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Examining the Effect of Internet Use on Television Viewing

Details Make a Difference

The proportion of U.S. households with a computer soared from 8.2% in 1984 to 56.5% in 2001. By September 2001, over 50% of U.S. households also had Internet access (U.S. Department of Commerce, 2002). The dramatic changes now occurring in household computing have the potential to change the lives of average citizens as much as the telephone did in the early 1900s and the television did in the 1950s and 1960s. Social scientists are now attempting to document how computing and the Internet are becoming integrated into the daily lives of users and the effects that this use is having. For example, efforts to document the effect of Internet use are occurring in the domains of psychological use of time and other media (see chapter 5), establishment and maintenance of social relationships (see chapter 19), political participation (Katz & Rice, 2002), psychological functioning, health, education (see chapter 11), and consumer behavior, among other domains.

This chapter examines the methods that many social scientists deploy to examine this effect. We review prior literature to illustrate problems that are widespread in examining the influence of Internet use. We argue that much of this research reaches limited or even erroneous conclusions, both because it uses cross-sectional data to draw causal implications and because it fails to distinguish between varieties of Internet use.

The empirical section of this chapter is based on a national panel survey of 980 individuals. We show that the Internet is used for a wide range of functions. We use confirmatory factor analysis to disaggregate overall Internet use into a set of components, which are only moderately related with each other: interpersonal communication with friends and family, interpersonal communication with strangers, instrumental information seeking, entertainment, and commerce. Just as one would expect that chatting with friends on the phone and watching entertainment on television would have different influences on those who use these earlier technologies, so too would one expect that using the Internet for different purposes will have different effects on its users.

The empirical study examines the effects of Internet use on television viewing, illustrating the time-use perspective on the effect of new media. We use hierarchical linear growth modeling to differentiate cross-sectional from longitudinal relationships. Conclusions from cross-sectional data differ from those based on longitudinal data, and both sets of conclusions depend on how people use the Internet. For example, the cross-sectional analyses

show that people who use the Internet heavily tend to watch television more frequently than those who do not use the Internet at all or who use it lightly. This association is especially strong for people who use the Internet for entertainment and escapist activities and is reversed for people who use the Internet to communicate with friends and family. In contrast, the longitudinal data show that heavier use of the Internet is associated with declines in television viewing. This association is especially strong for people who use the Internet to participate in online groups and meet new people online.

Problems with the Current Research

Varieties of Internet Use

Compared to television or the telephone, the Internet is a plastic technology, amenable to a wider range of uses. According to recent data from the Pew Internet and American Life project (Pew Internet & American Life Project, 2003), Americans use the Internet most for sending electronic mail, using search engines, researching products and services before buying, and looking for information for hobbies and leisure activities. However, the range of use is very diverse and includes playing online games, listening to music, downloading pornography, developing and displaying photographs, gambling, taking a class, and seeking dates. As individuals gain more experience with the Internet, they increasingly use it for a wider variety of purposes. Subscribers get Internet access for one purpose, but then its use extends to many other areas of daily life. For example, parents may buy a computer for their children's school work but then find that the household also uses it for e-mail, instant messaging, game-playing, and online shopping (e.g., Kraut, Scherlis, Mukhopadhyay, Manning, & Kiesler, 1996).

Moreover, the potential uses of the Internet have expanded greatly as businesses and other organizations offer new content and services online. Although information sharing and communication were available from the early days of the ARPAnet (Leiner et al., 2002) the amount of information available, the topics covered, the numbers of potential online communication partners, and the services to support information acquisition and communication have all increased since the 1970s, radically expanding the options open to users. Two popular yet recent additions include sophisticated search engines and instant messaging applications.

Despite this diversity of use, most research on the social impact of the Internet treats its use as an undifferentiatable whole. Many researchers simply compare Internet users with nonusers (e.g., Cole et al., 2000; Pronovost, 2002; Robinson, Kestnbaum, Neustadtl, & Alvarez, 2002), which is an especially crude comparison. Others compute an aggregate frequency-of-use measure without differentiating among types of use. For example, our own research used a summary index of Internet use (self-reported frequency of use in Kraut et al., 2002; machine-logged hours of use in Kraut et al., 1998) when assessing the consequences of Internet use on social involvement and psychological well-being. Others concentrate on people's history of online activity; for example, distinguishing new users from veterans (e.g., Cummings & Kraut, 2002; Howard, Rainie, & Jones, 2001; Katz & Aspden, 1997).

There is strong reason to think that different personal attributes and precipitating events will cause people to use the Internet for different purposes. For example, compared to adults, teenagers and young adults are much more likely to use the Internet for listening to music, for visiting chat rooms to meet new people, and for synchronous communication through instant messaging programs (Lenhart, Rainie, & Lewis, 2001). Consistent with their broader role responsibilities, women are more likely than men to use the Internet for communication with friends and family (Boneva, Kraut, & Frohlich, 2001). Women, people who are ill, and those who care for ill family members are especially likely to use the Internet as a course of health information (Kommers & Rainie, 2002). Extraverts are especially likely to use the Internet for social communication (Kraut et al., 2002).

There is also reason to expect that using the Internet for different purposes is likely to have differential effects on the users. McKenna (chapter 19) argues, for example, that people who use the Internet to reveal aspects of their true selves get more benefit from its use than do others. The parallels with television viewing, a much more constrained activity, are instructive. Watching dramatic violence on television in childhood leads to more aggressive behavior in adulthood (Huesmann, Moise-Titus, Podolski, & Eron, 2003). How television is used, however, makes a difference. In addition to this influence on adult aggression, using

television primarily for entertainment purposes (rather than for information) is associated with declines in civic engagement. In contrast, watching the news on television, even though it is filled with violence, seems to be associated with more benign social outcomes, including increased civic engagement (Putnam, 2000).

Very little research has attempted to demonstrate that specific uses of the Internet have identifiable consequences, and most of it is concentrated in the area of health (see Bass, 2003, for a recent review). More generally, Kraut, Mukhopadhyay, Szczypula, Kiesler, and Scherlis (1999) distinguished between using the Internet for interpersonal communication and using it for acquiring information. Although using the Internet for communication led to increased time spent online in subsequent periods, using the Internet for information-gathering purposes decreased time spent online in subsequent periods. Weiser (2001) also differentiated between using the Internet for social reasons and for information purposes. On the basis of cross-sectional data, he concluded that social uses of the Internet led to reduced social integration, whereas greater use of the Internet for informational purposes was associated with increased social integration. Although valid, the distinction between communication and informational uses of the Internet is not precise enough. For example, communication with friends and family is likely to differ from communication with strangers online, both in terms of causes and of consequences. Weiser's (2001) paradoxical conclusions that social uses of the Internet were associated with low social integration may reflect his construction of a social use scale that was dominated by communication with strangers. One of the goals of the current research is to differentiate among uses of the Internet in a richer way and to identify uses that lead to changes in other media use.

Comparison of Cross-Sectional and Longitudinal Research Methods

The second goal of this chapter is to illustrate how survey research design can influence the conclusions one can draw about the effects of Internet use. To do so, our research contrasts cross-sectional designs with panel designs. Cross-sectional designs assess the association of Internet use and a variable of interest at a single time point. In contrast, panel designs collect data from the same people at multiple time periods and estimate the degree to which changes in a dependent variable are associated with Internet use.

Documenting the Effect of Internet Use

To make these issues concrete, we examine the effects that Internet use has on television viewing. The Internet's effect on the use of other media is related to earlier research in media studies that examines the substitutability of the mass media or their ability to stimulate each other (Atkin, 2001; Robinson & Kestnbaum, 1999). In addition, this dependent variable is generally representative of a research tradition that examines how the introduction of one pastime affects other uses of time (Gershuny, 2000; Robinson, 1990).

Many commentators hypothesize that the Internet will displace television or, at least, will reduce its dominance in the American household, much as television viewing did to listening to the radio, reading magazines, or going to the movies. As Robinson and De Haan (chapter 5, this volume) note, according to a functional displacement hypothesis, one technology will displace another to the extent that the new technology can be used for similar functions as the old, while offering new opportunities or reduced costs (Carey & Moss, 1985). For example, television displaced radio as the preferred source for story-based entertainment and the evening newspaper as the source for news, in part, by augmenting the earlier technologies with moving pictures. By this logic, one may expect that the Internet could displace television as a source of both entertainment and news by increasing the diversity of available material and offering individualization of schedule and content.

To date, evidence on how Internet use affects television watching is ambiguous. For example, Coffey and Stripp (1997) concluded from PC meter data that personal computer use did not reduce the time users spent viewing television. Around that same time, in a seminal study of American use of time, based on self-report diary data, Robinson and Godbey (1999) found no substitution of television watching with computer use. However, results from more recent research are mixed, with some research indicating that the Internet is displacing television watching (Kaynay & Yelsma, 2000; Nie & Hillygus, 2002) and some showing just the reverse—that

Internet use increases TV watching and other media use (Cole et al., 2000). In chapter 5, Robinson and De Haan show that Internet users watch approximately 4 fewer hours of television per week than do nonusers in the United States (table 5.2), but in the Netherlands, Internet users and nonusers do not differ in their hours of television watching (table 5.4).

The functional displacement hypothesis goes beyond merely predicting that heavy Internet use will lead to reductions in television viewing. If functional displacement is happening, then how people use the Internet should determine what other technologies will be displaced. In particular, we should expect to see greater reductions in television watching among those who use the Internet for news and entertainment purposes than among those who use it for other purposes, including communication and commerce.

Data and Methods

Data Collection

The data for this study come from a national United States panel survey conducted between June 2000 and March 2002. Respondents completed a questionnaire at time 1, starting in June 2001, and again 6–8 months later at time 2, via postal mail or on the Internet. The national sample was recruited by random digit dialing of residential telephone exchanges to secure a representative sample of United States households. Of those initially contacted by telephone, 43% agreed to participate. Of the original sample, 41% completed the survey at time 1, and 82.8% of these participants completed the survey again at time 2. Seventy-four percent of respondents at time 1 and 72.3% at time 2 had Internet access. Respondents with Internet access were asked to complete the survey online, whereas those who did not have Internet access were mailed paper surveys. If respondents with Internet access did not complete their survey online, they were subsequently sent a copy by postal mail. Of all respondents at both times, 60% completed the survey online, and all others completed a mail survey. Respondents' ages ranged from 13 to 94 years. Of those who completed the surveys, 85% were adults (19 years of age or older), 43% were men, 89% were Caucasian, and 61% were married. Of all respondents, 30% had a household income of up to $30,000, 44% had incomes of between $30,000 and $70,000, and 26% had an income of $70,000 or more.

Key Variables

Internet Use

The major independent variable for this research is the extent to which respondents used the Internet. All the measures are based on respondents' descriptions of the frequency with which they used a computer or the Internet at home for 27 different purposes, such as "communicating with friends," "getting the news online," "playing games," and so on. Figure 6.1 lists the full set of items asked. Participants responded using a 7–point, quasi-logarithmic Likert-scale, with response categories of "several times a day," "about once a day," "3–5 days per week," "1–2 days per week," "every few weeks," "less often," and "never." We then used these items to construct several indexes of Internet use. These indexes indicated whether the respondent used the Internet for any of the stated purposes and included both a binary measure—indicating whether the respondent used the Internet at all—and several continuous measures for how often respondents used the Internet, both overall and for specific purposes. We describe the creation of these Internet-use indexes in the following paragraphs.

Some research has simply compared users and nonusers of the Internet (e.g., chapter 5; Katz & Aspden, 1997), whereas others have used a measure of time spent online among active Internet users (e.g., Goget, Yamauchi, & Suman, 2002). Because the first of these approaches uses a dichotomous measure, it is insensitive. The second approach uses a measure that can only be calculated for those who actively use the Internet, truncating the distribution of Internet use and limiting the statistical power available for analysis. Our research combines these approaches by constructing two measures of Internet use: a binary measure and a frequency measure. As described later, we also disaggregated the frequency measure of Internet use to create separate indexes to measure the use of the Internet for each of several different functions, among those who use the Internet at all.

Use of Internet. We constructed a binary measure of Internet use at home at each time period. This

variable was coded 1 if respondents indicated they used the Internet for any of the 27 functions listed in figure 6.1; if not, the variable was coded 0.

Frequency of Internet Use. We constructed an index to measure the frequency and range of applications for which respondents used the Internet. This index consists of the mean frequency of use for each of the 27 online functions. This was an internally consistent measure (Cronbach's alpha of .91) with high stability over time (test–retest correlation = .66). As described below, using both exploratory and confirmatory factor analysis, we examined the substructure of this index among those who used the Internet at all (i.e., those for whom *Use Internet* was true).

Components of Internet Use. Our previous work showed that one can differentiate participants' Internet use on the basis of their activities (Kraut et al., 2002). Exploratory factor analysis of a list of 28 online activities collected from respondents in the Pittsburgh area indicated that typical Internet use can be broken out into at least five components: communicating with friends and family, communicating with strangers, acquiring instrumental information, finding product information, conducting commercial transactions, and entertainment. Because in this study we added multiple items assessing respondents' use of the Internet to seek health-related information, we expected to uncover six components for why respondents used the Internet: communication with friends and family, communication with strangers, news and instrumental information, health information, commerce, and entertainment.

To examine the structure of Internet use in the current sample, we conducted a series of five confirmatory factor analyses. The single factor model (model 1 in table 6.1), in which all 27 items in figure 6.1 are presumed to reflect a single latent variable, represents the hypothesis that Internet use is

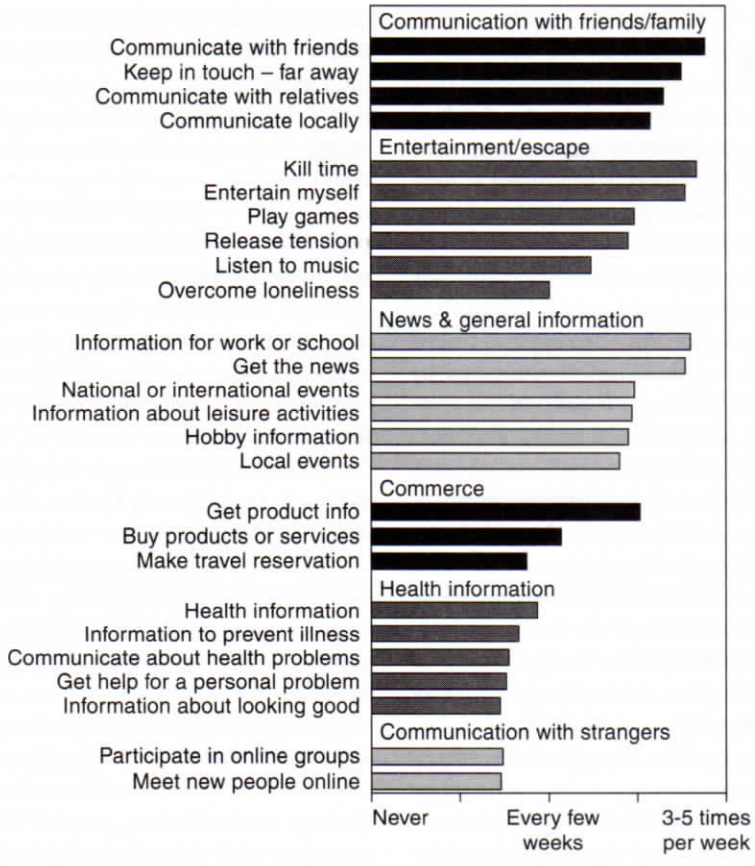

Figure 6.1. Frequency of Internet use for six distinct purposes.

best represented by a single index that taps how frequently respondents used the Internet, regardless of what they use it for. This model tests the default assumption made in the research literature as a whole. The single-factor model was a very poor fit to the data (Bentler-Bonett normed fit index = 0.79; comparative fit index = 0.81). The input data consisted of the respondents' average Internet use for each function across the two surveys (i.e., a 922 respondents with Internet access by 27-function matrix). We compared this single-factor model to several multifactor models. Model 2 tests whether differentiating between interpersonal communication and other uses explains the data well. Model 3 differentiates the noncommunication uses of the Internet but lumps communication with friends and family together with communication with strangers. Model 4 differentiates all components, except for the informational uses, and combines informational uses for news and local events with health information. Model 5 is the six-factor solution described previously. It represents the hypothesis that one can distinguish six distinct ways of using the Internet.

The six-component model (model 5 in table 6.1) was the best fit to the data. It is the model reflected in figure 6.1. It was a much better fit than the single-factor model (model 1) and significantly better than models that merely distinguished between communication and other uses (model 2), combined different kinds of communication (model 3), or combined different kinds of information (model 4).

Frequency of Television Viewing

Respondents also indicated at each time period how often they used television for each of 21 functions in the 6 months before the survey, using a logarithmic-like, Likert response scale that ranged from several times per day to never. These functions were a subset of the functions asked about the Internet, excluding the interpersonal communication activities that are impossible to perform using a television, such as joining online groups or communicating with friends or relations. The index was highly reliable (Cronbach's alpha = 0.85) and had high stability across time (test–retest reliability = 0.63).

Table 6.1. Confirmatory factory analysis of uses of the Internet.

Model no.	*No. of components*	*Component descriptions*	*NFI*	*CFI*	χ^2	*DF*	*P-value, fit improvement*[a]
1	1	Twenty-seven items as a single component	0.79	0.81	4638.3	325	
2	2	Communication with family/friends/strangers News/health information/commerce/entertainment	0.81	0.83	4212.95	324	<.0001
3	5	Communication with family/friends/strangers News Health information Commerce Entertainment	0.85	0.86	3413.19	325	<.0001
4	5	Communication with family/friends Communication with strangers News + health information Commerce Entertainment	0.88	0.89	2703.71	324	<.0001
5	6	Communication with family/friends Communication with strangers News Health information Commerce Entertainment	0.88	0.90	2660.26	325	<.0001

NFI, Normed Fit Index;CFI, Comparative Fit Index.
[a]*p*-value for the hypothesis that model N is a better fit to the data than model N-1.

Control Variables

Respondents provided their gender, age, marital status, level of education, race, and income, as reported at time 1. In addition, at time 1, we included Johnand Srivastava's (1999) measure of extraversion. The extraversion scale was reliable (Cronbach's alpha = 0.83). Because these variables have been associated with both Internet use and television viewing in other research, we include them in all analyses that follow

Data Analysis Methods

We use hierarchical linear growth models (Singer & Willett, 2003) to estimate how respondents' Internet use influenced their television watching. In hierarchical linear growth models, an outcome of interest (in this chapter, television viewing) is measured at multiple time periods (here on questionnaires collected in 2000 and 2001). The predictors include static characteristics of the respondent (here gender, race, education, and extraversion), time (whether the data was collected in 2000 or 2001), and the amount the respondent used the Internet. Although we collected information about Internet use both in 2000 and 2001, we use only the data from 2000 in the models to make interpretation of the data clearer. By using Internet use only from time 1, we exclude the ambiguity that may result from television habits changing as a result of Internet use.

Ordinary least squared regression techniques are not appropriate for longitudinal designs with repeated measures, because ordinary least squares regression assumes that measurement errors are independent and normally distributed and have constant variance. In contrast, hierarchical linear modeling recognizes that responses from the same respondent are not independent of each other. The hierarchical linear growth model separates out the variances associated with the respondent from the variances associated with the time period nested within the respondent. The models allow both intercepts (here, the initial levels of television use) and slopes (change in television use over time) to vary by respondent, and the analysis attempts to account for both individual differences in intercepts and slopes. It calculates the correct degrees of freedom associated with each level of the analysis (respondent or questionnaire) and provides more appropriate estimates of the standard errors than does ordinary least squares regression.

In the analyses in table 6.3 below, we distinguish between cross-sectional associations, which account for individual differences in intercepts, and longitudinal associations, which account for individual differences in slopes. Models 1 and 3 are cross-sectional analyses that test whether respondents who used the Internet at all or those who used it more frequently differ on television viewing from those who do not use the Internet at all or use it less frequency. For these cross-sectional analyses, Internet use and the dependent variable are measured on the first questionnaire. Models 2 and 4 are analyses of the panel data, adding time to models 1 and 3, respectively. The time effect in the panel analyses tests whether frequency of television viewing changes between time 1 and time 2. The time-by-use Internet interaction tests whether changes in television viewing differ among Internet users and nonusers. The time-by-Internet frequency interaction tests whether the change in television viewing varies with the amount the respondents uses the Internet.

In table 6.4, we conducted similar analyses, using the disaggregated measures of frequency of Internet use for specific purposes (i.e., communication with friends, communication with strangers, information, entertainment, commerce, and health). Because using the Internet for a distinct purpose is contingent on using the Internet at all, we conducted this analysis only among Internet users. We conducted preliminary analyses to determine whether the overall frequency of Internet use influences television viewing among Internet users (i.e., that the earlier results do not reflect only the comparison of Internet users and nonusers). We then substitute the six components of Internet use listed in table 6.1 for the overall frequency of use, including them in a single model to control for other Internet use when examining the effects of any single type of use.

Results

Preliminary Analyses

Table 6.2 shows the descriptive statistics for the variables used in the regressions in 2000.

Overall Internet Frequency

Model 1 in table 6.3 shows results from the cross-sectional modeling, predicting the frequency of

Table 6.2. Descriptive statistics in 2000.

Variable	*Mean*	*SD*	*N*
Age (years)	45.2	17.5	913
Education (7-point scale: 1 = elementary school, 3 = high school graduate, 5 = some college, 7 = advanced degree)	4.7	1.8	895
Income			
Marital status (1 = married, 0 = single)	0.6	0.5	963
Race (1 = white, 0 = other)	0.9	0.3	929
Gender (1 = male, 0 = female)	0.4	0.5	950
Extraversion (7-point scale: 1 = low, 7 = high)			
Frequency of Internet use (1 = never, 4 = 1 or 2 days/week, 7 = multiple times per day)			
Overall frequency (27 functions):	1.2	1.0	963
News & information	1.6	1.4	959
Entertainment	1.4	1.5	956
Commerce	1.0	0.9	958
Health Info	0.5	0.7	961
Communicating with friends and family	1.8	1.7	959
Meeting new people	0.3	0.9	955
Frequency of television watching (1 = never, 4 = 1 or 2 days/week, 7 = multiple times per day; mean of 21 functions)	1.8	0.8	958

television watching respectively from Internet frequency, the continuous measure of frequency of Internet use. In terms of control variables, poorer and more extraverted respondents watch television more frequently than do others. The significant, positive coefficient of the Internet frequency variable means that heavier Internet users, that is, those who use the Internet more frequently and for a wider range of purposes, also watch television more frequently.

Model 2 adds the time and time-by-Internet frequency interactions to model 1 to assess whether television viewing changed over time and whether Internet frequency moderated this change. Note that the estimate for the main effect for Internet frequency in model 2 is approximately of the same magnitude and significance level as it was in model 1. The main effect of Internet frequency represents the cross-sectional association of Internet frequency with the frequency of television watching (although in model 2 it represents the association of Internet frequency at time 1 with television watching at both time 1 and time 2). The statistically significant time effect in model 2 shows that television viewing increased between 2000 and 2001 for the sample as a whole. The statistically significant negative time-by-Internet frequency interaction shows that the growth in television viewing was less strong among respondents who used the Internet heavily compared to nonusers. Figure 6.2 illustrates the interaction. Although television watching increased for respondents who did not use the Internet at all, it declined among those who used it most in the sample.

The overall frequency of Internet use is based on two components: a contrast between Internet users and nonusers and the frequency of use among those who do use the Internet. To clarify the results involving Internet frequency in model 2, we conducted two supplementary analyses that contrasted Internet users and nonusers and, among Internet users, contrasted those with compared heavier and lighter use (table 6.4). The nonsignificant use Internet estimate in model 3 shows that cross sectionally, Internet users and nonusers did not differ in their television viewing. However, the significant, negative time-by-use Internet interaction shows that television viewing increased among respondents who did not use the Internet but declined among those who did use it. In model 4, the significant positive Internet frequency estimate is a cross-sectional effect. It shows that among Internet users, people who used the Internet more frequently also watched television more frequently. In contrast, the significant negative time-by-Internet frequency interaction represents a longitudinal analysis and shows that among Internet

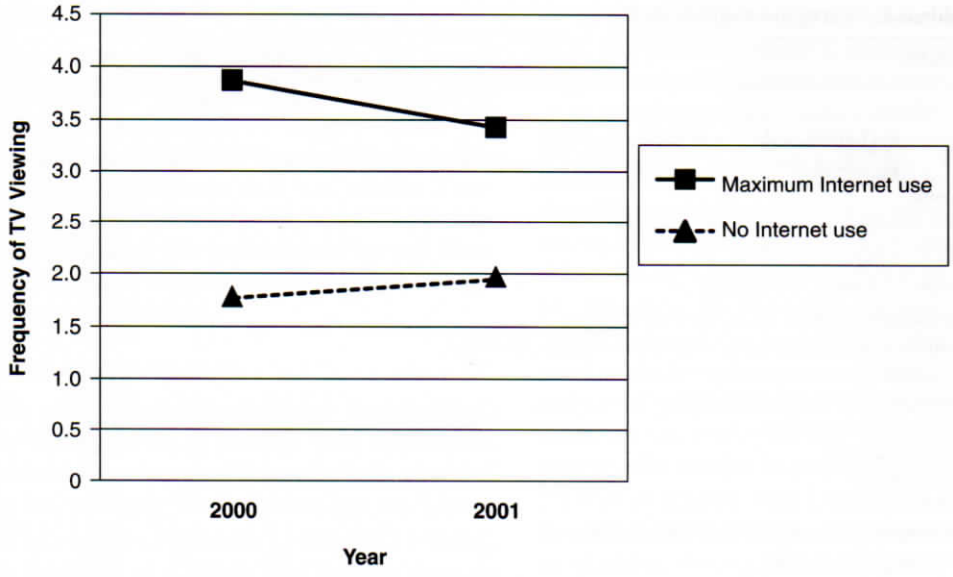

Figure 6.2. Internet use and changes in TV viewing. Plot shows the fitted values from model 2 for the amount of TV viewing at time 1 and time 2 for respondents who did not use the Internet at all compared to those used it multiple times per day at time 1.

users, heavier Internet use was associated with declines in television viewing.

Components of Internet Use

Model 5 in table 6.5 disaggregates overall frequency of Internet use into six components to determine whether different ways of using the Internet have distinct effects on frequency of television viewing. This model predicts television watching better than does the aggregated model (chi-square = 42.34, df = 10, $p < .0001$). The functional displacement hypothesis reviewed earlier predictions that cross sectionally, people who use the Internet most for entertainment would be the heaviest television viewers and that heavy Internet use for entertainment would lead to declines in television viewing as people shift their entertainment choices from one medium to the other.

The predictions from the functional displacement hypothesis were only partially confirmed. People who used the Internet for entertainment watched television more frequently than those who did not, but so did those who used it to gather health information, to research and purchase products, and to communicate with strangers. The time-by-entertainment and time by Information interactions were not significant, indicating that using the Internet for entertainment or for watching the news and getting other information did not lead to larger than average declines in television viewing. In contrast, the significant, negative coefficient for the time-by-communicating with strangers estimate shows that among Internet users, television watching declined more among people who joined online groups and used the Internet to meet new people than it did among other users of the Internet.

Discussion

Methodological and Substantive Contributions

This research examines the role of the Internet in changing people's use of other media. Our focus in this research was both substantive, to examine the functional displacement hypothesis in the context of Internet use, and methodological, to encourage researchers to be sensitive to methodological detail when investigating the effect of this new technology on people's lives.

Methodologically, our results show that researchers must move beyond the cross-sectional research methods that characterize most of work in this area to make causal claims about the effect of the Internet in daily life. As the research reported

Table 6.3. Predicting frequency of television watching from frequency of Internet use, all respondents.

	Model 1: OLS, cross sectional, Internet frequency				*Model 2: HLM, panel, internet frequency*			
Independent variables	*Estimate*	*SE*	*DF*	*P*	*Estimate*	*SE*	*DF*	*P*
Intercept	1.782	.163	956	≥.0001	1.765	.154	956	<.0001
Male (0 = female; l = male)	–.019	.051	956		–.018	.048	956	
Age (12–97)	.002	.002	956		.004	.002	956	≥.10
White (0 = minority; l = white)	–.125	.084	956		–.162	.079	956	≥.10
Married (0 = not married; 1 = married)	.005	.057	956		.035	.054	956	
Education (l = sorne elementary school; 7 = advanced degree)	–.058	.016	956	<.001	–.068	.015	956	≤.0001
Income (l = $l0K; 8 = >$70K)	–.058	.012	956	≤.0001	–.053	.012	956	≤.0001
Extraversion (1 = minimum; 5 = maximum))	.084	.032	956		.081	.030	956	≤.01
Time (0 = 2000; 1 = 2001)					.178	.035	791	≤.0001
lnternet, frequency (mean 27 items; 0 = no use; 6 = multiple times per day)	.239	.028	956	≤.0001	.350	.042	956	≤.0001
Time × Internet frequency					–.103	.024	791	≤.0001
R^2	.118							
χ^2					409.28			
AICC					3795.40			
BIC					3805.40			

OLS, ordinary least squares; HLM, hierarchica1 linear model.

Table 6.4. Predicting frequency of television watching from Internet use (all respondents) and frequency of Internet use (Internet users only).

	Model 3, all respondents: HLM, panel, binary Internet use				*Model 4 Internet users only: HLM panel, overall Internet frequency*			
Effect	*Estimate*	*SE*	*DF*	*P*	*Estimate*	*SE*	*DF*	*P*
Intercept	2.033	.161	956	≤.0001	1.422	.167	753	
Male (0 = female; 1 = male)	.020	.049	956		.027	.051	753	
Age (12–97)	–.001	.002	956		.001	.002	753	
White (0 = minority; 1~white)	–.153	.082	956	≤.10	–.134	..086	753	
Married (0 = not married; 1= married)	–.030	.055	956		.038	.058	753	≤.05
Education (1 = some elementary school; 7 = advanced degree)	–.038	.016	956	≤.10	–.040	.016	753	<.001
Income (1 = <$10K; 8 = ≥ $70K)	–.037	.012	956	≤.01	–.046	.012	753	≤.10
Extraversion (1 = minimum; 5 = maximum)	.095	.031	956	≤.01	.061	.031	753	≤.001
Time (0 = 2000; 1 = 2001)	.141	.043	791	≤.01	.300	.056	511	≤.0001
Use Internet (0 = no; 1 = yes)	.082	.096	956					
Time × use Internet	–.112	.052	791	≤.05				
Internet frequency (mean 27 items; 0 = no use; 6 = multiple times per day)					.561	.056	753	<.001
Time × Internet frequency					–.165	.032	511	≤.0001
χ^2	426.91				243.65			
AICC					2574.1			
BIC	3874.5				2583.3			

HLM, Hierarchical linear model.

Table 6.5. Predicting television watching from components of Internet use, among those who use the Internet at all.

	Model 6			
Effect	*Estimate*	*SE*	*DF*	*P*
Intercept	1.390	0.166	746	≤.0001
Male (0 = female; 1 = male)	0.058	0.051	746	
Age (12–97)	0.000	0.002	746	
White (0 = minority; 1 = white)	–0.106	0.083	746	
Married (0 = not married; 1 = married)	–0.020	0.057	746	
Education (1 = some elementary school; 7 = advanced degree)	–0.028	0.017	746	≤.10
Income (1 ≤ $10K; 8 ≥ 70K)	–0.035	0.012	746	≤.01
Extraversion (1 = minimum; 5 = maximum))	0.082	0.031	746	≤.01
Time (0 = 2000; 1 = 2001)	0.255	0.060	505	≤.0001
Internet use for communicating with friends & family	–0.030	0.022	746	
Internet use for communicating with strangers	0.085	0.034	746	≤.05
Internet use for news & general information	–0.001	0.028	746	
Internet use for entertainment	0.102	0.023	746	≤.0001
Internet use for health information	0.306	0.042	746	≤.0001
Internet use for commerce	0.115	0.039	746	≤.01
Time × communicating with friends & family	–0.032	0.021	505	
Time × communicating with strangers	–0.072	0.033	505	≤.05
Time × news & general information	–0.015	0.026	505	
Time × entertainment	–0.021	0.021	505	
Time × health information	–0.032	0.042	505	
Time × commerce	–0.008	0.038	505	
X^2	201.4			
AICC	2551.8			
BIC	2561.0			

[a]Hierarchical linear model, panel components of Internet frequency.

here demonstrates, cross-sectional data and longitudinal data led to different conclusions. Cross-sectional results showed that people who used the Internet more watched television more frequently and for a wider variety of purposes than did lighter Internet users. In contrast, longitudinal results show that both Internet use versus nonuse and the frequency of Internet use, among users, were associated with declines in the frequency of watching television.

The second methodological contribution of this chapter is to demonstrate that how people use the Internet makes a difference in the effects this use is likely to have. The confirmatory factor analyses demonstrated that conceptualizing Internet use as an undifferentiated aggregate fits the data poorly, even though this is the dominant approach in the research literature. At a minimum, research needs to distinguish among the ways that people use the Internet: information seeking, communication with friends and family, and entertainment. Among informational uses of the Internet in our data set, school, work and hobbies, product information, and health information uses can be distinguished. Undoubtedly, had we asked additional questions about using the Internet for gathering political information or information in other substantive domains, those domains would also have been distinguishable. Among social uses of the Internet, distinguishing communication with friends and family from communication with strangers fits the data better than a model that lumps all communication together.

Substantively, the results of our research provide evidence that use of the Internet is associated with declines in television viewing. That is, aggregate

Internet use in 2000 predicted declines in television watching between 2000 and 2001. Although these broad results are consistent with the functional displacement hypothesis, a more detailed examination is not. According to the functional displacement hypothesis, people who use the Internet most for informational and entertainment purposes should show the strongest declines in television viewing. However, the results were not consistent with this detailed prediction. The cross-sectional data show that people who used the Internet for entertainment, for health information, and for commerce are the heaviest television viewers, indicating that people who desire particular types of information in one media will use a new media for the same purposes. However, using the Internet for entertainment or news (the dominant uses of television) did not predict above-average declines in television viewing. In contrast, using the Internet for meeting new people was associated with declines in television viewing over and above those resulting from aggregate use. Interestingly, this function of Internet use has no parallels in television viewing.

Limitations

We have shown that one reaches different conclusions using cross-sectional and longitudinal data to examine the effect of using the Internet. The hierarchical linear growth models used in our research take into account individual differences in television viewing and Internet use at the initial time period and in the covariation between these individual differences and change. We acknowledge, however, that longitudinal designs are not panaceas. They are still subject to validity threats. Other events covarying with time may drive both changes in Internet use and changes in outcomes. These covariates can be internal to the individuals, such as learning or maturation, or external, such as the business cycle or change in popular culture. In addition, because of errors of measurement, preexisting differences among participants are never fully, statistically controlled in longitudinal designs. Finally, preexisting differences among individuals may lead some of them to be more susceptible to change. Only experimental research, in which participants are randomly forced to use the Internet or are prevented from using it, can lead to pure inferences about causation. However, true experiments are difficult to perform when one is seeking to examine broad social effects in the population or when examining the effect of technology on phenomena, such as the development of friendship, that are likely to emerge only after long periods of use. In addition, as Kraut et al. (2002) demonstrated, random assignment of participants to Internet use may no longer be possible in the United States, at least among people who buy their own computer. In their study, over 80% of individuals assigned to a no-Internet control group subscribed to Internet service on their own.

Conclusion

The Internet has become common in American homes. It is used for a wide range of purposes, including communication, information, entertainment, and commerce. There is controversy about the effects that widespread diffusion of the Internet is having on the lives of its users. This chapter used a national panel to examine how Internet use changed participants' use of time. We have made three contributions in this chapter. First, we have demonstrated that cross-sectional research methods are likely to lead to misleading conclusions about the effects of Internet use. Second, we have demonstrated that measuring and analyzing Internet use at a disaggregated level leads to better models in two senses. The disaggregated models fit the data better than models based on aggregated data. Third, we have demonstrated, using longitudinal data, that heavier Internet use is associated with declines in television viewing. Although this result is broadly consistent with a functional displacement hypothesis, detailed results were not. Using the Internet for entertainment and information was not associated with above-average declines in television viewing, whereas using it to meeting new people online and to participate in online groups was.

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