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No Man is an Island: The Influence of Knowledge, Household Settings, and Social Context on Private Computer Use

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Abstract: In modern societies, the digital divide indicates the emergence of a new form of social inequality. The theoretical model presented in this paper captures effects on the micro-, meso-, and macro-level. The empirical findings are replicated for the years of 1997 and 2001 of the GSOEP (the German Socio-Economic Panel). Large net effects are observed on the macro-level, for gender, Turkish ethnicity, and generation. On the micro- and the meso-level the net effects are substantial, too. Knowledge and household setting significantly add to explain who accesses computers and who does not. It remains an open question as to how a potential lack of primary social ties, i.e. living with children, may be compensated to help close the digital divide.

Keywords: Computer, knowledge, children, generation, gender, region, ethnicity

Introduction

The digital divide presumably forms an additional source of inequality within the already established social ordering. This sort of assumption may be challenged by charges of studying a non-existent myth or a "luxury" problem (Compraine, 2001). However, research results so far paint an entirely different picture. For example, computer literacy has been found to increase social activities and school performance (Wagner, Pischner, & Haisken-DeNew, 2001; Wagner, Pischner, & Haisken-DeNew, 2002), enhance mathematical and language skills (Attewell & Battle, 1999), improve successes in finding a job (Boes & Preißler, 2002), and last but not least, increase hourly wages (Kim, 2003). It is, therefore, important to find out why some people use computers while others do not.

When dealing with the digital divide, a certain lack of consistency becomes obvious as to how and for what purposes this terminology is used. It may, therefore, be helpful to start with a definition. I define the digital divide as the gap between the technological "haves" and "have-nots", particularly regarding private computer use. Sometimes a theoretical distinction is made between the "first" and the "second" digital divide (Attewell, 2001), that is, between the "access" to computers and the "purpose" of computer use (Hargittai, 2002; 2004). The former refers to research on the use of computers while the latter deals with the diversity and complexity of computer use. Before dealing with problems on user profiles, however, it should be made clear, who uses computers and who does not and why not.

The current study deals thus with the question to what extent private computer use is determined by socio-economic background. Studies that have dealt with this question so far have included the influence of social

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inequality, region, and ethnicity.[1] Beginning with the former, the digital divide is connected to socioeconomic inequality (e.g., Attewell, 2001; Bonfadelli, 2002; DiMaggio, Hargittai, Russel , & Robinson, 2001; Ekdahl & Trojer, 2002; Jung, Qiu, & Kim, 2001). Usually, "classical" attributes like education and income are introduced to explain the digital divide. A general finding is that the development of the digital divide parallels that of economic inequality (Attewell, 2001; Bucy, 2000; Ekdahl & Trojer, 2002; Luke, 2000; Martin & Robinson, 2004). A study on German teenagers from the lowest educational echelons shows that primary cultural skills, like reading and writing have to be improved before computer or Internet literacy may be acquired (Kubicek, 2004). For obvious reasons the use of new technologies like the Internet strongly depends on people's computer skills (De Haan, 2004; Raban, 2004). Thus, without a decent educational background people are unlikely to use a computer. This underlines the catalytic effects of the digital divide on social inequality as mentioned above.

Additionally, regional studies underline exclusionary trends. Dolnicar, Vukcevic, Kronegger, & Vehovar (2002), for example, shows that the use of computers in Slovenia has fallen far behind that in the EU. For the U.S., other studies forecast low income urban communities to be disqualified for further technological advancements (Servon, 2001). Other findings underline the relations between a lack of means to invest in infrastructure and the underdevelopment of rural areas (Hollifield, 2003). Others still stress that a general shortage of human capital in rural areas adds to a developmental lag (Malecki, 2003). Results from a European project indicate that the digital divide remains a pressing matter (Anderson, Brynin, & Raban, 2005). Compared to mobile technology (which has almost reached saturation level), for some time now the diffusion of the Internet has been stalling in various countries (ibidem). Using computer technology is probably more heavily linked to social structure than mobile phone technology.[2]

Research results on the influence of ethnicity cover a large range of issues. Some show that the digital divide reinforces race antagonisms between the North and the South of the world (Nelson, 2002). A study on ethnic differences between Anglo-Americans and Hispanics underscores the importance of ethnicity regarding the use of the Internet (Hacker & Steiner, 2002). Ethnic studies on small group behaviour show that race influences participation modes in seminaries on new technologies (Carstaphen & Lambiase, 1998). All these issues – social inequality, region, and ethnicity – seem to have a substantial influence on private computer use and need to be considered in a theoretical model.

Before turning to such a model, however, let us look first at the level of computer use in Germany. In 2002, only 35 out of 100 people in Germany owned a private PC, accounting for a 15% increase between 1990 and 2002 (IdW, 2003). However, two issues are evident here. First, most of the studies deal with the number of computers, hosts, Internet connections and the like without offering any explanation for the current developments (AG.MA, 2000; http://www.golem.de, 2000; http://www.heise.de, 2003; SPIEGEL, 1996; Statistisches Bundesamt, 2003; Van Eimeren, Gerhard, & Frees, 2003). This bespeaks a predominantly economistic view towards the problem, disregarding any social or cultural frameworks.

Secondly, the more recent a study, the more positive its undercurrent. In 1996, for example, concerns were voiced about the possible generation of status barriers regarding the use of new technologies (SPIEGEL, 1996). In 2003, however, a study appeared with the header: "More than half of all Germans are online!" (http://www.heise.de, 2003). International comparisons show that in Germany, however, the private use of computers is at a moderate level at best (Statistisches Bundesamt, 2003, p. 25).[3]

One area in which a theoretical explanation is sought for the digital divide is an international comparison of the number of Internet hosts. Here the diffusion rate of technology is related to general levels of trust and average material well-being in countries (Bornschier, 2001). The study shows that an early diffusion of Internet applications within a country is connected to high degrees of average trust and tolerance.

Despite numerous theoretical reflections on the matter, there is obviously a need for a more theory-driven approach to understand the development of the digital divide. Most of the work reviewed here neglects the interrelationship of different levels of social structure in their theoretical and empirical models. Studies on the digital divide often include the micro-level or perhaps the macro-level, but disregard household settings, which, because they represent people's immediate social environment obviously have a direct influence on their

[1] Another important domain of research not dealt with here connects the influence of policy or politics to the digital divide (e.g., Johnson, 2001 or Vartanova, 2002, for an overview: DiMaggio, et al., 2001).

[2] Although this division may become obsolete in the near future as computers are developing into hybrid technologies, i.e. mobile phones with integrated internet compliant computers.

[3] In 2002, 40.4% of all private households were supplied with internet access as an EU-15 average, the Netherlands leading with 65.5%, Spain and Greece at a low 29.9%, respectively, 9.2%. In comparison, Germany's level is intermediate. Seven countries have a higher and eight countries a lower level (Statistisches Bundesamt, 2003, p. 25).

behaviour. Other studies will analyse the micro-level and include household effects, but fail to consider the influence of the macro-level, although ethnic and regional studies call attention to its importance. In the next section I develop an encompassing new framework in order to build a multi-dimensional model. After discussing the theoretical model, the next section contains an overview on the data and methods used for the empirical analyses. Thereafter, the main analytic results will be presented and in the last section the most important outcomes are summarized and discussed.

The Micro-, Meso-, and the Macro-Level

The issues under investigation are reasons for people's private use of computers. In theoretical models, the use of computers resides at the highest level of a multidimensional concept of information technology access (De Haan, 2004). The use of computers is based on skills, which are based on possession, in turn resting on motivation. Without having passed any of the former stages, people are unlikely to use computers for their private means. Starting from this perspective, the digital divide is now incorporated into a multi-dimensional framework (see Figure 1).

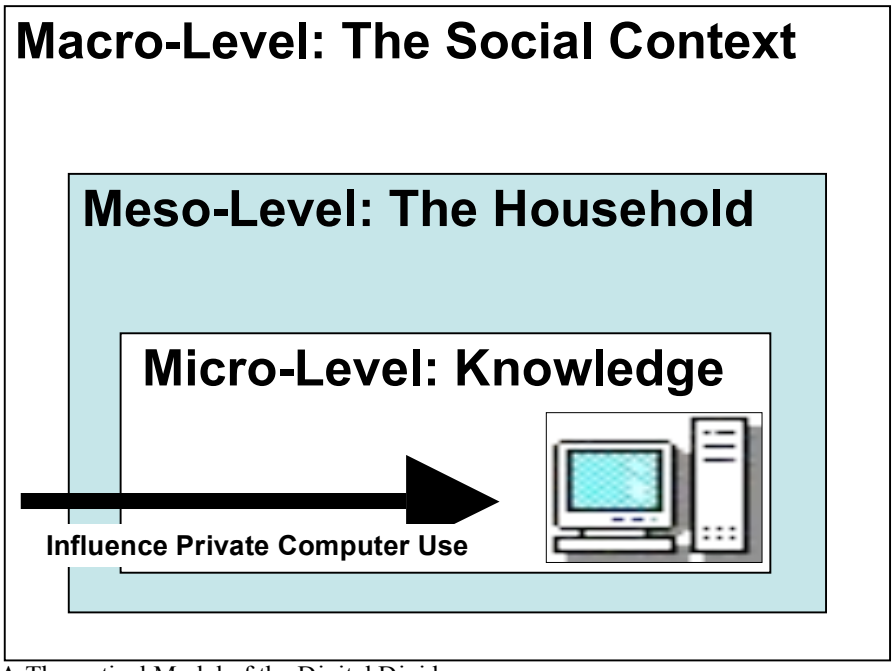

Figure 1. A Theoretical Model of the Digital Divide.

Who are early adopters and why are they the first in line to use computers for their private means? Regarding the micro-level, one is mainly looking at effects of knowledge or human capital, that is, education and computer literacy. For the meso-level one can identify household settings and their influence on individual computer use. Thirdly, the macro-level includes domains of group membership, that is, generation, gender, ethnic background, and differences between East and West Germany.

Let us first concentrate on the micro-level and how knowledge influences private computer use. Knowledge or human capital includes general and specific schooling and training, for example, high school diplomas or vocational training (Becker, 1964). I assume levels of education and vocational training to be positively connected to people's use of computers. Presumably, computer literacy is merely an additional educational skill. What is more, people with moderate levels of human capital are likely to work with computers in white collar jobs (Korupp, 2002). Getting acquainted with computers at work perhaps increases the likelihood that a person uses one for private purposes. On the micro-level, a positive relation is expected between both a person's general education and computer access at work on the one hand, and his or her private use of computers, on the other.

The household level is particularly central to this study. On the meso-level, the focus rests on household composition and consumption restrictions. Studies on computer use in families are embedded within the ecological framework of family theory (Watt & White, 1999). The ecological periphery of a family includes habitation and, more importantly, their technological environment. The incentives for children to deal with

computers are straightforward: Computer use includes playing games interactively and facilitates doing schoolwork (Leu, 1991). While catching the attention of children, teenagers, or young adults, the question remains how children induce their parents to use computers.[4] Several issues are relevant. For instance, parents may want to protect their children from unwanted informational contents. The best way of doing so is to know how computers work and control the contents offered. At this point we locate patterns of computer use in families at the level of control and regulation (Beisenherz, 1988).

Additionally, the image of the computer has developed from a distant "cold" machine into a socially "friendly" device and according to newer research, the computer has "[…] successfully connected to middle-class ideals" (Reed, 2000). So parents may simply want to adjust to middle-class ideals and ask their children to show them how to use one. Parents may also believe computer literacy to be essential for children. So to encourage them they may want to learn more about PCs together with their children.[5]

As mentioned above, household income restricts consumption patterns of household members. Therefore, a close positive connection is drawn between income and the possibilities to bridge the digital divide (Ekdahl & Trojer, 2002, Martin & Robinson, 2004). This underlies the expectation that the digital divide mirrors structures of economic inequality. In sum, on the meso-level the expectation is that both living with children and family income influence private computer use positively.

On the macro-level the influence of the wider social context is included. Several potential determinants are identified: generation, gender, ethnicity, and region. The approach for generations is derived from a concept called "technical generations" and outlines four ideal types (Sackmann & Weymann, 1995): The "pre-technical generation" (born before 1939) grew up in an environment bare of household technology; the "generation of the household revolution" (born between 1939 and 1948) was raised while basic kitchen technology like kettles and refrigerators diffused into private households; the third "generation of advanced household technology" (born between 1949 and 1964) grew up with inventions like the washing machine, stoves, central heating, i.e. more sophisticated technology; the following "computer generation" (born after 1964) was raised with an increasingly digitalized set of home technology. Today computer chips are implemented in microwaves, washing machines, fridges, telephones, heating systems etc. According to the technological generations approach, the home environment that people are raised in determines their general habits towards new technologies later in life.

The next determinant on the macro-level is gender.[6] Today we still observe a troubling gender inequality when it comes to judging participation rates of women in any of the related fields of information technology (Fountain, 2000). Census data show that fewer women than men own a computer, particularly if they live in a single household (Statistisches Bundesamt, 2003, p.24). In 1997, only approximately 30% of all Internet users were women (Suler, 1997). Research suggests that women are not socialized to become involved in matters of technology (Brunet & Proulx, 1989; Newman, Cooper, & Ruble, 1995). Regarding computers, however, both men and women are fascinated by the multitudinal applications of this new technology, but women are less emotional about computers and geared mainly towards practical applications (Löchel, 1992; Newman et al., 1995).

Let me now turn to the last two aspects, ethnicity and region. The major ethnic minority in Germany is a Turkish population of approximately two million members. Following a large immigration wave in the 1960s, a number of Turkish people have lived in Germany for more than 40 years. Still, Turkish people may tend to perceive the computer language to be culturally different, to belong to a so-called *outer sphere* (Nohl, 2001). Most of the computer programs bought in Germany use either German or English as languages for their user interfaces. These distinctions may cause delayed diffusion of computers among the Turkish ethnic minority.

Lastly, ten years after German reunification, large differences between the West and the East continue to exist including average prosperity, labour market chances, and political power (see e.g. Deutscher Bundestag, 2001; Geißler, 2002). In 1993, the first official numbers on the distribution of home computers showed PC ownership in West Germany to be at a 22.4% level compared to only 16.3% of the households in East Germany (Statistisches Bundesamt, 1994).[7] In the East, reasons such as insufficient funds or possibilities to purchase new

[4] To this day, the effects of computer use on children's social development cannot be predicted precisely (e.g. Subrahmanyam, Kraut, Greenfield, & Gross, 2000).

[5] In contrast to this, a lack of primary social ties at home should decrease people's use of computers.

[6] "Gender" is included on the macro level because sex roles are important for a whole set of social norms and values (e.g. Newman et al., 1995). Effects of ethnic background and region seem to be important according to the literature mentioned in the introduction.

[7] Before that, the statistical yearbook of the GDR offers information on radio and TV ownership only. From 1990 to 1993, the statistical yearbook for the reunited Germany contains information on PC ownership in West Germany only.

technologies before reunification explain part of their unequal starting position. The final goal is to detect long-term consequences of unequal starting positions regarding the digital divide. Thus, on the macro-level, the expectation is that being a member of an older generation, being a woman, being a member of a ethnic minority, or living in East of Germany will influence the use of computers negatively.

As new technology diffuses throughout society, one should be mindful of possible dynamic processes which exclude a static approach (see Figure 2). For the study presented here, the expected development is derived from the technology diffusion model (Rogers 1995). It states that over time, successful technology diffuses into all parts of society save into households in which people are resilient to change altogether. The main pathways run from the highest to the lowest position, concerning education and social status (see Figure 2). As diffusion continuously progresses and an increasing number of people use the new technology, computer and Internet access is less influenced by social inequality. According to the technology diffusion model, one should expect the effects discussed above to decrease (Rogers, 1995).

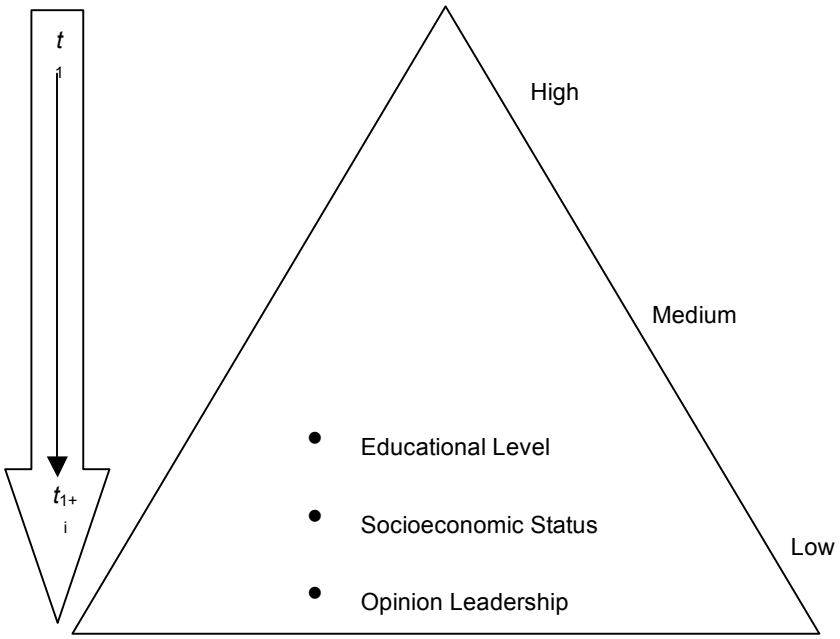

Figure 2. Diffusion Pathways of Computers in Modern Societies.

Data and Methods

The GSOEP is a representative longitudinal survey of private households in Germany (DIW, 2003). In 1997, the use of computers for private and professional means was surveyed for the first time. In 2001, these questions were posed again making an empirical replication of the model results possible for 1997 and 2001. The unweighted number of individuals in the database is 11,636 in 1997. In 2001, the unweighted number of cases increases to 20,708.[8]

Table 1 contains the cross-sectional weighted number of observations, means, standard deviations, and ranges of all the variables used in the analyses. The private use of computers is coded as a bivariate dummy variable ('yes'=1 and 'no'=0).[9] In 1997, 23% of the German population between 17 and 99 years uses a computer,

[8] Only foreigners living in Germany and not belonging to the Turkish minority were excluded from the analyses. The increase of cases between 1997 and 2001 is due to a refreshment of the sample (DIW, 2005). The GSOEP sample was refreshed in 2001 to counter problems connected to some of the anticipated future sampling biases that may have occurred due to sample attrition. It must emphasised that this wave contains a representative sample for the population living in Germany in 2001. Repeatedly testing a model is useful, because a successful empirical replication offer further evidence for precluding the presentation of chance findings. I thank the anonymous reviewers for their useful remarks on this issue.

[9] The translated question used in 1997 reads as follows: "Do you use a computer either privately, on your job, in your training/education? (by computer include the personal computer (PC) or the main-frame but not purely a game machine)." The answers are coded separately for "private" and "job, training or educational" purposes. In 2001 the question is posed: "Do you use a computer for activities not related to work?" The answer is a nominal "yes"/"no" scale. Where the computers have been accessed or used was not surveyed.

increasing to 41% in 2001. As some household members are adolescents, the GSOEP data contains a slightly higher figure of computer users than the one mentioned in the introduction (see: IdW, 2003).

Table 1
Descriptive Statistics

Contents of Variables	Range	Mean *(Std. Dev.)*	
		1997	**2001**
Privately Use Computers (No/Yes)	0/1	0.23	0.41
Knowledge			
Education (Year Proxy)	6-19	12.52 *(3.2)*	12.49 *(3.3)*
Use of a Computer at Work (No/Yes)	0/1	0.28	0.36
The Household			
No Children	0/1	0.26	0.27
Youngest Child 0-11 Years	0/1	0.18	0.17
Youngest Child 12-24 Years	0/1	0.20	0.20
Youngest Child 25+ Years	0/1	0.06	0.04
Adult Children Not Living at Home	0/1	0.30	0.32
Household Equivalent Income (D-Mark)	55-30000	2526.56 *(1248.6)*	2643.81 *(1345.4)*
Single Household	0/1	0.23	0.24
The Social Context			
Age	17-99	47.98 *(18.3)*	48.73 *(18.3)*
Pre-technical Generation	0/1	0.34	0.28
Generation of the Household Revolution	0/1	0.17	0.17
Generation of Advanced HH Technology	0/1	0.17	0.17
Computer Generation	0/1	0.32	0.38
Women	0/1	0.53	0.53
West German	0/1	0.78	0.79
Turkish	0/1	0.03	0.03
East German	0/1	0.19	0.18
Weighted Number of Cases (in Million)		47.7	50.4

Source: GSOEP, cross-section weights (DIW, 1997, 2001).

To study the effects on the micro-level (knowledge), the formal education of respondents is coded as a year-proxy for the yearly equivalent of schooling and vocational training. For instance, a university diploma equals 19 years, whereas an Abitur equals 13 years of education.[10] Calculated for the year-proxy, the formal education of the respondents ranges between six and 19 years in Table 1. On average, respondents had 12.5 years of formal education in 1997 and 2001. Of all respondents, 28% reported using a computer at work in 1997 and 36% in 2001.

To measure the effects of the meso-level, I used information on household settings (children and net equivalence household income). To indicate some social restrictions that adult persons face, only the youngest child in a household entered the equation. The age clusters for the children living at home are 0–11 years for young children, for teenagers and young adults 12–24 years, and for older adult children 25+ years. In 1997, 26% of the respondents neither lived with children in their household nor reported any adult children living away from home. Of all other people, 18% reported the youngest child in the household to be between newborn and eleven years old. About 20% reported their youngest child to be between twelve and 24 years old, and 6% lived with adult children (25 years +) at home. On average, 30% of the respondents reported having adult children living away from home. In 2001, 17% of the people lived with children from newborn to 11 years old, 20% reported living with a child between 12-24 years, only 4% were living with adult children (25+ years) at home, and 32% of the people reported having adult children no longer living at home.

Next, let us look at the household net equivalence income scaled by the OECD 2 scale. The average net household equivalence income increased from 2,526.56 DM in 1997 to 2,643.81 DM in 2001 indicating an average rise of income of about 120.- DM. This is in line with general findings (see: Deutscher Bundestag, 2001). The last variable on the household level measures whether people live in a single household (reference group: no single household). In 1997 and 2001, 23%, respectively, 24% of the people lived in single

[10] The years that are calculated according to the educational level are displayed in Appendix A.

households.[11] Approximately half of these (54% in 1997, 56% in 2001) were "genuine" single households; the others were due to what is called an "empty nest" (table not shown).

Let us now take a look at the macro-level variables within the general social context. Most of the respondents belonged to either the pre-technical generation (34% in 1997, 28% in 2001) or the computer generation (32% in 1997, 38% in 2001). The generation of the household revolution and the generation of the advanced household technology contained 17% of the population in both waves. The age of the respondents ranged between 17 and 99 years with an average of 48 years in 1997 and 49 years in 2001. The percentage of women in the data was 53% in both waves. In 1997, 78% of the population lived in West Germany and 19% in East Germany. In 2001, 80% of the people lived in the West and 18% in the East. The remaining three percent were Turkish citizens (all living in West Germany).

Results

Because the dependent variable — private computer use — is coded in a bivariate mode a logistic regression model is used to display the influence of the covariates (Andreß, Hagenaars, & Kühnel, 1997; Morgan & Teachman, 1988). In general, coefficients smaller than '1' signify a lower probability of private computer use (compared to the reference group). Parameters over '1' altogether indicate higher probabilities. The variables at interval level display marginal effects. The cluster adjusted odds ratios of the net effects of the multivariate logistic regression in 1997 and 2001 are displayed in Table 2.[12]

The results support the knowledge hypothesis that computer use is positively related to education and computer use at work. In 1997 and 2001, education has a substantial and significantly positive influence (odds ratios in Table 2 are 1.10, respectively, 1.16). The effect of the variable "Use of a Computer at Work" is large, too. People who work with computers are roughly four times more likely to use PCs for their private ends compared to those who do not (1997:3.99 and 2001:4.30).[13]

At the household level – living with children and the net equivalence income – most of the expected positive relations are detected. The variable measuring the influence of the presence of children under 11 years old in the household is non-significant in 1997, but significant in 2001. It is possible that parents of younger children increasingly use computers as a side effect of the growing market for children's software.[14] Living with children aged 12 to 25 years seems best to support the notion of the second hypothesis. The presence of teenager or young adults at home seems to make people almost twice as likely to use computers compared to people with no children (odds ratio 1.7, see Table 2). The presence of adult children (25+) does not significantly affect the private use of computers. In addition to specific generation effects (see below) in such households, we may be observing a peculiar social attitude: Perhaps because they do not feel responsible for their children's spare time activities any longer, the elderly most likely leave it up to their adult children to use new technology.

The positive household net income effect in Table 2 lends support to relations established elsewhere (Ekdahl & Trojer, 2002). We observe the marginal income effects to be 1.02 in 1997 and 2001. Compared to the influence of teenage children (e.g., 1.70 in 1997), household income has to be well above the population average to have the same influence (3,500 DM in 1997, arithmetic mean from Table 2).[15] Living in a "Single Household" has a

[11] Official statistics show percentages of single households in Germany to be around 30%. Statistical offices include all possible household affiliations of persons, whereas the GSOEP considers the composition of the current household only (personal communication DIW Jürgen Schupp, March 9, 2004). The GSOEP household weights render the correct figures, but due to the research questions I use person weights. Household weights are constructed to weight the GSOEP data on the level of the household, i.e. when using the household data. Person weights, on the other hand, are used to weight the GSOEP data that is analysed on the individual level.

[12] The significance level is chosen at $p < 0.01$ due to the large number of cases in the data. All other outcomes are rejected as chance findings. Odds ratios (or) are calculated by or=exp(log) and interpreted as relative probabilities. The net effects of Table 2 show the magnitude of the effect after controlling for all other variables in the model. Cluster adjustment takes place on the level of the household. Here the assumption of the independence of observations has to be relaxed because all members of the household have the same values for household variables (see Huber, 1967). The significance level for the changes in coefficients is not computed because the main methodical concern is to empirically replicate the results. In studies on social inequality it is difficult to extract trends within a small time frame of four years (for quasi-time dependent models, see Martin & Robinson, 2004). I thank the reviewers for pointing out this important issue.

[13] People who use computers for private ends are perhaps more likely to get a job which acquires computer expertise, too.

[14] In 2001 already, computer applications could be bought for very small children between two and three years.

[15] Note the equivalence income in Table 2 is divided by 100 to make the integers visible. The calculation is: 3,500= 70/2*100.

strong and significantly negative influence on the private use of computers underlining the importance of primary social ties for innovation diffusion into private households.

Table 2
Odds Ratios for Private PC Use in 1997 and 2001

	Cluster Adjusted Odds Ratios[a)]	
	Computer Use 1997	Computer Use 2001
Knowledge		
Education (Year-Proxy)	1.10**	1.16**
Use a PC at Work (Yes)	3.99**	4.30**
The Household Context		
No Child Reported	Reference	
Child 0-11 Years	1.01	1.33**
Child 12-24 Years	1.70**	1.65**
Child 25+ Years	1.14	0.80
Ad. Child not in HH	1.00	0.99
HH Equiv. Income /100	1.02**	1.02**
Single HH (Ref.: Shared Household)	0.70**	0.61**
The Social Context		
Pre-technical Gen.	Reference	
Gen. Of HH Rev.	3.68**	2.80**
Gen. Of Adv. HH Tec.	5.72**	4.96**
Computer Generation	9.29**	8.68**
Women (Ref.: Men)	0.49**	0.63**
West German	Reference	
Turkish	0.21**	0.30**
East German	0.72**	0.84**
Pseudo R^2	0.25	0.30
Wald χ^2	1611	4155
No. cases (unweighted)	11636	20708

Source: GSOEP (DIW, 1997, 2001).
**= *p< 0.01*
[a)] Standard errors adjusted for clustering on the household level (Huber 1967).

On the macro-level it was proposed that people belonging to the older generations, women, ethnic minorities and people living in East Germany would lag behind with respect to private computer use. These hypothesised effects seem to hold if we look at the results in Table 2. Compared to the oldest pre-technical generation (reference group), all succeeding generations display increasing odds ratios for using computer.

In 1997, men are about twice as likely as women to use computers (odds ratio in 1997 is 0.49). However, in 2001 the odds ratio has increased to 0.63. It may be indicating a slowly closing gender gap. Regarding the Turkish ethnic minority in Germany, in 1997 Turkish people are four times, and in 2001 three times less likely than West Germans to use computers. Thus, this effect remains to be substantial. Also, indications exist for a negative effect of the unequal starting position in East and West Germany after the reunification. The digital gap is still detectable roughly 10 years later, although it seems as if recently the East is catching up with the West.

With respect to the diffusion hypothesis it must be said that effects on the micro and meso-level thus far seem to be unaffected by the diffusion process. A tendency to decrease is not discernible between 1997 and 2001.[16] In a way, only the variables on the macro-level seem to offer evidence for the possible existence of a diffusion effect: By and large, they are decreasing in size between 1997 and 2001. However, one should not overlook that with an observation window of only four years (1997-2001) and two moments of observations it is still too early to judge this as conclusive support.

[16] This result implies that future studies will have to focus on significant changes in the relations between the micro- and meso-level and the first digital divide.

Discussion

Analysing what causes different levels of computer access provides valuable insights into a newly emerging issue for studies on social inequality. The general question is, to what extent is private computer use determined by socio-economic background. Empirical indications exist that socioeconomic background heavily influences computer access. As expected, the net influence of individual knowledge influences private computer use positively.[17] Early adopters are found in the upper educational echelons where people often use computers at work. It may be concluded that this new technology does not diffuse haphazardly but systematically, via the work place into higher educated people's homes.

Regarding the meso-level the main finding is that having teenage children in a household enhances people's likelihoods to use computers. The explanation is at least twofold. It may be a result of parents' efforts to increase their computer proficiency because of a sense of responsibility for their children's future skill needs or for their own need of control. Likewise, children perhaps urge their parents to invest in computers and thus create an innovation friendly atmosphere at home. The question whether we are looking at a "push" or "pull" effect has to be left to future research.

Additionally, as other studies before show, net equivalence income increases people's chances of using computers. But comparing the size of the influence of household income to that of teenagers living in the household shows that income has to be well above the arithmetic population average to match the influence of teenagers. For becoming a computer user the effect of having children, particularly teenagers, is remarkably strong. Although living with teenagers perhaps occasionally might be trying, regarding the digital divide this household constellation seems to offer a competitive edge for computer access. Of course, other forms of social capital are conceivable, like the friendship networks or the extended family. Therefore, further studies are needed to see, whether social capital is indeed more advantageous than economic capital to bridge the digital gap.

On the macro-level, the influence of belonging to a certain technical generation, or gender, or ethnic background, respectively, living in East Germany was analysed. As all the hypothesised relations are empirically supported here, several conclusions may be derived. Confrontation with computer technology at a young age seems to generate individual technological adaptability, though it is too early to proclaim a closure of the generation gap.

According to the ambivalent role model, women were expected to be less likely than men to use computers privately. Despite the empirical support for this hypothesis, conclusions should be hedged with caveats. The data of the GSOEP does not contain a measure of some of the possible motivations of women for dismissing private computer use. Due to this lack of information it remains unknown whether women try to meet some of the expectations mentioned implicitly in the theory. A follow-up study should focus on this question.

Looking at the empirical support for ethnicity, belonging to the Turkish minority seems to inhibit people from using computers. This relation persists even if we control for knowledge, household settings and the social contexts. The assumptions for the theoretical notions were that computers are perceived as cultural tools belonging to the "outer sphere" (Nohl, 2001). Due to an ongoing acculturation when living in a foreign culture over time this effect may be expected to taper off. However, the influence of belonging to the Turkish minority living in Germany is substantial. To get more insights, why this is the case one would probably need information on the duration of time spent in Turkey or Germany. More research on this topic is necessary to explain this large and persisting digital gap between the Turkish minority and the (West) German majority.

Due to the unequal starting positions after reunification in 1989, it was expected that the digital gap is still detectable between the East and the West in Germany, more than 10 years after the reunification. The empirical results show that this is the case. Tentative hints exist that the digital gap is slowly closing. However, more research is necessary to follow-up on this process and draw firm conclusions on possible trends.

Generally, a firm judgement whether the abstract notions of the diffusion theory holds would be premature in view of the time window covered by this study. A trend study at a later point in time is to be recommended. By successfully replicating the empirical results in 1997 and in 2001 the probability of chance findings has been somewhat reduced.

[17] All the empirical results discussed below are derived from so-called net effects that display the influence of a particular variable after controlling for the influence of all the other variables in the models (see footnote 12).

While substantial evidence has been produced for the emergence of the first digital divide the second digital divide may be already following in the wake. Therefore, future studies should also concentrate on probable relations between the "first" and the "second" digital divide (Attewell, 2001). These issues deal with the question how the chance of using computers and the purpose of their use may be linked to each other (Hargittai, 2001; De Haan, 2004; Korupp, 2005).

By and large, knowledge and household settings are very important for becoming a computer user. How they may influence the rise of the second digital divide is still an open question. Another worrying issue that remains is how a potential lack of social relations might be compensated to help close the digital divide.

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Appendix – Coding for the Year Proxy of Educational Level

Approximated Years of Formal Education	Graduation Level
6	Volksschule ohne Abschluß
8	Volksschule ohne Abschluß mit Lehre
9	Hauptschulabschluß ohne Lehre
10	Mittlere Reife ohne Lehre
11	Hauptschulabschluß mit Lehre
12	Mittlere Reife mit Lehre
13	Fachhochschulreife/Abitur ohne Lehre
14	Fachhochschulreife/Abitur mit Lehre
17	Fachhochschulabschluß
19	Universitätsabschluß