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WHERE DOES INTERNET TIME COME FROM?: A RECONNAISSANCE

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ABSTRACT

An analysis of the 2002 SIQSS time-diary data offers support for the displacement theory of time utilization. Time spent on the Internet is found to have a negative relationship with a number of daily activities, especially discretionary activities. Most notably, time spent on the Internet appears to come at the expense of time spent on social activities, hobbies, reading and TV viewing. Time spent on the Internet has a small, but less substantive, impact on time spent on work, childcare, housework and sleep. These predictions are robust to multivariate controls and proportional comparisons.

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There seems to be little doubt that the Internet offers an exciting new technology for communication, working, shopping and so on. There is, however, considerable disagreement regarding the extent to which the Internet has changed the way daily lives are spent. Numerous academic articles have covered the ongoing debate about the impact of information technology on interpersonal communication and sociability. The central question addressed both in this article and this entire issue of *IT&Society* is whether Internet use has transformed the way people spend time on other daily activities. In other words, does time spent on the Internet come at the expense of other daily activities? If so, which activities are most impacted by this expanding technology?

THE TIME-DISPLACEMENT HYPOTHESIS

In prior articles, a general theory about the hydraulic nature of time use has been put forth (Nie and Hillygus 2002). This displacement hypothesis is rooted in the notion that time is largely a zero-sum phenomenon. Because there are only 24 hours in a day, time spent on one activity must often be traded off against time spent on other activities. Various studies have repeatedly demonstrated that increased time on the Internet often comes at the expense of other activities, particularly face-to-face social interactions. For instance, the more time individuals spend in front of a computer screen at home, the less time they spend with friends and family. It is argued in this article that time online fundamentally competes with, rather than complements, time spent on other activities. To use an analogy, time is much like a liquid rather than a gas—it can be reshaped, but not expanded. If Internet use comes at the expense of other activities, then it is clearly of interest to identify the particular activities that are affected.

Other studies, however, have argued that Internet use does not impact other daily activities, including socializing (e.g., Kestnbaum et al. 2001; Franzen 2000). The explanations offered in these studies are typically of two different forms: the efficiency hypothesis and the multi-tasking hypothesis. One set of studies have argued that the Internet increases efficiency, so Internet users actually have *more* time for other activities (Franzen 2000). For instance, if an individual is able to shop online more quickly than shopping at a store, it may free up time to spend with friends or family.

The other hypothesis put forth is that it has less to do with the technology itself than with the individuals who use the technology. This research argues that the technologically advanced individuals tend to be the type of people who are simply able to fit more activities into less time (Robinson et al. 2000). Thus, as individuals use the Internet more and more, they become increasingly able to squeeze other activities into the remainder of their day. While this hypothesis seems plausible for an individual who spends just a few minutes on the Internet each day, it seems less likely at the limit. It seems

difficult to believe, for instance, that the individual who spends 8 hours online playing video games (as a number of teenage boys these days seem to do) is not sacrificing time on other activities. The question addressed in this article is whether that online time comes at the expense of sleep, TV, family care, social time or nothing at all.

RESEARCH DESIGN

A unique new survey methodology is used to differentiate amount, location and type of Internet use, thus producing more accurate measurements of respondents' time use. The survey is based on a time-diary approach. Robinson and Godbey (1999) argue that a judiciously administered time-diary study is necessary to accurately measure time spent on various activities. The diary procedure avoids the problems of a "time estimate" approach by preventing "guesstimate" errors, and by helping to prevent respondents from purposefully distorting activity estimates. Respondents can no longer easily manipulate survey responses to portray themselves in a particular light (e.g., as only moderate TV viewers or as being particularly socially active). With a time-diary approach, respondents would have to manipulate their entire diary, not just one report of time spent on a particular activity.

SIQSS therefore developed a research design that combines the best of both worlds—the detailed time-use estimates of the diary approach, without the respondent burden of a 24-hour diary. While closely following the basic methodology of telephone-implemented diary studies, such as those at the University of Maryland, these techniques were adapted to take advantage of the unique methods of Knowledge Networks' survey instrument for online survey administration conducted via the Microsoft Web-TV set top box. In May 2002, Knowledge Networks fielded the second SIQSS Time-Diary Study with a representative sample of approximately 5,500 Americans between the ages of 18 and 65. Appendix A contains a more detailed description of the Knowledge Networks survey.

Like the University of Maryland time-diary studies, the SIQSS modified time-diary study asked respondents about their activities "yesterday." Rather than covering the entire day, however, Appendix B shows that the focus was on six randomly selected hours of the day—one in each of six time blocks (strata): night, early morning, late morning, afternoon, early evening and late evening. The sampling design was structured to collect an even distribution of days of the week across the total sample and of hours over the course of the day for each respondent.[1]

With a six-hour design, the survey is less monotonous than a 24-hour design. Thus, the SIQSS diary is able to go into great detail about the social context of each activity without fatiguing respondents. This also permits more follow-up questions, including information on social context and interaction for each and every primary activity.[2] Engaging a larger sample provides high

quality comparable data for each hour of the day. That allows more detailed data about each specific activity, developing a more fine-grained picture of time use that becomes the backbone of this study.

Given the detailed diary design, the survey collects much improved data on the main independent variable: time spent on the Internet. Respondents are able to identify Internet/email use as an activity associated with a number of different main activities (work, education, social time and the like) and were also prompted about whether these particular activities (e.g., reading newspapers, corresponding) were done online.

THE DATA

This survey design provides ideal data for examining the fundamental questions regarding time tradeoffs between Internet use and daily activities. These data allow for a detailed comparison of the relationship between Internet use and various leisure and nondiscretionary activities, while controlling for various demographic background factors, such as education, age, work hours, household composition and other key activities. Time use for each of the various activities was computed by summing the number of minutes spent on each *as a main activity* across the six diary hours.[3] Table 1 presents the basic distributional characteristics of these variables. The mean, median and standard deviation of each measure are shown in *extrapolated* minutes spent over 24 hours.[4] The activities that are contained in each of these categories are identified in Appendix B. The mean usage for the population of both users and nonusers was 18.5 minutes.

On the sampled day in the second half of May of 2002, about 22% of Americans between the ages of 18 and 65 spent time on the Internet at their homes. In other words, these respondents reported using Internet/email at home as a *main* activity on their given diary day. This percentage is larger than the 14% reported by the University of Maryland study (Kestnbaum et al. 2002), but it is much less than the 50% that report having used the Internet/email at some point yesterday in the study of recall (Cole et al. 2000).[5] Of Internet users, 42% reported less than an hour of online time during the surveyed day, 25% reported approximately one hour of use, and 22% spent more than one hour. The question at hand is how that Internet use relates to time spent on other daily activities.

DATA ANALYSIS

Before moving to the analysis, a limitation of this study deserves comment. In this article, interesting relationships and correlations between Internet use and various activities (e.g., Internet use correlates negatively with TV use) are identified, but it is not possible to directly test for causality in those relationships. It cannot be shown, for instance, that increasing the amount of

TABLE 1: DESCRIPTIVES OF IMPUTED TIME USE (IN MINUTES OVER 24 HOURS)

Activity (n=5243)	Mean	(Median)	Std. Deviation
Sleep time	464.4	(464.8)	50.5
TV time	128.7	(109.3)	46.5
Video/radio/music time	17.9	(11.3)	19.2
Reading time	22.3	(17.5)	15.9
Social time	57.1	(33.2)	41.4
Recreation/hobby time	43.9	(29.0)	30.1
Other free time	15.0	(NA)	NA
Total free time	287.9	(272.7)	73.0
Internet time at home	18.5	(6.8)	30.1
Source: Time Study, 2002, SIQSS			
Note: Free time includes time on education, TV, video/music, reading, social, hobby and church/organization.			

time spent on the Internet *causes* individuals to spend less time, say, watching television. It is entirely possible that the direction of causality is in fact reversed—individuals who do not like watching TV spend more time on the Internet, because they view it as an alternative form of entertainment. These two hypotheses are observationally equivalent and are best sorted out with panel data or a controlled experiment. The most that can be said in this analysis is that Internet users, on average, spend less time watching television than do individuals who spend no time on the Internet. This is an interesting finding in and of itself.

In exploring the relationships for various daily activities, it is first useful to examine the bivariate comparison of Internet users and Internet nonusers in Table 2 (noting, of course, that such a comparison fails to control for important demographic characteristics).

This basic cross comparison of the data suggests that Internet users are indeed spending less time on some daily activities, particularly sleep, free time and work time. Before drawing any conclusions, however, these relationships should be explored in a multivariate setting. This article looks more closely at four major categories of activities: sleep, discretionary time, family care and work for pay.

The hypothesis put forth in this article is that Internet use comes disproportionately at the expense of discretionary time. It is expected that Internet use has less of an impact on those activities over which one has less control and flexibility.

To test this hypothesis, a separate OLS regression is estimated for each of the daily activities to examine the statistical significance of the relationship between Internet use and that activity. However, to then examine the substantive and relative impact of these relationships, an additional step is necessary. The regression model estimates are used to calculate the predicted

TABLE 2: TIME USE (IMPUTED TO 24 HOUR ESTIMATE) BY LEVELS OF HOME INTERNET USE

	Nonuser (0 min)	Light user (1-59 min)	Medium user (60 min)	Heavy user (60+ min)	Non-Heavy Difference
Number of cases (n=)	**(4137)**	**(474)**	**(386)**	**(247)**	
Sleep time	467.2	457.8	454.2	446.3	-20.9
TV time	130.2	126.1	120.7	121.3	-8.9
Video/radio/music time	18.1	16.2	16.2	18.8	0.7
Reading time	22.7	21.2	21.0	19.2	-3.5
Social time	58.2	57.3	49.8	48.5	-9.7
Recreation/hobby time	44.5	43.1	42.4	37.7	-6.8
Total free time	292.2	281.6	266.4	262.5	-29.7
Education time	7.4	7.2	7.4	6.7	-0.7
Work time	173.7	156.7	156.7	141.4	-32.3
Housework time	93.0	95.4	93.1	87.1	-5.9
Childcare time	37.3	37.6	35.5	33.1	-4.2
Errands/shop time	42.8	41.4	41.7	38.5	-4.3

absolute and proportional impact that different levels of Internet use have on the set of activities adumbrated above. This is a critical addition because it allows for a more thorough analysis of the impact of Internet use than in previous analyses.

A brief hypothetical example helps to illustrate the necessity of evaluating both the absolute and proportional effects. Suppose it is found that increased time on the Internet is significantly related to decreased time spent on hobbies and decreased time spent on sleep. Although both of these relationships might be *statistically* significant, they may have very different *substantive* effects because of the different proportional reductions in the activities. Suppose, for instance, that a nonuser is predicted to spend 45 minutes on hobbies while an Internet user is predicted to spend 30 minutes on hobbies. The predicted 15 minute decline between users and nonusers represents a 33.3% proportional reduction in time spent on hobbies. In contrast, if a nonuser is predicted to spend eight hours sleeping each day and an Internet user is predicted to sleep 15 minutes less, the effect of Internet use on sleep amounts to a 3.1% proportional reduction. Thus, although the predicted absolute reductions related to Internet use are the same in this hypothetical example, the proportional impact is substantially greater for time spent on hobbies.

To estimate the independent effect of Internet use on each of the activities, each regression includes numerous control variables.[6] The regression models control for the basic demographic characteristics that are often thought of with respect to the digital divide, including marital status, gender, age,

education, race/ethnicity, number of children, single parenthood and living alone.[7] Also included are important time-use controls for various "necessary" activities.[8] Time spent on sleep is important because it defines the length of the conscious day—it expands or contracts the day. In terms of the displacement model, time on sleep reduces the denominator of time available. Likewise, time spent on work and necessary household and family duties are less malleable so they have also been included as controls in the models.

Each of the four main categories of activities will now be analyzed separately to examine the potential time tradeoffs between Internet use and the activities of daily life.

SLEEP

Sleep is perhaps one of the most interesting activities in thinking about time utilization. The amount of time spent on sleeping establishes the length of the conscious day. Those who regularly sleep less than average simply have more conscious time in the day than those who sleep more. In other words, short sleepers have extra time for additional activities, or for more time on the activities in which they participate. Though the data does not allow for a comprehensive comparison of the time-utilization differences between those requiring more or less sleep, the snapshot of the day allows for an examination of the relationship between sleep time and time spent on other activities in a given day. Given the importance of sleep in defining the length of day, special attention will be paid to the trade-offs that are involved for this activity. Parallel regression results for sleep are reported in Table 3. The regression results for the remaining activities can be found in Appendix C.

In interpreting the regression results for sleep, the first thing to note is that there are only very small demographic differences in amounts of sleep. With all else controlled, men sleep about 5 minutes less a day than do women. The very elderly, those who live alone, and single parents all sleep a few minutes less on average than do their counterparts. However, the biggest differences in the amount of time spent in slumber are related to the day of the week and time spent on other activities. The average American sleeps almost a half an hour less on weekdays than on weekends, even controlling for the number of hours worked in that day.

But the amount of sleep is most strongly associated with time spent on other activities. Work for pay, housework, childcare, errands and the like are all negatively related to sleep time. For each hour engaged in one of these activities, individuals spend 10 to 15 minutes less on sleep. Since many of these activities require hours each day, the cumulative impact on sleep can be quite substantial. These findings are not terribly surprising. In terms of the independent variable of most interest, Internet use, the effects are equally dramatic. Those who use the Internet less than an hour a day sleep about 13

TABLE 3: REGRESSION RESULTS FOR TIME SPENT ON SLEEP

	B	*t*	*Sig.*
(Constant)	557.94	74.99	***
Education	-1.20	-4.49	***
Male	-4.87	-3.71	***
Married	0.35	0.20	
African-American	-1.41	-0.70	
Hispanic	-5.56	-2.65	**
Asian and other	-3.78	-1.29	
Age	0.63	1.83	
Age square	-0.01	-2.57	**
Weekday	-22.66	-11.00	***
Living alone	-8.34	-3.65	***
Single parents	-6.52	-2.69	**
Work time	-0.18	-16.56	***
Housework time	-0.16	-8.95	***
Childcare time	-0.15	-7.08	***
Shop/errands time	-0.18	-6.57	***
Low Internet time at home	-11.30	-5.12	***
Medium Internet time at home	-15.16	-6.27	***
Heavy Internet time at home	-25.91	-8.55	***
Adjusted R Square	0.20		
F	73.50		
(n=)	(5195)		

minutes less on average, those who use it for an hour are spending an average of 15 minutes less on sleep, and those who spend more than an hour a day on the Internet spend 26 minutes less on sleep. Sleep and time on the Internet co-vary to a considerable degree. Recall, however, that to evaluate the impact of Internet use on sleep, it is necessary to examine not only absolute differences but also relative differences. The proportional reduction in sleep provides the appropriate substantive interpretation. Using the estimates from the multivariate regression in Table 3, the predicted number of minutes spent on sleep for Internet users and nonusers are reported in Table 4.[9]

The predicted number of minutes that nonusers spend on the sleep is 465, or approximately 7.8 hours. Internet users who spend less than 60 minutes on the Net are predicted to spend 7.6 hours sleeping, medium users are predicted to spend 7.5 hours, and heavy Internet users are predicted to spend just 7.3 hours sleeping on an average day. Though the predicted reduction in sleep between nonusers and heavy Internet users amounts to nearly half an

TABLE 4: PREDICTED HOURS SPENT ON SLEEP FOR INTERNET USERS AND NONUSERS

	Nonuser (0 min)	Light User (1 59 min)		Medium User (60 min)		Heavy User (61+ min)		Non-Heavy Difference
Predicted Hours	7.8	7.6		7.5		7.3		-0.5
Proportional reduction		-2.4%	***	-3.3%	***	-5.6%	***	

†Predicted hours of sleep from multivariate regression models, controlling for education, age, race, weekend/weekday, living alone, single parent and time controls for major daily activities (time on work, TV, sleep)

hour per day of sleep—a considerable absolute number—the proportional reduction is just 5.6%. In other words, given the amount of time that people spend on sleep every night, a 25-minute decline represents a 5.6% relative decline in the time spent on sleep. Thus, Internet use does have a negative impact on sleep, but it does not appear terribly substantial, given the number of minutes still spent sleeping at night. In other words, Internet use may be traded for some sleep time, but Internet use does not appear to come at the expense of a good night's sleep. Moreover, it must be remembered that this finding cannot offer insights into the direction of causality. Do Internet users stay up late at night beyond what would otherwise be their bedtimes in order to find time to use the Internet? Or is it the reverse—that is, is it insomnia that drives Internet use? Long beyond when there is anything interesting on the television, do the sleepless seek out the Internet to fill this time?

Beyond the biological requirements of sleep, the time in one's day can be divided into two categories: nondiscretionary time and discretionary time. There are certain activities that appear to be inescapable parts of daily life, and these activities are much more difficult to compress or reshape. Work is clearly one such activity, but it is also true of eating, self maintenance (from bathing to doctor's appointments), child care, housework, errands, car repairs, bill paying and the like. All of these activities must somehow be accomplished if one's life is not to come unglued.

On the other hand, most people also have at least some discretionary time in their daily lives—that is, time when all of the labors are done, time when there is flexibility to choose how to shape and to fill the time with activities of choice. It is common for people to spend their discretionary time watching television, visiting with friends and family, or spending time on hobbies. It is hypothesized that time spent on the Internet at home will come disproportionately out of these discretionary activities because they are much easier to trade off against one another. The analysis first turns to look at the impact of Internet use on these discretionary activities in one's daily life.

INTERNET USE AND DISCRETIONARY TIME: MEDIA, LEISURE, AND SOCIAL ACTIVITIES

As shown in Table 1, the American population, age 18 to 65, spends a considerable amount of time watching TV, listening to radio, music and/or watching recorded videos, and reading newspapers, books, and magazines. On average, TV viewing consumes nearly 130 minutes a day, reading just over 23 minutes, and listening to radio, music and the like another 18 minutes each day. Traditional mass media therefore account for almost 3 hours of primary activity time in the day of the average American. Interestingly enough, the nearly 20 minutes of Internet use, as seen earlier, averages about the same amount of time each day as music or reading.

Scholars have hypothesized that Internet use comes largely at the expense of mass media use because these activities are functionally equivalent (Robinson et al 2002; next article). The common wisdom seems to be that much of the time spent on the Internet at home is a direct transfer of time once spent on the TV, in particular. A number of studies have found a strong negative association between TV viewing and Internet use (Nie and Erbring 2000; Robinson et al. 2002). Table 5 below presents the relationship between media usage and time spent on the Internet at home. Using the same methodology as with sleep above, the data presented in Table 5 are based on a fully specified OLS model. The regression estimates can be found in Appendix C.

Table 5shows there is a clear tradeoff between TV viewing and home Internet use. Among those who do not use the Internet at home, the predicted number of minutes on TV viewing is 130 minutes. It declines at each level of Internet use—about 9 minutes less (121 minutes) among those who use the Internet less than an hour, another 8 minutes (113 minutes) for medium users and an additional 6 minutes (107 minutes) for heavy users. The absolute differences are large—a nearly 24-minute reduction in TV viewing is predicted for heavy Internet users (enough time that an entire sitcom could be missed). Moreover, it should be remembered that these differences are based on a fully specified model controlling for demographics, living arrangements and marital status, sleep time and other daily activities. The 24-minute reduction in TV time between nonusers and heavy Internet users is substantial, as is the proportional reduction in television time. The 24 minutes represents a little over a 17% reduction. There seems to be substantial evidence that individuals trade off TV viewing time with Internet use. The hydraulic or displacement system is once again evident, although it should be reiterated that one cannot speak as to the direction of causation. One cannot say with certainty whether people are giving up TV because of the Internet, or whether they are simply turning to the Internet when there is nothing interesting on TV.

In looking at the relationship between Internet use and music/videos, it is found that Internet use makes very little difference to these activities. Here the relationship is curvilinear and not significant among the heaviest Internet

TABLE 5: PREDICTED MINUTES SPENT ON DISCRETIONARY ACTIVITIES FOR INTERNET USERS AND NONUSERS

Time spent on...	Nonuser (0 min)	Light User (1 59 min)		Medium User (60 min)		Heavy User (61+ min)		Non-Heavy Difference
TV	138.0	129.4		121.2		114.0		-23.96
Proportional reduction		-6.2%	***	-12.1%	***	-17.3%	***	
Video/Music	15.2	13.2		12.9		15.0		-0.22
Proportional reduction		-13.2%	*	-15.1%	*	-1.4%		
Reading	21.3	19.0		18.7		16.1		-5.18
Proportional reduction		-10.5%	**	-12.1%	**	-24.2%	***	
Social	43.4	40.5		32.9		29.2		-14.23
Proportional reduction		-6.6%		-24.3%	***	-32.8%	***	
Hobby	42.0	38.80		37.8		30.8		-11.16
Proportional reduction		-7.8%	*	-10.1%	***	-26.6%	***	
Total free time	277.0	256.4		237.5		218.8		-58.22
Proportional reduction		-7.5%	***	-14.3%	***	-21.0%	***	

users. While there is some fall off among light users, heavy Internet users actually report listening to more music than anyone but nonusers. This is not terribly surprising given that the heaviest Internet users tend to be younger than nonusers. It is also certainly plausible that heavy Internet users listen to music while surfing the Web or doing Instant Messaging. It is the one type of activity that is compatible with using the Internet and can even be a pleasant backdrop for an activity that otherwise commands full attention.

In contrast, activities that command full attention appear to bear the biggest brunt of Internet use. The impact of Internet use on time spent reading perfectly illustrates the necessity of looking at both absolute and proportional time reductions. Nonusers are predicted to spend 21 minutes reading in an average day. In contrast, heavy Internet users are predicted to spend 16 minutes reading (omitting online reading) in an average day. This 5 minute decline, though small in absolute terms, represents a 24% proportional reduction in reading time. In other words, given the small amount of time that people spend reading each day, the impact of Internet use is quite substantial. Unlike TV or music, both reading and Internet use require complete attention and concentration—it is not really possible to do both at the same time.

HOBBIES AND SOCIAL TIME

If the hypothesized character of the tradeoff relationships is correct, it would be expected that Internet use would substantially displace time spent on hobbies and social activities as well. This should be so for two reasons. First, as discretionary activities, they are prime candidates for displacement by Internet

use. Again, that means that they are part of the day's activities that can be reshaped without seriously affecting required daily functioning. Second, as activities that require full engagement, they are activities that are quite difficult to combine with Internet use. In other words, they are primary or foreground activities that cannot easily fade into the background, as TV or radio can.

As shown in Table 5, the hypothesized proportional tradeoffs between Internet use and these two activities are among the strongest found thus far. Both are only modestly reduced by light Internet use, which might help to reconcile some of the conflicting studies with respect to sociability. However, once Internet use reaches an hour or more, the impact on social activities and hobbies becomes quite sizable. In absolute terms, heavy Internet users are predicted to spend 14 minutes less on social activities and 11 minutes less on hobbies. In proportional terms, this amounts to a 33% reduction in social time and a 27% reduction in hobby time. This finding offers additional evidence that Internet use is taken disproportionately out of sociability time. More broadly, it appears that Internet use involves time tradeoffs with activities that require full dynamic engagement.

Finally, there is the impact of Internet use on all free time activities in Table 5.[10] Again, after controlling for the day of week, demographics, and other time controls, it is found that Internet use has a considerable impact on other free-time activities. Nonusers are predicted to spend an average of approximately 4.5 hours on discretionary activities in an average day. Heavy Internet users, in contrast, are predicted to spend nearly an hour less on other free time activities, a 21% proportional reduction. While the relationship is clearly less than 1-to-1—it remains clear that a very substantial proportion of Internet use comes at the expense of other discretionary activities. The analysis now turns to look at the impact of Internet use on some of these nondiscretionary activities.

NONDISCRETIONARY ACTIVITIES: FAMILY CARE AND WORK FOR PAY

Daily lives are composed of some activities that are difficult to compromise. For those who work for pay, displacing working hours is occasionally possible, but there are clear limits lest a threat to livelihood. Housework, childcare, errands and shopping have a similar character in that these activities can be postponed, but they are difficult to ignore completely. When one runs out of clean clothes, dishes or groceries, the situation must be attended to—dishes and laundry must be washed, doctor's appointments kept, the car serviced and so on. It is expected that the hydraulic-displacement theory works on nearly all activities, but nondiscretionary activities in particular should demonstrate a lower level of displacement in relationship to Internet use. If time is a somewhat reshapeable but not expandable vessel, those activities that are discretionary are much easier to trade against one another than these necessary or non-discretionary activities. The first

TABLE 6: PREDICTED MINUTES SPENT ON NONDISCRETIONARY ACTIVITIES FOR INTERNET USERS AND NONUSERS

Time spent on...	Nonuser (0 min)	Light User (1-59 min)		Medium User (60 min)		Heavy User (61+ min)		Non-Heavy Difference
Work (for all workers)	298.1	284.3		284.7		275.3		-22.8
Proportional reduction		-4.6%	***	-4.5%	***	-7.6%	***	
Housework	90.4	89.5		87.3		79.4		-11.0
Proportional reduction		-0.9%		-3.4%		-12.2%	***	
Childcare	41.0	38.5		36.8		34.1		-6.9
Proportional reduction		-6.1%		-10.4%	**	-16.9%	***	
Errands/Shopping	43.8	40.4		40.2		35.6		-8.2
Proportional reduction		-7.6%	**	-8.2%	**	-18.8%	***	

†Predicted minutes from multivariate regression models, controlling for education, age, race, weekend/weekday, living alone, single parent and time controls for major daily activities (time on work, TV, sleep)

nondiscretionary activity that is analyzed is work. The regression results for all of these activities can be found in the Appendix C—the heart of the findings is found in Table 6.

The predicted amount of time that nonusers spend on work (including part-time and full-time workers) in relation to very heaviest Internet users amounts to a 7.6% proportional reduction in work time. Among the light and medium Internet users, the proportional reduction is less than 5 percent. Thus, unlike discretionary activities, Internet use does not have a sizable impact on work time. It appears that individuals who are using the Internet at home are not at risk of jeopardizing their jobs for the Internet, even if they might spend slightly less time on work. It should be noted that this analysis does not distinguish between working for pay at home or at work. In other words, the negative relationship could be attributable to the fact that individuals who are playing on the Internet at home might be working less *at home*. This relationship can be untangled in future analyses.

Although there are statistically and substantively significant tradeoffs between time spent on the Internet and all of the nondiscretionary activities, the magnitude of these relationships is much smaller than that with discretionary activities. The pattern for housework is similar in its modest magnitude, though the pattern is somewhat different. Only heavy Internet users find much of a change in the time spent on housework, while there is only a negligible effect for light and medium users. For the heaviest Internet users, the data shows a 10 minute or 12% reduction in housework performed on that day.

Time spent on childcare and errands/shopping show slightly larger amounts of displacement, but all remain considerably smaller than the tradeoffs with discretionary activities. The heaviest Internet users are predicted to spend

7 minutes less on childcare (17% proportional reduction) and 8 minutes less on errands/shopping (19% proportional reduction). The direction of causation for these relationships seems particularly ambiguous. Do heavy Internet users spend less time on errands/shopping because they have less time to do these activities, or because they do much more of these activities on the Internet? Furthermore, are Internet users just less likely to have children or do Internet users sacrifice childcare for surfing the Net? Given the time-consuming nature of childcare, the former seems more plausible.

CONCLUSIONS

Overall, there are a few major findings from this analysis. The displacement hypothesis finds support in the 2002 SIQSS time diary data. With the possible exception of music/video games, it appears that time spent on the Internet comes at the expense of time spent on other activities. More notably, these findings suggest that Internet use comes disproportionately from time spent on discretionary activities rather than from nondiscretionary activities—such as work, housework, and childcare. And among the discretionary activities, it appears that social time is most likely to be sacrificed for time on the Internet. Thus, the findings from the 2002 study return to the controversial conclusion of both the 2000 and 2001 studies—Internet use has a considerably negative impact on sociability.

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APPENDIX A: KNOWLEDGE NETWORKS METHODOLOGY

The data used in this analysis were collected by Knowledge Networks using a new time-diary methodology that needs further explanation. In order to overcome the fact that close to half of all Americans did not have access to the Internet at the time of the study, Knowledge Networks provides representative national samples with Internet equipment in exchange for participation in surveys. Respondents in the Knowledge Networks (KN) panel are randomly recruited through Random Digit Dial (RDD) sampling methods on a quarterly-updated sample frame consisting of the entire U.S. telephone population and are provided with WebTV equipment. All telephone numbers have an equal probability of selection, and sampling is done without replacement. Although this sampling technique entails the coverage error of excluding households without telephones (less than 5% of population), the approach has significantly broader coverage than sampling techniques that draw only from computers users with Internet access (e.g., Harris Interactive).

Before the initial telephone calls are made, households in the RDD sample with listed addresses are sent letters describing the proposed exchange relationship. During the initial RDD telephone interview, respondents are told they have been selected to participate in an important national study, and they will be given a WebTV receiver that will allow them free access to the Internet if they will answer brief weekly surveys on their television screen. It is emphasized that confidentiality and privacy are always upheld and that no other household can replace theirs. Respondents are immediately polled regarding the extent to which members of their households are experienced with the Internet and proficient with computers.

Once the WebTV equipment is installed in their homes, respondents are asked to respond to some profile surveys that record the key attributes of each household member. For example, respondents are asked about their gender, date of birth, ethnicity, education, income and the like. All adults (aged 18 and older) in each selected household are asked to respond to surveys via WebTV. Each member is sent one short survey per week, usually not taking more than 15 minutes to complete. In rare instances, as when panel members are asked to respond to longer surveys, they would be given a week off from responding or some other form of incentive. Respondents can respond to the surveys at any time at their convenience, and are permitted to interrupt before completing the survey, and return to it at a later time. Respondents who fail to respond to eight consecutive surveys have the WebTV receiver removed from their homes.

More detailed information on the methodology can be found at http://www.knowledgenetworks.com.

APPENDIX B: DIARY SURVEY DESIGN AND CODING

The time-diary survey was structured such that respondents were asked about their **main** activities during six randomly selected hours, distributed over the course of the previous day ("yesterday"). Respondents could select from a list of 15 main activities (or enter one of their own).

Respondents were then asked to identify their **specific** activity categorized under the main activity they selected. For instance, if they selected Housework as their main activity they were asked to select among the following specific activities: Cook, Kitchen Cleanup, Laundry, Repairs, Yard Work, Internet/Email, Other Computer, Telephone Calls, Plant Care, Pet Care, Paperwork, Organize/Unpack, or Other (*user defined).*

For each of the main activities, Internet/Email, Telephone, Computer Work were included as options. This picks up Internet use whether that use was for educational, professional or simply recreational purposes. At the end of each sampled hour, respondents were asked to indicate which of their mentioned activities were done online.

After each noted activity, respondents were then asked **how long** the activity lasted (15 minute increments), **where** the activity took place, and **with whom** the activity was performed. Respondents were finally asked if they did **anything else** at the same time as this (*primary*) activity, being provided with a check list of (*secondary*) activities (including user-defined *other*) and were asked to identify any secondary activities they did at the same time as the main activity.

After finishing these questions for each of the activities recorded in their six selected hours, respondents were then asked a series of follow-up questions including *estimates* of the amount of their general Internet use, the content and number of emails (personal vs. work related), their types of Websites browsed, and their amount of TV watching, sleep and social interactions. These follow-up questions provided additional measures of the independent and dependent variables (and results were generally replicated using these measures usually with similar results)—as well as providing an independent check on their time-diary estimates. A sample of the survey screens from the 2001 SIQSS study can be found in Appendix B of the Nie and Hillygus article in issue 1 of *IT&Society*.

Activity coding: The coding for the time variables in this article include:

Social time: bar/lounge/restaurant, party, visiting/going out, conversation, movie, concert, sports event, write/respond, telephone and other.

Recreation/Hobby: exercise, sports, outdoors, walk, games, computer/video games, other computer hobbies, gardening, crafts/hobbies, art, creative writing, think/relax and travel.

Music/Video time: videos, radio, music, computer/video games and other computer hobbies. The other categories are self explanatory.

APPENDIX C: REGRESSION RESULTS

The following regression results were used in computing the predicted number of minutes on various activities reported in the text.

A) WORK REGRESSION RESULTS (FULL TIME AND PART TIME WORKERS)

	B	*t*	
(Constant)	376.69	21.83	***
Education	-0.88	-2.08	
Male	3.56	1.77	***
Married	10.14	3.66	
African-American	-3.89	-1.21	**
Hispanic	-0.37	-0.11	
Asian and other	-8.39	-1.79	***
Age	1.53	2.55	***
Age square	-0.02	-2.60	***
Number of kids	1.45	1.28	***
Weekday	166.03	63.45	
Living alone	6.12	1.75	
Single parents	4.25	1.05	
Housework time	-0.52	-18.13	***
Childcare time	-0.43	-10.89	***
Shop/errands time	-0.66	-14.82	***
Sleep time	-0.40	-18.47	***
Light Internet time at home	-13.75	-4.02	***
Medium Internet time at home	-13.38	-3.35	***
High Internet time at home	-22.80	-4.28	***
Adjusted R Square	0.70		
F	455.74		
(n=)	(3748)		

B) FAMILY CARE REGRESSION RESULTS

	HouseWork Time			*ChildCare Time*			*Errands/Shop Time*		
	B	*t*		*B*	*t*		*B*	*t*	
(Constant)	149.88	18.15	***	96.87	14.07	***	74.66	13.92	***
Education	-0.70	-3.35	***	0.01	0.05		0.09	0.65	
Male	-13.07	-13.17	***	-8.42	-10.18	***	-2.65	-4.11	***
Married	-0.10	-0.07		9.25	7.79	***	0.74	0.80	
African-American	-6.03	-3.84	***	1.48	1.13		-0.88	-0.87	
Hispanic	-3.75	-2.29	*	2.30	1.68		-2.02	-1.90	
Asian and other	-0.29	-0.13		-3.32	-1.75		-1.70	-1.15	
Age	1.82	6.68	***	-0.51	-2.23	*	-0.10	-0.54	
Age square	-0.02	-5.38	***	0.00	0.55		0.00	1.02	
Number of kids	3.76	6.68	***	2.77	5.91	***	-0.26	-0.71	
Weekday	-11.30	-7.06	***	13.64	10.21	***	9.73	9.36	***
Living alone	0.19	0.10		0.10	0.07		2.57	2.23	*
Single parents	-2.35	-1.16		-3.54	-2.08	*	3.79	2.87	**
Work time	-0.14	-17.09	***	-0.08	-11.79	***	-0.07	-12.85	***
TV time	-0.05	-4.65	***	-0.07	-7.86	***	-0.05	-6.33	***
Sleep time	-0.09	-8.77	***	-0.07	-7.57	***	-0.05	-6.66	***
Light Internet use	-0.85	-0.49		-2.50	-1.75		-3.34	-2.99	**
Medium Internet use	-3.03	-1.60		-4.26	-2.70	**	-3.61	-2.93	**
High Internet use	-10.99	-4.63	***	-6.92	-3.50	***	-8.21	-5.33	***
Adjusted R Square	0.20			0.12			0.05		
F	72.08			40.50			16.51		
(n =)	(5195)			(5195)			(5195)		

C) DISCRETIONARY TIME REGRESSION RESULTS

	TV Time		*Music/Video Time*		*Reading Time*	
	B	***t***	***B***	***t***	***B***	***t***
(Constant)	260.78	25.18 ***	51.46	11.51 ***	29.22	7.82 ***
Education	-2.30	-8.93 ***	-0.37	-3.30 ***	0.72	7.75 ***
Male	3.74	2.96 **	0.12	0.23	-1.75	-3.83 ***
Married	-3.05	-1.80	-1.13	-1.55	-0.67	-1.09
African-American	4.53	2.33 *	0.74	0.88	-1.28	-1.82
Hispanic	2.97	1.46	1.55	1.78	0.13	0.17
Asian and other	1.67	0.59	1.70	1.40	1.44	1.42
Age	0.60	1.82	-0.39	-2.72 **	-0.18	-1.53
Age square	0.00	-0.22	0.00	2.08 *	0.00	2.65 **
Weekday	20.99	10.45 ***	-7.36	-8.50 ***	1.30	1.79
Living alone	1.84	0.83	0.94	0.99	0.32	0.40
Single parents	-4.32	-1.85	0.15	0.15	0.70	0.83
Work time	-0.19	-17.38 ***	-0.02	-4.72 ***	-0.02	-6.33 ***
Housework time	-0.10	-5.85 ***	-0.01	-2.02 *	-0.01	-1.57
Childcare time	-0.18	-8.70 ***	-0.02	-2.55 **	-0.02	-2.46 **
Shop/errands time	-0.19	-7.13 ***	0.02	1.83	-0.01	-0.63
Sleep time	-0.18	-13.27 ***	-0.02	-3.01 **	-0.02	-4.04 ***
Light Internet time at home	-8.53	-4.01 ***	-2.00	-2.18 *	-2.24	-2.92 **
Medium Internet time at home	-16.70	-7.14 ***	-2.30	-2.28 *	-2.58	-3.06 **
High Internet time at home	-23.91	-8.13 ***	-0.21	-0.17	-5.15	-4.86 ***
Adjusted R Square	0.13		0.06		0.04	
F	42.05		17.52		12.63	
(n=)	(5195)		(5195)		(5195)	

	Social Time		*Hobby Time*		*Free time*	
	B	***t***	***B***	***t***	***B***	***t***
(Constant)	211.41	26.57 ***	128.27	19.66 ***	735.60	59.79 ***
Education	0.16	0.82	0.24	1.50	-1.23	-4.03 ***
Male	-4.10	-4.21 ***	2.16	2.70 **	-0.10	-0.07
Married	-5.81	-4.46 ***	0.20	0.19	-9.47	-4.71 ***
African-American	1.63	1.09	-3.52	-2.87 **	5.14	2.22 *
Hispanic	-6.46	-4.15 ***	-3.69	-2.89 **	-6.69	-2.78 **
Asian and other	-2.82	-1.30	-2.64	-1.48	-1.62	-0.48
Age	-0.89	-3.48 ***	-0.50	-2.39 *	-1.53	-3.88 ***
Age square	0.01	2.29 *	0.01	2.39 *	0.02	4.42 ***
Weekday	-46.20	-29.95 ***	-18.67	-14.75 ***	-55.43	-23.23 ***
Living alone	0.52	0.30	-1.03	-0.74	1.54	0.59
Single parents	-0.98	-0.55	0.48	0.33	-2.98	-1.08
Work time	-0.10	-12.59 ***	-0.09	-13.44 ***	-0.47	-36.85 ***
Housework time	-0.11	-8.67 ***	-0.09	-8.19 ***	-0.38	-18.83 ***
Childcare time	-0.14	-8.71 ***	-0.08	-6.23 ***	-0.46	-18.89 ***
Shop/errands time	-0.09	-4.22 ***	-0.09	-5.48 ***	-0.40	-12.69 ***
Sleep time	-0.11	-11.00 ***	-0.07	-8.22 ***	-0.43	-27.18 ***
Light Internet time at home	-2.85	-1.74	-3.25	-2.42 *	-20.65	-8.16 ***
Medium Internet time at home	-10.53	-5.86 ***	-4.24	-2.88 **	-39.52	-14.23 ***
High Internet time at home	-14.22	-6.29 ***	-11.17	-6.03 ***	-58.28	-16.68 ***
Adjusted R Square	0.35		0.18		0.50	
F	147.88		59.72		278.32	
(n=)	(5195)		(5195)		(5195)	

ENDNOTES

[1] The sampling time blocks were Hour 1: midnight-5am; Hour 2: 6-9am; Hour 3: 10am-1pm; Hour 4: 2-5pm; Hour 5: 6-8pm; Hour 6: 9-11pm

[2] The questionnaire asks how long the activity lasted, where the activity took place, with whom the respondent did the activity and if the respondent was doing anything else at the same time. See *Appendix C* in the authors' article in the first issue of *IT&Society* for more detailed description of the survey questionnaire.

[3] For ease of interpretation, all diary measures are reported as 24-hour estimates. Estimates of the 18 hours not selected for each of the respondents are obtained through imputation of the missing data. Assuming a multivariate normal distribution for the activity times by hour, the follow-up questions and the demographics, the corresponding likelihood function is maximized using the EM (expectation-maximization) algorithm as implemented in SPSS' MVA function.

[4] Because Internet/email is used as an independent variable in the multivariate analysis, time spent on Internet/email when coded as the dependent variable was excluded. This time accounted only for a minimal amount of total time on Internet/email.

[5] Two different hypotheses about the differences in the measures are possible: (1) the follow-up measure relies on summary recall and thus is susceptible to all of the estimation problems, such as overreporting, that has already been mentioned. (2) The time estimate used in this analysis does not include Internet/email use that occurs incidentally, and therefore is coded as a secondary activity. It misses, for instance, individuals who reported talking on the phone as a main activity, but who checked their email briefly at the same time. Examining the secondary activities in the SIQSS data is a substantial task that planned for future research.

[6] The regressions were also estimated using the follow-up (rather than diary measure) of Internet/email use. With these estimates, the only substantive changes are that Internet/email use does not have a statistically significant impact on shopping/errands, childcare or TV. The other relationships do not change substantively.

[7] For comparison, analyses were also replicated using recall estimates from the follow-up questions (see *Appendix C)* as an alternative measure of Internet use.

[8] When the regressions are estimated without the time controls, the impact of the Internet use on the various dependent variables changes slightly with regard to statistical significance, but they do not change the overall conclusions. Generally, the relationships that are found to be less substantial with the time controls lose significance when controls are not included. More specifically, Internet use at any level does not have a statistically significant negative impact on housework, childcare or music/videos. Internet use remains statistically significant at all levels for sleep, reading and work. Internet use is no longer statistically significant for the medium and light users for shopping/errands and hobbies; and it is no longer statistically significant for just the light users for TV and social time. These estimates might help to reconcile conflicting findings with regard to some of the relationships because the impact is not felt among the lightest users for some activities.

[9] The predicted minutes are estimated setting all other variables at their means and dummy variables to their mode.

[10] Measure is made of all the above plus a few unexamined activities.