
[3] It is important to note that those effects were self-reported (e.g., respondents are asked directly whether the Internet has decreased, increased, or left unchanged the time they spend with their families and friends), which introduces the possibility of respondent bias.
[4] One important limitation of Katz and Aspden's study is that, although they included some demographic variables in their regression analyses, they did not include social interaction control variables that might have important explanatory power on their dependent variables. Their study also lacks conceptual interpretations of their results. It is largely atheoretical.
[5] Perlman and Peplau (1982) define loneliness as "the subjective discomfort one feels when social relations lack some important feature." As such, loneliness is different from aloneness in that it is a psychological state that can be felt even in the presence of others while aloneness refers to being physically alone.
[6] This is represented by the question mark on the arrow that goes from Internet use to loneliness on the model.
[7] (1) You feel outgoing and friendly. (2) You feel you have a lot in common with people around you. (3) You feel no one really knows you well. The full list of items is shown in the Appendix to the next article by Cole and Robinson.
[8] (1) You're left out of things around you. (2) You wish you had more confidence in social situations (3) In general, you are a shy person. (4) Your life could be happier than it is now. (5) Most of the things you do are boring or monotonous. (6) These days, a person doesn't really know whom he or she can count on. (7) Most people really don't care what happens to the next fellow.
[9] For these two variables, outliers were replaced by the mean plus three times the standard deviation. In addition, the variables used in the regression analyses for these two variables were their natural logarithm. This was done to reduce the excessive long right tail of the distribution: the distribution of the variable "time spent with friends" had a skewness of 3.0 (with a S.E. of .05) and the distribution of the variable "number of friends" had a skewness of 8.0 (with a S.E. of .05).
[10] In Table 3, the first regression, with "Time spent with face-to-face friends" as a dependent variable, shows no improvement of the model when the variable "user/nonuser" is added to the demographic control variables.
[11] In Table 4, the first regression, with "Time spent with face-to-face friends" as the dependent variable, shows no improvement of the model when the variables "weekly hours use," "experience," and "digital socializing" are added to the demographic control variables. In Table 4, the last regression, with "Digital socializing" as the dependent variable, shows improvement of the model, and the variable "weekly hour use" has a significant positive coefficient.
[12] C.f. tables 3 and 4: regressions with "Number of face-to-face friends" as the dependent variable.

[13] C.f. Table 4, regression with "loneliness" as the dependent variable.
[14] Both coefficients are standardized and in the same regression equation, which allows for comparison of their respective effect.