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Web-use and net-nerds: a neo-functionalist analysis of the impact of information technology in the home

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A Neo-Functionalist Analysis of the Impact of Information Technology in the Home

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ABSTRACT

This paper investigates the question of the impact of use of various facilities of the Worldwide Web on patterns of sociability. Its sets out a neo-functionalist model of socio-technical innovation which is designed to explore prospectively the impact of innovations in areas such as Information and Communications Technology, on the full range of sociable and non-sociable activities. And it uses evidence from a unique dataset (a nationally representative time diary panel study, collected in the UK for the period 1999-2001) to explore this model.

NON-TECHNICAL SUMMARY

It has been asserted, on the basis of "cross-sectional" survey data, that use of the Internet leads to a loss of sociability, a diminishing level of participation in those activities that contribute to the formation of "social capital". The evidence for these claims—surveys showing that people who use the web spend more time alone, less time in activities that involve other people—seems, at first sight, quite straightforward and conclusive.

The argument, however, is not quite as simple as it seems. There are, in fact, two quite distinct reasons for not taking the survey evidence at face value:

1. The surveys themselves use questionable questions. People asked directly to estimate how much time they devote to particular activities are in general unable to provide reliable answers (sometimes because the categories of time use are unclear, sometimes because the designated period over which the estimate is to be made is not appropriate or in any way salient to the respondent, frequently because the respondent fails to remember all the episodes of particular activities over the designated period, or mis-remembers the true duration of those episodes).

2. Estimating the effects of the web by comparing the activities of users and non-users as demonstrated by a single "cross-sectional" survey, involves a logical fallacy. Processes of change can not be explored merely by examining differences between people. Any difference we find between users and non-users of the web *may* be a consequence of the web—or it may reflect some other prior difference between people that relates to their *choosing to use* the web. (So, for example, people who have special computer skills may also be less sociable than others, and, incidentally, better represented among early users of the www; under these circumstances the cross-sectional difference between users and non-users would be better understood as a cause of web-use than a consequence of it!)

There are two quite distinct methodological implications. We can deal with problem 1, by adopting a specific survey research technique, which requires respondents to keep a diary of their daily activities, which researchers can use subsequently as a basis for better estimates of time allocation. And objection 2 can be dealt with by making repeated observations of this sort (in a "panel study"), to see what changes emerge by comparing behaviour before and after the start of web-use. The research reported in this paper therefore relies on a unique, nationally representative, *panel diary study* design.

When we do the measurements properly in this way, the apparently negative effect of the web on sociability disappears. In fact, for reasons which are explored both theoretically and empirically in the paper, it appears that some aspects of sociability may actually be *enhanced* by web-use. It appears in particular that those who start to use the web, also actually increase the time they devote to out-of-home leisure activities such as cinema-going and eating out at restaurants.

Web-use and Net-nerds: A Neo-Functionalist Analysis of the Impact of Information Technology in the Home

1 A Neo-functionalist View of Consumption.

Norman Nie's Net-nerds.

What follows was stimulated by a striking finding reported by a group of eminent social scientists in the US (Nie and Erbring 2000). On the basis of US cross-sectional survey evidence, they concluded that those who use the internet have less social contact than others, and implied that the use of the net turns us into web-nerds (the "nerd" is an English term of art previously used to describe 1960s optical astronomers during their night-time observation phases, collectors of locomotive numbers, and other solitary and technically-oriented obsessive personalities).

The present paper:

- contends that this finding is methodologically flawed, both because of the questionnaire-based design of the cross-sectional time-use measurement, and because longitudinal panel survey materials are necessary to draw any such implication;
- argues for a particular "neo-functionalist" theoretical perspective within which the impact of such new technologies may more helpfully be considered; and
- illustrates these propositions through the analysis of a new UK panel study of time-diarists.

Technologies as a chains of provision for services

There are a number of recent reviews of research on the social impact of the Internet (interested readers are directed particularly to Dimaggio et al 2001, Wellman et al 2001); the theoretical discussion that follows relates particularly to the currently contested issue of the "time displacement" results of the internet. It concerns the role of technical change in delivering "final services"—those ultimate consumption experiences which are the real purpose and end point of all economic activity.

There are many alternative chains or sequences of activity that might lead in principle to the same or a similar final service. A woman might plant and harvest her own wheat, mill it herself, bake, slice the bread, butter her own sandwich and eat it. Or she might enter a café, eat a sandwich and pay for it. There are fundamental differences in the sensations she might experience as a result of these two chains of activity. But it would also surely be perverse to deny that there are also some important similarities, a degree of functional equivalence. Rather similar sorts of wants are satisfied by quite different sequences of various sorts of paid and unpaid work and consumption—by, in the broad sociological sense of the word, different *technologies*.

The fully developed theoretical perspective from which this example is drawn is too elaborate to spell out in detail here (see instead Gershuny 2000 Chapters 2 and 8). But a simple listing of some of its key definitions provides a sufficient introduction for the limited purposes of this paper. It distinguishes various "final service functions", which might be specified either in a very general way (eg: basic wants /luxury wants /other) or else in a more detailed manner (eg nutrition /shelter /education /medicine /spectator sport etc) in such a way that all the paid work, unpaid work and consumption activity in the society can be related to one or other of the categories. The different sets of activity that relate to one or another service function constitute the "chains of provision" for that category of want. Technical innovations allow the development of new sets of activities that go to satisfy to satisfy particular wants—"innovations in modes of provision".

Thus, to choose a pertinent example, in the 1950s, people progressively reduced time devoted to trips to the cinema to watch films, but bought televisions and produced the final entertainment service themselves at home; thus a change in the balance between different modes of provision for passive entertainment—a change (to adopt a term from transport studies) in the "modal split" which has clear reflections both in employment and time-use data. Using such definitions, and combining the conventional National Accounts statistics (including input-output tables) with time-budget studies, it is possible to produce complete accounts of societies' time use, broken down by different sorts of work and consumption time, across each of the "service functions" (see, for example, Gershuny 2000 Table 8.1 pp 224-5). Such accounts subsume the whole of the society's economic activity within the wider context of its overall time budget.

This is a neo-functionalist approach, where the functions are "wants" for particular sorts of final consumption experiences. It must be stressed that the "functions" in this approach—the particular set of wants that are satisfied by the economic system—are of course, not givens; this is no Maslovian list of human needs. The functions are certainly not to be seen in any way as determined by any inevitable forces whether biological or economic. They are merely the outcomes of historical processes, contingent, culturally diverse, and varying widely over time and between countries. But, while they are socially constructed (in the sense spelt out by Berger and Luckman 1970 pp 70-85), they are nevertheless real, and it is innovations in modes of provision for them that drives the economy. And with the economic change, comes change in patterns of time use.

It is presumably in this sense—though without the explicit statement of the theoretical approach—that the authors cited by DiMaggio *et al* refer to "time displacement". There is a certain functional equivalence, in exactly the sense set out above, of time spent watching television and time spent at the cinema. Historical and cross national comparative time use studies of the diffusion of television use across the developed world suggest that time spent watching television "displaced" time at the cinema (eg Szalai 1972). DiMaggio *et al* pose the question of whether the internet has similar effects in relation to television as well as other leisure activities, citing studies for and against such time displacement effects.

In fact, once we set out this neo-functionalist perspective explicitly, it becomes clear that there are a number of different ways that the diffusion of new technologies may affect time-use patterns. For example:

- Technical change may increase the productivity of paid work in production of "basic" commodities, in turn freeing time to be transferred to chains of provision for more sophisticated or luxury wants. The last 150 years, in OECD countries, have seen enormous transfers of societies' time away from food production, and into chains of provision for more sophisticated or luxurious services.
- Increased productivity has also led to very substantial reductions in paid work time—if for no other reason, to free time for the consumption of all the extra product. The "harried consumer" solution to accommodating productivity growth without ever-rising unemployment, as predicted by Staffan Linder (1970) has been adopted in the US and the UK, but other economies (France, Germany, Sweden) have continued successfully to reduce work hours throughout the 20th century.
- Unpaid work time may be substituted for paid service work (or vice versa). Mid 20th century economic growth was fuelled by technologies encouraging a major transfer of time of this sort which might be thought of as the "self-service revolution" (eg using domestic washing machines for laundry services, driving private cars instead of purchasing transport services, use of supermarkets vs fully serviced shops; see Gershuny 1978, 1984).
- And of course, closely related to these self-servicing examples, new technologies lead to "displacement" of consumption time. This is the substitution of new consumption activities for old – precisely the DiMaggio *et al*, TV vs cinema example.

It is not unlikely that the impact of home-based computing technologies, in combination with increasingly broad bandwidth switched telecommunications infrastructure, will have similar scale of impact—though with quite distinct impacts on time allocation—to the mid 20th century self-servicing innovations. New consumer information systems, systems for purchase and delivery of goods and services, new systems for provision of advice and training, have already emerged as net-based commodities, and there are opportunities for much more of this sort of change. These various sorts of innovation imply a number of different possibilities. The "time displacement" case—with internet time, considered as a leisure or final consumption activity, displacing, for example, social contact or television—is in fact just one among a considerably wider group of such phenomena.

Let us consider just two further cases, of more complex chains of consequences, which are perhaps more generally representative of the effects of a multi-purpose consumer technology (or it may be more appropriate to consider it as a "technological infrastructure") such as the internet.

(1) The final service function may be subject to inelastic demand, in the sense that if it could be done more efficiently in time as a result of the technological change, the resulting time savings could then be devoted to satisfying other wants. This corresponds to the historical case of the declining social time devoted to food production. For example home internet time may take on a new role in an existing chain of intermediate production activities such as shopping. Home shopping using the internet could lead to a substantial reduction in time spent shopping away from home (and related travel) by consumers, while in turn: (i) generating new paid employment both directly in software and telecommunications industries, and indirectly in construction and home delivery services; and (ii) freeing time that consumers could use to satisfy wants for other forms of consumption, which might not directly involve the internet at all (and might well generate yet more new paid employment).

(2) The final service function may be subject to elastic demand: the technology might improve the efficiency and effectiveness (ie either the amount of time or the quality of result) of time devoted to the satisfaction of a particular class of want, to such a degree that consumers want more of it. To use the old language of production for the chain of provision as a whole, in such a case, growth in output of the service function is greater than productivity growth and leads to more consumption time; this is the historical case of the effect of domestic radio and television technologies on time spent in passive home leisure consumption. We shall return to consider this case in relation to the internet after the empirical discussion.

It should be admitted in advance of the empirical analysis that the impacts of web-related activity that we can identify are, as yet, very small. We are at present, to continue the analogy with the mid-20th century “self-servicing” changes, in something like the late 1930s in relation to the putative IT revolution. But we now have that analogy, as we did not in 1937. We can, even at this early stage, both consider appropriate methodologies for the investigation of this prospective new wave of technological change, and study the evidence of its very first manifestations. And whatever these manifestations are, we can be certain that they will be complex, involve various different sorts of changes throughout the chains of provision for various different wants, in general involve a mixture of changes in paid work, unpaid work and consumption activities, and not a simple transfer between pairs of consumption activities. On the basis of the arguments set out here, we would certainly expect to find, something more than just the straightforward transfer from out-of-home sociable activity to www-based home computing implied by Nie’s net-nerd model.

2 Questionnaires, Diaries and Time Use Estimates

The arguments deployed here concern the “effects”—in a sense to be discussed in a moment—of diffusion of a particular technology on time use patterns. So we require, at this point, a brief preliminary discussion on the measurement of time use. There are two distinct methodologies: “stylised estimates”, direct questions about amounts of time devoted to particular activities over given periods, and the administration of time use diaries. The first of these methods, perhaps surprisingly in the light of the comments that follow, is very widely used; virtually every industrialised economy has an annual or continuous ”labour force survey”, which includes a question or series of questions of the general form: “how many hours did you work last week/month”? It has been demonstrated repeatedly (eg Niemi 1983, Hoffman 1981, Robinson and Godbey 1997) that the estimates resulting from this sort of instrument are systematically biased, since, while most employed people are aware of their contractual hours of work, their actual hours of work very frequently differ from these. (The recent suggestion, in Jacobs 1998, that these findings reflect the phenomenon of “regression towards the mean” seems to mistake two balancing sources of systematic error—men working long hours overestimating because of unnoticed work-hours interruptions, women working short hours underestimating because of employment-regime-induced guilt—for a .random error process.) In fact, unless they have some particular reason for knowing their work hours (eg employees clocking on and off, or the self-employed billing clients for work actually done), people simply do not know the answer to this question. And if not paid work time, how much less likely is it that one might know the weekly time devoted to other activities?

The reasons for an a priori rejection of the stylised estimate approach to time-use measurement include the following:

- we do not in general maintain in our conscious mind a continuous cumulative count of time recently devoted to particular activities;
- if we did, we would have no reason in general either to choose any particular period of cumulation (day/week/month), or to use any particular set of time-use categories;
- which means in turn that it is unlikely that respondents share the questionnaire designers' particular concepts (eg does shopping time include visits to the oculist, but not to the doctor?)

All in all, since people cannot be expected to have knowledge of the elapsed time they have recently devoted to various activities, it seems inappropriate to base our measurement of the use of time on a technique that pre-supposes this knowledge. Questionnaire respondents will in general answer estimate questions, since giving answers to sensible-sounding questions is what respondents *do*. But in fact if they are to construct these answers, respondents have to go through, repeatedly, casual and inexplicit versions of the diary methodology itself, summarising their recent time use in their heads, and then totalling, probably inaccurately, elapsed periods in the target activity, in the real time of the interviewer (and probably with an impatient interviewer paid on a completed-interview-based piece-rate).

The diary-based methodology, which involves the establishment of a random sample of records of sequences of recent activities (ideally in the respondents' own words) together with estimates of the clock time of the start of each activity, seems altogether more reasonable. If the preliminary explanation of the study is reasonably neutral with respect to the researchers' chosen topic, respondents have no reason to wish to mislead them, and there is not the tendency to over-count activities; calculations of daily time allocations will automatically sum to 24 hours/day and so on. A narrative account of a sequence of recent events, by contrast to the stylised estimate, is a natural category of self-knowledge, and in fact the skill of constructing sequential narratives is a frequent outcome of early-school-years socialisation in the respondents' household-of-origin (Ie: "What did you do at school today").

This observation is, in fact, pretty much all there is to the first objection to the Nie and Erbring argument. Respondents to an instrument focussing on internet use are always likely to exaggerate the extent of this in stylised estimate questions, and also, perhaps as a result, to reduce their parallel estimates of time devoted to other activities. And more generally, they do not really know the answers to the questions. Time use patterns should be established by diary techniques.

However, there is a serious problem with the diary approach. Diaries are very onerous to complete. As a result they have relatively low response rates. This problem is, as we shall see, doubled and then redoubled by the "panel" design of the present study. The arguments for a panel or "repeated measures" approach to this problem are set out in the next section; they led us to adopt a three-times repeated diary collection from the same individuals over a three year period. This strategy in fact produces two distinct sorts of response burden.

The first relates to the design of the diary instrument itself. The point of the panel approach is to measure change in time use. But, for any person, time allocation varies widely from day to day. A repeated-measures type comparison of single day diaries would be likely to reflect more intrapersonal variation than genuine change. Hence (as a consequence of the observation that most intrapersonal variation is captured within a weekly cycle) it was decided to collect seven consecutive days of diary accounts, considerably more onerous that the standard time-diary instrument (though using a specially simplified diary format, with precoded activities, recording multiple simultaneous activities but with no "who with" record).

The second relates to the repeated measurement. In addition to the higher-than-normal non-response to the diary instrument itself, there is also the problem of attrition in successive waves of data collection. Of course, since we know a great deal about the identity and characteristics (including specifically the time-use characteristics) of the diary attritors, we are able to make use of the standard panel non-response weighting techniques to compensate for this problem. But the two problems together mean that we must devote rather more preliminary space in this account to the discussion of the problem of systematic non-response than would normally be the case.

The data

What follows is based on the Home-on-Line (HoL) time-diary panel study (Lacohee and Anderson 2001) based at ISER, University of Essex. The HoL study had an initial random probability sample of 1000 UK households, with an over-sample so as to provide 50% of the achieved household sample with home computer access (the UK average was 32% at the time of the first wave in 1999: Taylor et al 2000). All adult (16+) members of household were interviewed. Two further annual waves in the early spring of 2000 and 2001 were undertaken. Wave 1 consisted of computer aided personal (CAPI) interviews, while waves 2 and 3 involved an initial telephone (CATI) interview. Each wave consisted of a multistage investigation, consisting of an initial household interview with a randomly selected household informant, followed by individual interviews with all adult household members. A seven day self-completion time-use diary was left behind for all adults, together with children over 10 (using a slightly simplified design, results of which are not discussed further here), with a request to complete this at least once per day, and then mail back at the end of the designated week. Rules for inclusion in the subsequent waves follow those of the British Household Panel Survey (similar to the US Panel Study of Income Dynamics); broadly all members of Wave 1 respondent households, plus all current co-residents, are interviewed in subsequent waves. There have been previous diary panel studies (Harvey and Elliott 1984, Juster 1985; and Kraut et al 1998 discuss the specific issue of the impact of the internet on sociability); the present study is however the first nationally representative diary panel using the sort of long diary suitable (since it reduces current intra-personal variability in time use) for exploring changes in time use at the individual level.

The wave 1 questionnaire response rate was a barely respectable 57%. Only 66% of the wave 1 respondents completed the wave 2 questionnaire; no doubt the extremely onerous requirement to complete a full and continuous seven day diary contributed to this poor result. Because of the high attrition rate a fresh sample was drawn in wave 2, providing similar response rates and attrition from wave 2 to wave three: for this reason only pooled 2-wave analyses (ie wave 1 to wave 2 transitions pooled with wave 2-wave 3, together with some wave 1-3 transitions for the wave 2 attritors who rejoined the sample in wave 3) are examined in this paper. Longitudinal weights to compensate for differential non-response and attrition have been calculated, but are not used within the regression and other analyses that follow here.

Just over 62% of wave 1 questionnaire respondents successfully completed diaries, hence a major issue of concern is the possibility of systematic bias in the diary sample. The next section therefor sets out an approach to establishing whether the diary sample is in fact biased.

The "Crowding-out Hypotheses"

It is asserted that busy people have less time, so they are less likely to complete their diaries. Now, it is never possible to answer the question of whether non-response bias is "informative" in a fully general way. But in the case of a multistage survey, there is the potential for a partial solution to this problem, by considering responses to the successive stages of the survey.

The particular hypotheses is that busy people don't keep diaries. We need therefor to see if nonresponse is indeed related to how busy – or leisurely – are the diary non-respondents. The tests used here all rely on the fact that the questionnaire respondents all answered a range of questions about their activity patterns, each of which give some clue as to individuals' state of busyness. In each case we are able to compare questionnaire responses of the diarists with the questionnaire responses of the non-diarists. If their respective states of busyness are similar, then we are entitled to conclude that the non-response is, in this respect at least, non-informative. Three distinct sorts of questionnaire evidence are used for this purpose:

- Questions about frequency of participation in particular activities. These are different in principle to stylised estimate questions about aggregate time use. Most people can say at the least when they last did activity x, and can, as a result, make some kind of reliable attempt at estimation of the frequency of occurrence of the activity.
- Questions about division of tasks within households. These are (I conclude from personal experience) a frequent subject of discussion within busy households, and respondents are as a result likely to have well-grounded views on this subject. This is, in short, and (unlike, for example, the amounts of time devoted to specific leisure activities) a "natural category of self-knowledge"
- Stylised estimate time-use questions. It is of course somewhat embarrassing to use these in the current context. But irrespective of the biases and double counting of time discussed above, we have no a priori reason to expect diarists and non-diarists to be differentially biased. Hence, irrespective of the actual estimates themselves, and just as in the two foregoing cases, a similarity between the responses of the two groups implies non-informative non-response to the diary instrument.

Table 1 calculates the probability of participating in various sorts of leisure activities of the 659 non-diarists and the 1181 diarists in wave 1 and the 628 non-diarists and the 741 diarists in wave 2. (The original question used a "several time pre week/ once per week/at least once per month/ several time per year/ less frequently" categorisation and the weekly participation probablities were assigned on this basis. The current version of the wave 3 questionnaire dataset is only partially cleaned; wave 3 columns will be added in the next draft.)

Table 1 Non-diarist vs diarist leisure participation frequency estimates

Probability of participation per week	1999 non-diarist	diarist		2000 non-diarist	Diarist	
play sport/ take walk	0.70	0.71	ns	0.70	0.71	ns
watch sport	0.17	0.15	ns	0.17	0.15	ns
go to cinema	0.17	0.14	**	0.17	0.14	**
eat out	0.50	0.47	ns	0.50	0.47	*

significance ** P=<.005 * P=<.05

There are some significant differences; 14% of diarists going to the cinema once or more per week, as compared with 17% of non-diarists; 47% of diarists eating out as compared with 50% of diarists. But the differences, among the two groups are not, in absolute terms, very large.

The evidence on the domestic divisions of responsibility for four distinct type of task shown in Table 2 (coded as: men do it =0 spouses share =.5, women do it =1) shows similarly small differences. All adult respondents answered these questions, and in fact the women's responses show very little significant difference between the diarists and non-diarists; the men's responses, as we would expect from the literature, are a little more optimistic about their own contribution than are the women's about the men's – but in general the reported patterns correspond reasonably well with each other.

Table 2 Non-diarist vs diarist domestic task participation

1999 all	non-diarist	diarist		men non-diarist	diarist		women non-diarist	diarist	
shopping	0.67	0.68	ns	0.66	0.66	ns	0.68	0.71	ns
cooking	0.73	0.77	*	0.72	0.75	ns	0.74	0.79	ns
cleaning	0.73	0.75	ns	0.72	0.72	ns	0.74	0.77	ns
washing	0.81	0.87	**	0.79	0.86	*	0.82	0.88	*
2000 all	**non-diarist**	**diarist**		**men non-diarist**	**diarist**		**women non-diarist**	**diarist**	
shopping	0.61	0.64	ns	0.54	0.60	*	0.68	0.68	ns
cooking	0.64	0.69	*	0.58	0.64	ns	0.71	0.74	ns
cleaning	0.67	0.70	ns	0.63	0.65	ns	0.72	0.76	ns
washing	0.72	0.76	*	0.65	0.71	ns	0.79	0.81	ns

When we construct (Table 3) a domestic division of labour index (as, eg, in Laurie and Gershuny 2000) aggregating the four types of unpaid work, we again find a similarity—with perhaps a suggestion that the women diarists are slightly more hard-working than the diarists. (We are of course using unweighted data for these comparisons; the difference here may reflect a slight preponderance of non-employed women diary respondents—and employment status is controlled for in the regressions estimated in the later stages of the paper.)

Table 3 Non-diarist vs diarist domestic task division (domdiv) index

domdiv index	1999			2000		
	non-diarist	diarist		non-diarist	diarist	
both	0.73	0.77	*	0.67	0.70	ns
men's accounts	0.72	0.75	ns	0.60	0.65	*
women's accounts	0.74	0.79	*	0.73	0.74	ns

Finally Table 4 compares the stylised estimates of paid work, female stereotypical and male stereotypical unpaid work time. Again, there is no significant suggestion that the diarists are less busy than the non-diarists.

Table 4 Stylised estimates of three sorts of work

Hours/week	1999			2000		
	non-diarist	diarist		non-diarist	diarist	
housework	11.2	11.5	ns	11.9	11.7	ns
DIY	4.2	4.4	ns	4.7	5.4	ns
paid work (participants only)	37.9	36.7	ns	37.5	36.0	ns

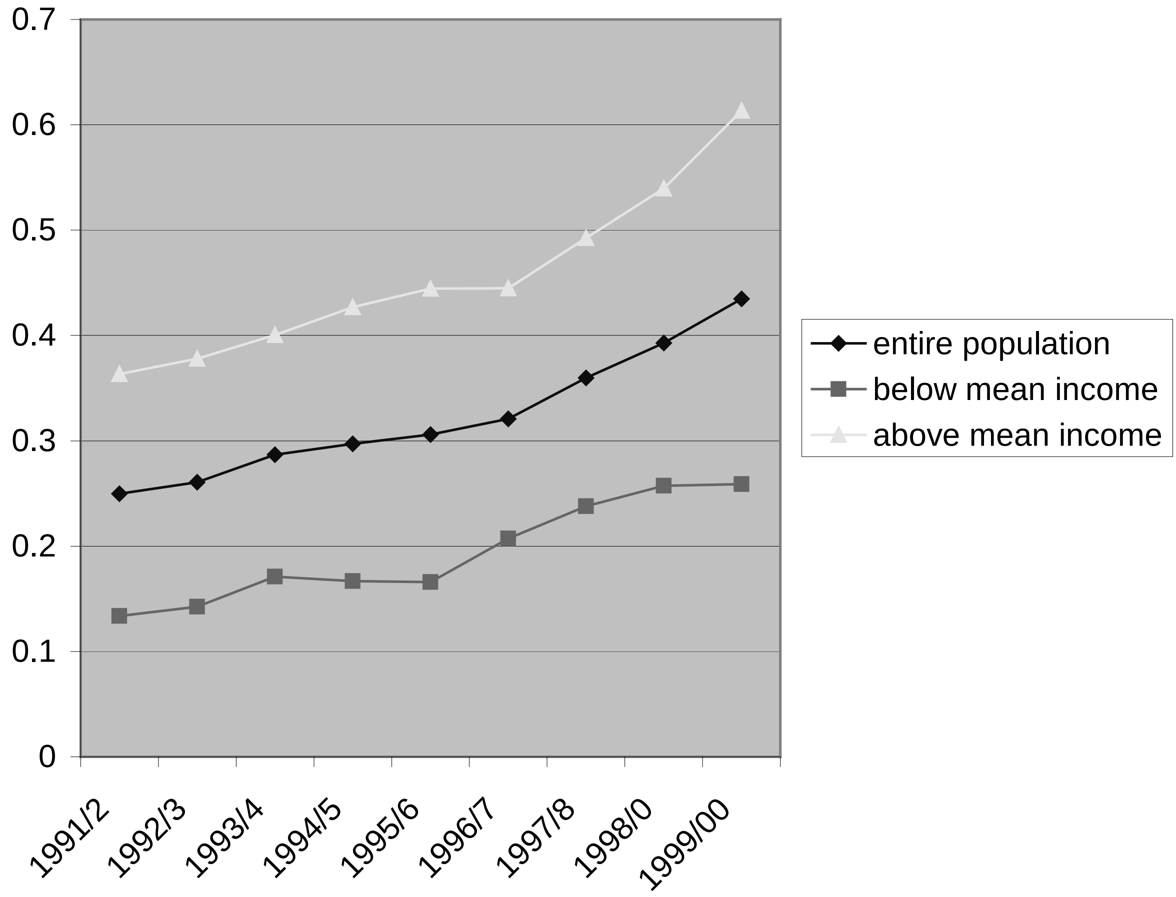
On the basis of these generally small or non-significant differences, we may be entitled to conclude that non-completion (or non-return) of the diary instrument is reasonably non-informative, at least as regards the relative busy-ness of the respondents. So, as against the “crowding-out” hypothesis, we might counterpose an “inertial hypothesis”, that busy people **fit more in** – they are just as likely to complete their diaries. (This sort of result is frequently reported in relation to cross-sectional time-use studies – see, eg Gershuny 1990, Robinson and Godbey 1997).

3 IT in the home: a very *small* revolution

Our substantive starting point must be the diffusion of home computing. Figure 1 (data from the first nine waves of the British Household Panel Survey) shows that on an individidual basis 45% of people by early 2000 (probably approaching 50% by now) are in households with home computers. But the distribution of access is socially skewed. Getting on for two thirds of those in households above the mean income have access, but fewer than a quarter of those in below-mean-income households, and there are negligible level of ownership in households below the official half-median income poverty line. There is a substantial "digital divide".

We see, in Figure 1, evidence of regular growth. This is a classic diffusion curve, entering the steep growth phase. But note that all the aggregate growth comes at the top end of the market. Is this an acceleration of the digital divide? Or does it reflect a change in the way low-end households get IT services, through relatively restricted approaches to online access, through specialised telephone or TV based email systems in which the local computing power is either limited or inaccessible? The evidence is just starting to come in on this.

Figure 1
Proportion of British adults in households with computers (BHPS)



Time diary evidence of change

But to get a proper perspective on the nature of the putative IT revolution, we need to see how home computers are actually used in the home—how they relate to ongoing changes in the pattern of daily life. There is immediately a problem, There are lots of economic statistics about what goes on in "the economy", but very little about activity patterns outside the economy. Yet most of what we do goes on outside the economy, including about half the work of the society, which is done on an unpaid basis in private households and community organisations.

We need to have some picture of the full range of activities—paid work *and* unpaid work *and* leisure. To understand this big picture we need an unusual sort of evidence—on how people spend their time. This is why we need the time diary statistics. We are fortunate in the UK that we can put together a quite long-term time use data series. The BBC Audience Research Department (which conducted time budget surveys as far back as the 1930s) has surviving time-diary micro-data going back to the early 1960s. From the early 1980s, the Economic and Social Research Council has been supporting national time-use surveys. The 1999/2000 comes from the BT-funded study described above.

Table 5 Historical change in time-use

	UK men 25-65				UK women 25-65			
	1961	1975	1987	1999/00	1961	1975	1987	1999/00
Hours per week								
sleep, personal care	64	65	65	63	64	66	67	65
eating at home	10	9	8	6	12	10	8	7
unpaid work at home	9	7	11	10	33	26	18	16
child and adult care	0	1	2	4	3	3	3	7
shopping	1	2	3	3	5	5	5	5
church, voluntary etc	1	0	1	1	1	0	2	1
paid work	47	38	34	34	15	15	21	22
travel	3	7	9	7	2	5	8	6
active leisure	4	7	4	4	3	5	3	4
eating out of home	1	2	3	4	0	1	2	3
radio, tv etc	16	17	17	19	14	15	14	16
other home leisure	11	12	10	10	15	17	13	13
other	1	1	2	1	2	1	4	2
home computing	0	0	0	2	0	0	0	1

So we are able to give quite a long term picture of change in national activity patterns strecthing back from the present to the early 1960s. Table 5 (covering adults aged 25 to 65) shows the following key changes for men:

- Sleep time remains *unchanged* over the period.
- Eating meals at home is declining strongly throughout the period (food at home being more frequently in a “grazing” form simultaneously with other activities)
- while eating out (and going to pubs) has been growing substantially.
- Shopping time has been increasing; this is related both to the increased distance to shops and hence travel time, as well as the spread of self-service shops over the period.

- There is a surprisingly small growth in TV and radio over the period.
- An extraordinary decline in paid work
- Overall, around two hours per week were devoted to home computer-related activities in 2000

The picture for women, is pretty similar except for:

- A very substantial decline in unpaid work time, and
- a small increase in paid work (since the great bulk of increase in women's employment over this period is in unpaid work.
- Women's time using personal computers is about half that of men.

Of course the really surprising thing from this table, given recent discussions in the media, is that there is no long-term evidence for the widely discussed "time congestion" phenomenon. Even among working-age adults (the table focuses on the 25-65 age-group, to exclude the effects from the very rapid expansion of tertiary education over this historical period), we find a notable and unexpected *growth* in leisure time. What we can see instead is a phenomenon that corresponds to another related argument—about time use *polarisation* over this period. The hypothesis is that developed societies show the emergence of two distinct groups: at one extreme the work- (and money-) rich, leisure poor, and at the other, the work-and-money-poor with lots of leisure but insufficient money to spend on it.

Table 6 Historical change in time-use, by social position (MRS Social Grade)
1 =MRS AB: head of HH higher professional, managerial 2=MRS C1: other white collar
3=MRS C2,D,E other occupations, unemployed

	UK men 25-65						UK women 25-65					
Hours/week	1961			1999/2000			1961			1999/2000		
MRS social grade	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
sleep, personal care	63	63	64	62	62	63	65	65	64	63	65	66
eating at home	11	11	9	6	6	7	12	13	12	6	6	8
unpaid work at home	11	10	8	8	10	11	33	34	32	10	14	19
child and adult care	2	0	0	2	4	4	5	4	3	2	5	9
shopping	1	2	1	3	3	3	5	5	5	4	4	6
church, voluntary, etc	3	1	1	1	1	1	2	1	1	1	1	1
paid work	40	43	50	39	37	29	12	12	16	35	31	12
travel	6	4	2	9	8	5	1	2	2	9	7	5
active leisure	5	4	3	4	4	4	3	4	2	3	4	3
eating out of home	1	1	1	4	3	4	0	0	0	5	3	2
radio, tv etc	10	14	18	15	17	23	13	11	15	13	14	19
other home leisure	15	12	9	10	10	11	16	16	15	13	11	14
other	1	1	1	2	1	1	1	1	2	1	2	2
home computing	0	0	0	4	2	1	0	0	0	3	1	1

Table 6 shows the long term historical change in activities, as in the previous table, but broken down by a crude indicator of "social grade". Note in particular:

- The reversal of the traditional gradient between paid work-time and social class: the economically dominant class works the longest hours, and the highest leisure time totals are associated with those least well-provided-for. This presumably reflects the changed composition of capital: those who own financial or fixed capital can earn profits without committing their own time; but to extract profits from embodied human capital, which has proportionately increased in importance over this period—its possessors must also spend their time in paid work..
- There is an increasingly strong class gradient in passive leisure: lower social grade is associated with more TV viewing.
- And we can see the outlines of a nascent digital divide effect, with those in the highest social grade associated with much more home computing time than others.

I have argued elsewhere that the reversed class/leisure gradient provides us with a potential explanation of the absence of a marked time-congestion phenomenon in these data (Gershuny

2000 Chapter 3). It may be that the "time bind" is, rather than a real phenomenon, a reflection of the particular circumstances of those who write about lifestyle issues in the media. Real long-term evidence about historical time use change is very difficult to find. And in the absence of real quantitative evidence, writers are forced to draw on their own subjective or observed experience of change in time use patterns. In general those writing about this belong themselves to the well-off, well-educated "leisure-poor-work-rich" sub-group who indeed *have* lost out in relative terms as compared to the general population. But this group's *current* problems over their personal time budgets, do not of course amount to a general historical *trend*.

For the purposes of the current paper we should particularly note the relatively low level of time devoted to home computing overall—hardly two hours per week for working-age men, around one hour per week for working age women (and with a very strong social class gradient in the amount of time used). The time-use data put the questionnaire-based studies of the effects of the internet into an appropriate perspective. Plainly if there are *any* observable affects of the internet, then these are going to be small ones: one or two hours makes only a small dent in the 168 hours of the week, and there have been much larger changes (eg reductions in women's unpaid work time, overall growth in leisure time) over the period covered by the two last tables. And internet-related activity (web-browsing plus email) is just one part of home computer use. *Are* there any discernible consequences of this recent emergence of this new, and small, category of time use, for the other things people spend their time on?

TABLE 7: Time in various activities: "good" diarists only

	All respondents			Non-www users			www users		
	1999	2000	2001	1999	2000	2001	1999	2000	2001
(mins/day)									
paid work, ft education and assoc. travel	229	225	227	226	220	212	251	243	267
unpaid work, shops etc and assoc. travel	208	212	208	210	221	218	194	183	180
sleep, personal care, meals at home	619	617	624	622	620	633	603	607	600
social life, 'going out', associated travel	52	52	49	50	50	46	62	56	56
visits to friends houses_being visited	55	52	51	56	53	53	42	50	45
playing sports, walks, outings	24	29	24	25	29	24	19	30	25
telephone calls	9	10	10	8	9	9	11	11	12
hobbies, games etc	12	11	12	12	11	12	9	12	14
Radio, TV, video etc	159	153	159	163	158	167	132	133	138
Reading newspapers, books, magazines	27	29	29	27	31	29	27	26	27
doing nothing, other	20	20	23	20	21	25	21	17	16
computer games etc	5	4	3	4	3	2	12	10	7
email, browsing the web	3	5	7	0	0	0	22	23	26
study, paid work, other, on the computer	11	12	9	8	6	4	28	32	21
missing	9	8	6	9	8	6	8	7	6
	1442	1439	1441	1440	1440	1440	1441	1440	1440
N	*938*	*673*	*683*	*822*	*520*	*499*	*116*	*153*	*184*

TABLE 8 www users and non-users: time in various activities
(* P<.05 ** P<.005)

minutes per day	All	all non-user	all user	men non-user	men user	women non-user	women user
paid work, ft education, assoc. travel	227	220	255 **	258	294 *	192	200
unpaid work, shops etc * assoc. travel	209	215	185 **	167	151	251	232
sleep, personal care, meals at home	620	624	603 **	611	587 **	634	626
social life, 'going out'. Assoc. travel	51	49	58 **	56	56	44	60 **
visits to friends houses_being visited	53	54	46 *	46	43	61	50 *
playing sports, walks, outings	26	26	25	30	26	22	24
telephone calls	9	9	11 **	6	9 **	11	15 **
hobbies, games etc	12	12	12	10	11	13	13
Radio, TV, video etc	157	163	135 **	178	144 **	151	121 **
Reading newspapers, books, magazines	28	29	27	32	24 **	26	30
doing nothing, other	21	22	18	23	18	20	17
computer games etc	4	3	9 **	5	13 **	1	4 **
email, browsing the web	5	0	24 **	0	28 **	0	18 **
study, paid work, other, on the computer	10	6	26 **	9	31 **	4	20 **
missing	8	8	7 *	7	6	9	8
	1440	1440	1441	1438	1441	1439	1438
N	*2294*	*1841*	*453*	*791*	*258*	*1038*	*190*

TABLE 9 A cross-sectional time-use model

(* P<.05 ** P<.005)

(mins/day)	personal	going out	Visits	Sports etc	phone	hobbies	TV etc	Reading	nothing	missing	total
AGE	-3.15 **	-0.81 *	-0.03	0.94 **	-0.21 *	0.06	1.59 **	0.11	1.34 **	0.15 *	0.00
AGESQ	0.04 **	0.00	-0.01	-0.01 **	0.00 *	0.00	-0.01 *	0.01 **	-0.02 **	0.00	0.00
WOMAN	21.76 **	-3.80	11.60 **	-8.02 **	5.12 **	1.96	-25.07 **	-3.73 *	-2.14	2.33 **	0.00
WAVE2	1.01	2.24	-0.61	4.83 *	1.23	-1.26	-6.93	0.06	1.27	-1.85 **	0.00
WAVE3	1.76	-0.41	-1.10	1.36	0.38	-0.40	-1.21	-2.27	5.68	-3.80 **	0.00
contracted time	-0.25 **	-0.08 **	-0.14 **	-0.07 **	-0.01 **	-0.02 **	-0.25 **	-0.05 **	-0.13 **	-0.01 **	-1.00
committed time	-0.16 **	-0.15 **	-0.13 **	-0.06 **	-0.01 **	-0.02 **	-0.27 **	-0.05 **	-0.14 **	0.00	-1.00
computer games	-0.30 **	-0.21 **	-0.09	-0.07	-0.01	-0.04	-0.11	-0.01	-0.16	-0.01	-1.00
other home comp	-0.10 *	-0.10 *	-0.14 **	-0.06 *	-0.01	-0.03	-0.45 **	-0.02	-0.10 *	0.01	-1.00
internet	-0.31 **	0.16 *	-0.22 **	0.02	0.06 **	0.02	-0.53 **	-0.07	-0.12	-0.01	-1.00
(Constant)	760.14 **	136.56 **	122.10 **	41.36 **	14.61 **	16.03 **	247.00 **	32.67 **	64.56 **	4.96 **	1440.00
Adj R Square	0.35	0.13	0.12	0.07	0.05	0.04	0.29	0.26	0.08	0.06	

4 Cross sectional differences between users and non-users

We can now turn to the straightforward comparisons of time data for www users and non-users. The brief summary of the results is that there is little sign of the Nie et al finding in the UK time-diary data. (Similar non-results have been reported both from US questionnaire evidence (Wellman et al 2001, and from time diary materials: Robinson 2001).

TABLE 7 (using unweighted data, as throughout this paper) shows the means for a comprehensive set of 14 categories of time use (together with a fifteenth catchall other/missing category: this table includes just those “good diarists” with at least 23 hours/day allocated to one of the substantive activity categories). The table shows first of all, despite the sampling vicissitudes described in the previous section, and despite relatively small N of cases, quite a considerable stability in estimates of the sample’s behaviour over the three successive years. We see—as indeed we would expect over such a short span of historical time—very little evidence of change in anything.

The table provides us with a first hint of comparison between web-users and non-users. It looks as if web-users have rather more paid work, and less sleep than non-users; more “going out” but less visiting friends in their own houses, less television watching….. But for this sort of comparison, and given the short-term inter-temporal stability of the estimates, we would do better to turn to the pooled data for all three years as in Table 6.

Table 8 illustrates in quite the most straightforward of ways, the most basic—and as it will turn out, the most important—of the objections to the simple comparison of web users and nonusers: users and non-users differ also with respect to other variables. We can see that many of the general categories of apparent difference from Table 5 emerge as significant differences (by t-test). Web users do indeed have substantially, significantly, more paid work and less unpaid, for example. But, immediately we consider the means separately by sex, these apparent “effects” dwindle, to be replaced by (i) the long established tendency for men to do more of one and less of the other, which we might explain in terms of historically contingent gender ideologies, or whatever, and (ii) an unexplained propensity for men to participate more frequently in web use.

Some of the associations persist once we control for gender. The Nie and Erbring finding that television watching time is much lower among web-users is still strongly supported. But is this really because of the web-use, or because of the fact that, for example, web-users do more paid work? And some findings are shown to reflect in fact interactions between gender and web-use. The two time use categories most closely connected with the net-nerd hypothesis—"going out" and "visits"—show something of this sort: relatively small differences for the men, but really quite substantial differences between women users and non-users, with women users apparently "going out" a lot more, but visiting friends' houses a lot less—which might in turn suggest that the female users and non-users are in some sense "different sorts of women".

This is clearly not the right way to go about the analysis. Three distinct problems are emerging:

1. There may some other "third variables", measured in the survey, but not yet included in the analysis, causally prior to both net use and social activity, which confound our view of the connection between them.
2. Some of these "third variables" (eg employment status) have very strong connections with particular categories of time use (paid work) so the effect of the variable might be either direct (ie employed people are the sort who do less visiting) or a result of time-use crowding (employed people have less free time for visiting).
3. Some of the remaining differences between users and non-users may still not be consequences of the net-use, but relate to other interpersonal differences which have not been measured, and indeed might in principle not be measurable at all ("unobserved heterogeneity").

We can deal with the first two of these problems, by adopting a rather more formal regression modeling strategy. And indeed the third problem has a straightforward solution in the panel analysis to which we turn in the next section.

There are three different categories of right-hand-side variable in the regression models presented in Table 9. First, there are the straightforward sorts of categorical and other classificatory information. Second are those time use elements that might be expected to be closely associated with "causally prior third variables". In the models, I have used paid work and unpaid work ("contracted and committed activities" in the conventional time-diary analysis terms: Aas 1978) as right-hand-side predictor variables where they can both act as proxies for categories of employment status and household responsibility and also provide appropriate cross-sectional elasticity estimates—so as to deal with the "crowding" problem.

Third, there are the predictor variables which are of direct interest to our analysis, connected with web use. Web-use is itself a time-use category, so we enter it as a scalar quantity rather than as a classificatory category. And highly correlated with internet use are the two other sorts of home computer use (games playing and use of the personal computer for work or study purposes), which are also entered as scalar quantities. It would of course be possible at this point to do something a little more econometrically sophisticated in the way of causal modeling to disentangle the effects of the web use from that of the other scalar variables here; I will make the reason for not doing so fully explicit in the next section. But for the moment we will simply estimate **Equation 1** for each of the time use categories not mentioned on the right hand side of the regression.

Equation 1

Time use = f(age, age squared, sex, date of survey)
+ f(time in: contracted, committed, games, other pc, internet)

This produces a table of results with three pleasing characteristics:

1. The effects of the various categorical and other classificatory characteristics sum, across the full set of time use variables not included on the right hand side of Equation 1, to exactly zero, since, whatever the characteristics—age, female gender, year of measurement—there are always exactly 1440 minutes in the day; more time spent by a person with any given characteristic in one activity, must therefor be exactly compensated for by less time spent in the other activities.

2. The effects of the right-hand-side time-use variables must sum, for just the same reasons, to –1 (since the regression coefficients tell us, for each left-hand-side time use category in turn, the effect of spending one extra unit of time on the rhs variable).
3. And the intercepts sum to exactly one day's worth of the time units (since they represent the condition where all the right-hand-side variables are set to zero).

Thus Table 9 gives us the evidence we require: the effect of spending time on the internet, controlling appropriately for the effects of all the other measured, relevant variables. It appears, on this basis, that each extra minute on the internet is associated with about one-third of a minute reduction in personal care time, one fifth of a minute less visiting, half of a minute less watching television – but, to pick a result that does not apparently accord well with the net-nerd hypothesis, nearly one fifth of a minute of extra time devoted to "going out" – eating or drinking in a public place, going to the theatre or cinema. Not necessarily what we would initially associate with our nerds.

It should immediately be said that even this formally specified regression model is still not the correct way to consider the general problem. In fact, the elasticities we are estimating here are not really elasticities in the sense of changes consequential on the variation of the right-hand-side scalar variables. All we have so far are in fact cross-sectional differences; we are in effect simulating change, by comparing people who have at some point changed. We have, for the moment, different people, perhaps people who differ in ways that are not yet included in the model, perhaps even differing in ways that are not measured in the survey instrument. There is really only one way to see effects of change: to take repeated measures of the behaviour patterns of the same individuals. We can only ultimately identify change, by measuring changes. We need, to get at Nie's net-nerds, the sort of natural experiment provided by the diary panel, which looks at the consequences of people changing their net use.

But before we turn to the evidence from our natural experiment, there are a couple of other things we might note from Table 9. The first concerns the coefficients for the dummy variables indicating the year of the survey. These are insignificant for all of the time use categories, with the exception of the final “missing data” category. In this last category the coefficients are increasingly negative with each of the two successive years of measurement. The numbers are small, -2 minutes in the second year of the panel, -4 minutes in the third year, but in both cases clearly significant. We have here a combination of learning—people getting better at filling their diaries—and sample selection (ie losing bad diarists). The sample selection effect is there, significant, but not numerically very large. So we do not really have to worry very greatly about whether the panel effects we shall discuss in the next section are produced by a fall-off in recording quality: quite the contrary.

The second concerns the block of coefficients relating the right-hand-side independent time-use variables to the various left-hand-side dependent time use categories. They are virtually all negative. This is not at all surprising: these are, after all (something like) time-use elasticities, in the context of a fixed length day. What should surprise us, is where these coefficients are positive. A positive coefficient indicates that something is really going on, that there is some sort of complementarity between the independent and the dependent variable…. More of this in a moment.

5 Longitudinal consequences of net-use

Now we can start to use the diary panel study *as* a panel. In this section we pool year-on year changes, putting together pairs of years, so that we consider together the pair of years 1999 and 2000, and 2000 and 2001 (and also just those cases where individuals kept diaries in 1999 and 2001 but not 2000), referring to the earlier year as “p” and the later as “q”. We can first of all make straightforward comparisons of change in time use patterns for changers and non-changers, in the manner of the natural experiment mentioned previously. There are in fact four possible cases; an internet user in neither year, a user in year p who stopped using the internet in year q, a “new user” in year q, and an “old user”, who makes use of the internet in both years.

TABLE 10 Time-use means by internet change status

Mins per day by change in www use. (pooled annual panel data 1999-2001)
(paired t-test significance)

on line use =	neither time		user p,not q		new user q		old user	
(* P<.05 ** P<.005) N=	622		42		116		79	
	p	q	p	q	p	q	p	q
Paid work	164	170	173	183	197	192	187	193
Travel	46	47	55	48	51	60 *	71	80
Unpaid work (incl. voluntary)	206	207	193	216	178	170	167	171
Sleep and personal care	560	564	568	549	546	549	531	534
Eating at home	67	71 **	58	60	60	57	59	62
Study, courses	14	12	16	24	39	27	16	17
Social life, 'going out'	34	35	40	36	30	39 *	38	39
Visits to friends houses_being visited	54	51	49	52	44	47	46	38
Playing sports, walks, outings	25	24	22	28	25	22	26	26
Telephone calls	9	9	10	11	10	11	9	11
Hobbies, games etc	13	13	13	13	18	13	15	12
Radio, TV, video etc	167	169	146	153	157	142 *	133	129
Reading newspapers, books, magazines	31	30	29	27	27	29	29	24
Doing nothing, other	17	16	12	10	19	16	24	21
Computer games etc	2	2	6	1	10	10	14	7 *
Email, browsing the web	0	0	15	0 **	0	18 **	21	29 *
Study, paid work, other, on the computer	5	5	10	8	14	20	39	33
not known	27	15	26	23	17	19	15	13

Of these four groups, clearly that relevant to the question of the impact of the internet on styles of life, is the third group, the "new users", whose time use before and after the start of their net-using career is given by the third pair of columns in Table 8. This for the first time allows us to look genuinely at what happens when people start to use the net. What emerges from this natural experiment is substantially (and in some cases significantly) contrary to the Nie net-nerd model.

In the 116 cases of new users, we notice first that (as compared with for example the user/non-user columns of the cross-sectional Table 5) not much changes—since, unlike the earlier table, these are actually the same people at successive time points. There is significantly more travel time, for a reason not yet apparent. There is significantly more "going out" and less television watching; study time at home is reduced by 12 minutes per day (though this change is not significant) and study time on the computer increases by 6 minutes (again not significant). These are not big changes, but at least we are now genuinely looking at change. And they are not unambiguously in the direction of the reclusive, screen-fixated loser of all social contact. On the contrary: starting to use the internet seems if anything to be associated with a small increase in social life. This is not unexpected, given the implications of the neo-functionalist analysis alluded to in Section 2 above: just like the car and the telephone, the internet is not in itself necessarily just an object of final consumption, but may used as part of new chain of provision—it may complement other sorts of time use. Which brings us back, finally, to the line of modelling started in the previous section

A more formal and general analytic approach models change from year p to year q, using essentially the same regression models as in Section 4 for the pooled cross-section data. So equation 1 becomes the pair of equations:

Equation 1a

Time use t_p =f(age, age squared, sex, survey date at t_p)

+ f(time in: contracted, committed, games, other pc, internet at t_p)

Equation 1b

Time use t_q =f(age, age squared, sex, survey date at t_q)

+ f(time in: contracted, committed, games, other pc, internet at t_q)

Now, our research question concerns change in the left-hand time-use variables, t_q minus t_p. And we have to estimate a new regression equation which is derived by subtracting Equation 1a from Equation 1b.

Some of the right-hand-side variables estimated in the original Equation 1 are time-invariant. Sex, for example, does not change between year p and year q; when we subtract 1a from 1b constants disappear altogether. Others (eg age) advance by exactly the same amount for all cases between each wave of data collection, so subtraction produces a new constant which must be dropped from the regression equation. Alone among the non-time-use variables in the estimation of Equation 1, the age-squared term does not drop out as a result of the subtraction. This is, potentially at least, substantively meaningful insofar as (for example) older people might have different dynamics to younger. However, we find that in fact the effect of the (age squared t_q minus age squared t_p)

variable is not significant, and has little effect on the other coefficients (and it does slightly complicate the interpretation of the model) so the following analyses drop this variable, and we find ourselves estimating the straightforward Equation 2

Equation 2

Time use change $t_q - t_p$

= f (contracted time at t_q - contracted time at t_p ,

committed time at t_q - committed time at t_p ,

computer games time at t_q - computer games time at t_p ,

other pc time at t_q – other pc time at t_p ,

internet time at t_q - internet time at t_p)

…. which has only time use variables on both sides. This is genuinely an elasticity equation; it is estimated from panel data, with repeated measurements of the same respondents, and shows us directly the effect of changes in time use, on time use!

Now, if, over some period, we spend more time in one activity, we must necessarily spend less time in some other activity – a simple matter of time displacement. So, by default, we would expect that all the regression coefficients should be negative. And if we do not find negative coefficients relating one of the right hand variables to a particular left-hand variable, then we may be entitled to conclude that there is some kind of complementarity between those variables.

Consider Table 11.

Table 11 Modelling Change in Time Use

(* P<.05 ** P<.005) change in:	personal	go out	visits	sports	phone	hobbies	TV etc	Reading	nothing	missing	total
paid work	-0.23 **	-0.10 **	-0.23 **	-0.06 **	-0.01 **	-0.02 *	-0.19 **	-0.05 **	-0.11 **	-0.01	-1.00
unpaid work	-0.14 **	-0.16 **	-0.17 **	-0.06 **	-0.01 *	-0.03 *	-0.24 **	-0.06 **	-0.11 **	-0.01 *	-1.00
comp: games	-0.26	-0.36 **	-0.04	0.03	0.02	-0.05	-0.39 *	0.11	-0.07	0.02	-1.00
comp: offlin	0.03	-0.17 *	-0.23 *	-0.10 *	0.00	-0.13 **	-0.20 *	-0.04	-0.17 *	0.01	-1.00
comp: www	-0.16	0.23	-0.20	-0.11	-0.02	-0.18 *	-0.43 *	-0.03	-0.13	0.03	-1.00
(Constant)	4.67 *	0.72	-1.15	-0.52	0.72	-0.85	1.11	-1.52	-0.24	-2.95	0.00
Adj R Square	0.14	0.09	0.12	0.04	0.01	0.02	0.14	0.04	0.06	0.01	

Table 12 Modelling Change in Time Use: women only.

(* P<.05 ** P<.005) change in:	personal	go out	visits	sports	phone	hobbies	TV etc	Reading	nothing	missing	total
paid work	-0.20 **	-0.11 **	-0.23 **	-0.06 **	-0.01	-0.03 *	-0.18 **	-0.06 **	-0.11 **	-0.01	-1.00
unpaid work	-0.12 **	-0.20 **	-0.17 **	-0.07 **	-0.02 **	-0.04 *	-0.20 **	-0.06 **	-0.11 **	-0.01	-1.00
comp: games	-0.68	-0.21	0.76	0.05	-0.05	0.06	-0.44	0.07	-0.64	0.08	-1.00
comp: offline	-0.23	-0.29 *	0.09	-0.19 *	0.02	-0.11	-0.03	-0.08	-0.22	0.03	-1.00
comp: www	0.02	0.51 *	-0.46	-0.07	0.07	-0.60 **	-0.77 *	0.25	0.08	-0.02	-1.00
(Constant)	6.26	0.48	-3.67	-1.78	1.03	-1.01	4.59	-1.31	-1.61	-2.98 **	0.00
Adj R Square	0.10	0.16	0.12	0.05	0.01	0.03	0.11	0.05	0.05	0.00	

Our expectation on the basis of time displacement is that in each case the coefficients will be negative. And indeed we do find that virtually all of the coefficients *are* negative. But not *quite* all of them. The effect of spending more time on the internet on “going out” is substantial (and we might note, quite a bit bigger than the equivalent coefficient in the cross-section-based estimate). According to our model, for each extra minute spent logged onto the internet, there is something like 14 seconds of extra time spent going out. The coefficient is not significant—but if we look at the women in the sample alone (Table 12), the coefficient is even larger; an extra minute devoted to the internet is associated with more than 30 seconds of extra time spent eating, drinking, going to the cinema. And this coefficient is statistically significant. In both cases, other sorts of socialising time do reduce: time spent visiting other people’s homes declines at about the same rate that “going out” increases. But if we sum these two types of “out of home socialising”, we still see that the increase in the internet time does not lead to a reduction of socialising time. (Note, incidentally, that the change coefficients in Table 12 are generally quite similar to the cross-sectional “elasticity” effects in Table 9: this tells us that cross-sectional observations *in this case* are not in fact misleading—but panel observations are nevertheless needed as confirmation.)

Table 13 Two alternative models of effects of the internet on sociability

(* P<.05 ** <.005)	going out		visits	
model	1	2	1	2
going out (wave p)		-0.54 **		
visiting (wave p)				-0.68 **
change in:				
paid work	-0.10 **	-0.08 **	-0.22 **	-0.15 **
unpaid work	-0.16 **	-0.12 **	-0.16 **	-0.10 **
comp: games	-0.36 **	-0.28 *	-0.04	-0.10
comp: offline	-0.17 *	-0.14 *	-0.23 *	-0.18 *
internet	0.23	0.29 *	-0.20	-0.24
(Constant)	0.71	26.85 **	1.15	34.43 **
AdjR Square	0.092	0.311	0.12	0.435

There is a potential statistical objection to modelling change in the way I have done in tables 11 and 12, in that there may be an inherent correlation between the level of the dependent variable and its rate of change. (Among possible substantive, as opposed to merely econometric, reasons for this, might be “barriers to entry” to the activity such that those already engaged in it find it easier to increase the time devoted to it, than do those who have not yet started.) One simple way of dealing with this problem is to enter the initial level of the dependent variable as an additional predictor on the right-hand side of the regression equation. But there is a significant disadvantage, as compared with the approach taken in general in this paper: in all the previously reported regressions, we estimate the same set of right-hand-side variables for all the dependents, so we can sum the coefficient along the rows, so as to see the balance of effects of the independent variables on time-use as a whole. Entering a different “initial level” variable for each equation loses this straightforwardly interpretable feature of the earlier tables. Table 13 compares the coefficients from the Table 11 estimations (model 1) with those using the alternative approach (model 2); there is a small change to the estimate of the internet effect, but the same conclusion emerges. Indeed we now see a significant positive relationship between internet use and “going out”, as in Table 11, approximately balanced by a (a slightly smaller, non-significant) negative association with visiting. Overall, we are left with the same conclusion: increasing internet usage has either a positive (on the narrow “going out” definition) or a neutral (on the broader definition) effect on time devoted to sociability with non-household members.

I will speculate, in a moment, on the meaning of this result in the light of the neo-functionalist analysis that I introduced earlier. But it is worth reiterating the implication of this finding in formal terms. We expect to find negative coefficients, on a straightforward time-displacement argument. If, as in the case of the relation of growth in internet time to out of home socialising, we do not find negative coefficients, something must be counteracting the time displacement. There may be something, in the use of the internet, that actively complements “going out”. The coefficients are not strongly significant. But, to put it formally in the cumbersome language of statistical inference, the Nie net-nerd finding suggests, from our point of view, a null hypotheses that significant negative coefficients relating net-use to sociability are to be expected – and this null hypothesis is clearly disconfirmed. To paraphrase Wellman et al (2001 p. 450) on a parallel finding: “This is one of those few situations in social science where a *lack of statistical association* is a meaningful result".

6 What we know, and do not know, about the IT revolution, and how to find it out

It is not of course at all surprising that, once we model this process correctly, using time diary measurement techniques, controlling appropriately for other sources of variation, and checking the cross-sectional "difference" evidence against longitudinal change, the apparent association between internet use and unsociable behaviour should disappear. We all knew people, in the 1980s and 1990s, who corresponded to the Nie and Erbring stereotype of the net-nerd, somewhat reclusive, somewhat obsessive, more often than not located behind a computer screen. We would expect the stock of computer-users in 1998 to include a fair number of such people. But this is not to say that the diffusion of net use leads to such behaviour. It is, ultimately, only when we distinguish *the sort of person who had a computer in 1998*, from the *consequences of acquiring a computer*, or an internet connection, at that particular historical juncture, that we can establish the effect of the internet. The panel design allows us to do this. And a time-diary panel study, which provides adequate and stable measurement of time allocation, at successive points in history, allows us to construct proper time-use elasticity models which show, at least, the time-use correlates of growth in internet usage.

But this does not provide an interpretation for our findings. Why *is* internet use positively (or at least, contrary to our "time displacement" expectations, not-negatively) associated with sociability?

I started by discussing the conceptualisation of technical change as change in the chains of activity associated with the provision of particular final services. New technologies are used in chains of provision that satisfy particular wants. So, how (apart from my own work-related obsessions) do I use this technology?

I use it (or I could do so):

- To find out what is on at my local cinema
- To book tickets on trains and aeroplanes
- To make hotel and restaurant reservations
- To buy routine groceries and arrange delivery as an alternative to shopping…
- …and hence freeing time for leisure activities
- To email my friends to arrange to meet them
- …and so on

In short: I use the technology at least in part as a means of organising and promoting my social life.

The complementarity of internet time with sociability may be unexpected, particularly if we set out expecting to find net-nerds, but nevertheless the findings are reasonably clear. They might, furthermore, be explained in terms of my own sorts of applications of the technology. We might quite reasonably—if still entirely speculatively—associate this finding with the second of the categories of impact of technical change on time use listed in Section 1: of a service function subject to elastic demand. The internet can be used to search for and gather together information and compare what's available in the way of different sorts of out-of-home leisure activity from a wide range of current sources; it can be used to make arrangements and change them, to pay in advance or for others, to reserve speculatively and select subsequently; to contact friends to explore their availability for joint outings. And so on. It can allow us to do all of these things with much more flexibility, immediacy, certainty, than was possible with the preceding technologies (post, telephone, fax)—and it can also be for some purposes combined with these older technologies. In short, it makes going out more efficient—potentially at least, more pleasant, and more sociable, better focussed on our particular wants and preferences. And so, "at the margin" as economists say, we might be tempted to do more of it.

But the connection of the internet/going-out complimentarity to the innovation is still at this point just speculation. If we could establish cause, then we could go further—but establishing a true elasticity, as we have done here, still falls well short of establishing causal priority. We can be certain now that internet use and social life vary together to some extent. But we cannot on the current evidence say definitively that the former causes the latter. It is still possible that there is yet another process going on—it may be for example that there is a personal process of “opening out to the world” going on among computer users and that the increase in internet usage and “going out” are both reflections of this prior phenomenon.

Where to go from here? There is certainly a great deal more to do. More sophisticated modelling with the pooled two-wave data may tease out some more of the causal structure than has been done here. Some three-wave analysis might also help us—but the present study has come to an end, and the size of the panel may be insufficient. We need also to do some serious modelling of the day as a whole in terms of the way internet may change the relation between different sorts of paid and unpaid work and consumption in relation to chains of provision for various wants.

But in my view we also need some more immediate evidence. We should continue to monitor time use on a panel basis but this ought, as is often the case, to be complimented by qualitative, observational work (of the sort pioneered by Silverstone, Hirsch and Morley 1991, and recently recommended by Anderson and Tracey 2001). We will only discover what the actual “chains of provision” are by asking, and seeing, what people are actually using the net for, how it relates to other aspects of peoples’ lives—by observing directly how the technology is embodied in the chains of provision for the various final services we consume.

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