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Causes and Trends of the Digital Divide: A European Perspective

Sylvia E. Korupp

Introduction

The abstract notion of the digital can be defined as a division between individuals and households at different socio-economic levels, regarding their chance to access or use information and communication technology (OECD 2002). A theoretical division exists between the »first« and »second« digital divide, sometimes addressed as »first-level« and »second-level« digital divide (Attewell 2001; DiMaggio/Hargittai 2001; Hargittai 2002). The »first« or »first-level« digital divide deals with the problems associated to accessing the internet, while the latter focuses on the user profiles, *id est* in which way and for what purposes the internet is used. Before studying different user profiles, however, reasons for accessing versus non-accessing the internet should be clear. Therefore, I investigate the »first« digital divide.

Starting point of the research is a theoretical view on the digital divide that is embedded into an individual, institutional, and social framework. An encompassing three-fold model is based on theoretical concepts drawn from a micro-, meso- and macro perspective. On the micro level the effect of *education* is included. On the meso level I look at the *household context.* On the macro level the *social context* is included. This model thus far has worked very well with German data sets (see Korupp 2004; Korupp/Szydlik 2005), but results vary within the European context. Parts of the variations unquestionably may be explained by cultural differences within countries.

At times, research on this topic has been challenged by charges of studying a non-existent myth or »luxury« problem (Compraine 2001). Nevertheless, empirical results paint an entirely different picture as to how innovations can affect individual lives. For example, internet literacy is positively related to social activity and school performance (Wagner et al. 2001; Wagner et al. 2002), math and language skills (Attewell/Battle 1999), or success in finding a job (Boes/Preißler 2002). In order to identify which of the influences can be attributed to which variable a multivariate analysis is carried out. In the following section I will offer a brief overview on how the theoretical model is derived.

Theory

Issues of education include general and specific schooling and training, e.g., high school diplomas or vocational training (Becker 1964). I assume levels of education and vocational training to be positively connected to an individual's use of the internet. In fact I presume internet literacy to be merely an additional educational skill.

What is more, we see that age often is determined as a key issue, *id est* youth commonly grants a quick innovation adoption. In this case innovation diffusion spreads as over time the adopting young generations grow older (Watt/White 1999; Sackmann/Weymann 1995). According to this concept, the home environment that people are raised in determines general habits towards new technologies and thus age determines technological adoption odds.

Regarding gender, I assume that women face contradictory role models in technology operating fields (see e.g., Waibel 1992). That is, they experience inconsistencies when linking their job and household obligations regarding the use of the internet (Collmer 1995). Other than in their job, for fulfilling household tasks usually they are not socialized to deal and become involved in technological issues (Collmer 1995). The above facts and assumptions lead me to expect fewer women than men to use internet.

Let us now turn to the meso level of the theoretical model. The image of the computer has developed from being a distant »cold« machine into a socially »friendly« device and is according to newer research, »(…) successfully connected to middle-class ideals« (Reed 2000). Parents may want to adjust to middle-class ideals, believing computer proficiency to be an essential future skill for children. These assumptions lead me to expect that living together with children enhances people's likelihood to use a computer at home. A lack of primary social ties at home on the other had should decrease people's use the internet.

What is more, a close positive connection is drawn between income and the possibilities to bridge the digital divide (e.g. Attewell 2001; DiMaggio et al. 2001; Jung et al. 2001; Ekdahl/Trojer 2002; Bonfadelli 2002). Generally, household income constrains purchasing power. Therefore one can expect family income to positively affect the private use of computers and internet.

Moreover, ethnic minorities may perceive computer language to be culturally different, to belong to a so-called *outer sphere* (Nohl 2001). In all countries most of the computer programs bought use either the native or English language for their user interface. These cultural differences may cause a delayed diffusion of computers and internet among the ethnic minority.

Last but not least, studies on regional aspects often stress exclusionary trends. Dolnicar et al., for example, shows that compared to the EU the use of computers in Slovenia has fallen far behind (2002). For the U.S., other studies forecast low income urban communities to be disqualified for further technological advancements (Servon 2001). Some findings underline a relationship between lacking means to invest into infrastructure and the underdevelopment of rural areas (Hollifield 2003). Others stress that a general shortage of human capital in rural areas adds to a developmental lag (Malecki 2003). With regard to internet diffusion we can thus expect rural areas to be lagging behind compared to cities or urban areas. The entire assumed theoretical framework of the model is shown in Figure 1.

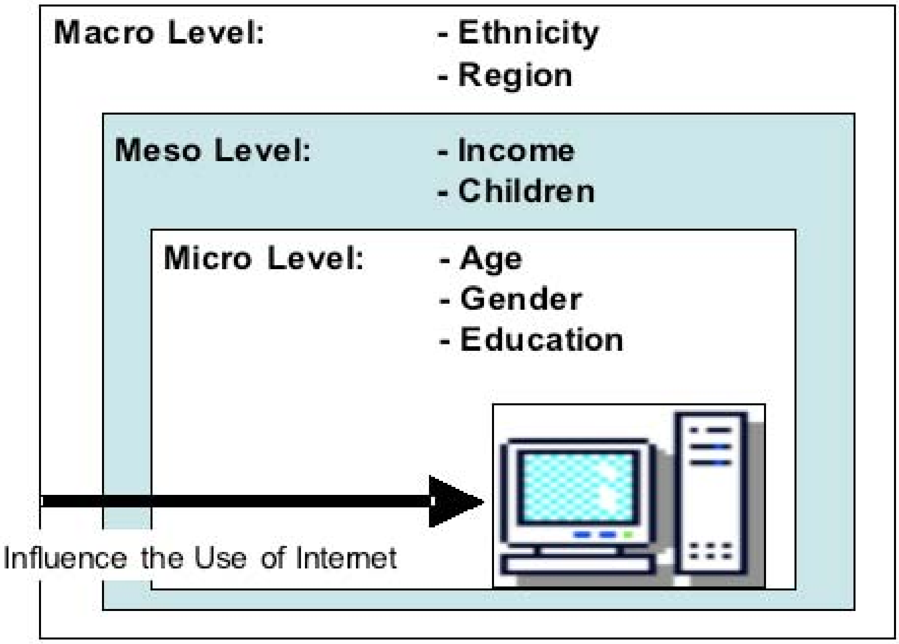

Figure 1: Theoretical ModeReferences

Data and Methods

The empirical analyses were carried out using the European Social Survey (see http://www.europeansocialsurvey.com). Within my theoretical model I consider the main theoretical and empirical results in the literature regarding the digital divide. Mainly, I expected the model to work out well in the European context, too. However, as we will see further down the model does not fit equally well in all countries. It contains a question on internet use and the other levels of the theoretical model from 20 European countries. The data were weighted by their design and person weights to calculate the descriptive statistics (see Table 1). In Europe we observe a distinct distribution of internet use along a north-south and a west-east-axis. Most of the people that use the internet can be found in the north of Europe, *id est* in Denmark, Sweden, and Finland. Furthermore, we see that in Central Europe the countries in the West have a higher rate of internet users than in Eastern Europe.

On average, educational levels are lower in Southern and Eastern Europe, compared to their mean values in West Central Europe and Northern Europe.[1] This may be a first hint towards the fact that innovation saturation may be related to country specific levels of education. The distribution of mean age does not vary too much, except for the value in the Czech Republic, which is slightly higher than the other ones. The gender distribution is roughly at the 50 percent level in all of the countries.

Looking at the proportion of minorities in the countries we usually observe a percentage of two to three percent in the European Countries that were surveyed. The percentage of the age of the smaller children (age 0 to 14) ranges between eight percent (Czech Republic) and 18 percent (Luxembourg). The percentage of the youngest child being Teenage or young adult and living at home range between 16 percent (Belgium, Spain, Great Britain, Luxembourg) and 25 percent (France). Adult children living at home are not reported quite as often anymore and may be highly dependent on the culture of a country. Here the range lies between one percent (Sweden) and 20 percent (Slovenia). The approximated year household equivalency income ranges between a low 3.608,- Euro for Hungary and 28.486,- Euro for Norway. All currencies were computed in Euro to make international comparisons feasible.

In Table 2, the computed odds ratios for the theoretical models are shown. This time only design weights are used because this is recommended for country comparisons by the research group of the European Social Survey (see http://www. european socialsurvey.com). Coefficients which are less than »1« signify a lower probability of private internet use in comparison to the reference group in the dummy variables. Regarding our variables at interval level, they display the marginal

1 Educational level can take on the value one (primary or first stage of basic education), two (lower secondary or second stage of basic education), three (upper secondary), four (post-secondary, non tertiary education), five (first stage of tertiary education), and six (second stage of tertiary education).

effects. Parameters over »1« altogether indicate higher probabilities. If we look at the outcomes for all countries (column 1) we see that for every additional educational level the marginal effect of internet use increases by 76 percent. The effect of age is negative, indicating that the older a person is, the less likely this person becomes to be identified as an internet user. Furthermore, the effect of gender is negative, too, indicating that women in Europe are by far less likely to use the internet than men.

Living together with smaller children (up to 14 years) has a negative influence on internet use, but not living together with teenagers and young adults at home (14 to 24 years). Here we observe an on average higher significant probability to use the internet. Living with adult children (25+ years) has almost no effect on the use of the internet. It remains insignificant for the analyses. Income is significant for using the internet, but as its marginal effects are small, the here chosen cut-off value for two decimals means that the effects do not show in the table. The Cox-Snell R-square of the analysis is approximately at 33 percent indicating a fairly good model fit.

Discussion

This study deals with the question how we can explain variations on the digital divide model in a European comparative perspective. Starting point of my research is the appearance of a new form of social inequality: the digital divide. We see that the proportion of adult population in Europe has a distinct north-south and west-east divide. A three-level model is build, to explain different levels of internet use and applied to 20 different countries in the European Union. Although the theoretical notions are based on the general theoretical and empirical results of the first digital divide and works fairly well in a universal model, a large variation is found within the 20 countries. Indications were found that the speed of innovation diffusion within countries may be positively related to the country specific levels of education. Thus, the usual diffusion process seems to be a vertical movement from the highest to the lowest status positions along the socio-economic strata until most households are included.

Country	all	At	Be	cz	de	dk	es	fi	fr	gb	gr	hu	ie	it	lu	nl	no	pl	pt	se	si
WWW	0,39	0,57	0,43	0,30	0,48	0,62	0,24	0,56	0,40	0,48	0,13	0,19	0,41	0,30	0,56	0,59	0,59	0,22	0,30	0,66	0,35
EDU	2,81	3,25	3,03	3,10	3,31	3,20	2,28	2,88	3,00	2,99	2,27	2,27	2,75	2,30	2,80	2,95	3,43	2,52	1,67	3,00	3,33
AGE	46,49	44,76	45,80	50,01	47,37	47,33	46,64	46,63	45,31	47,42	47,68	47,14	44,88	46,48	41,05	46,42	47,52	43,79	46,34	47,26	45,41
SEX	0,52	0,52	0,48	0,49	0,51	0,49	0,52	0,52	0,53	0,51	0,55	0,51	0,54	0,55	0,53	0,54	0,45	0,51	0,54	0,49	0,52
MNRT	0,03	0,06	0,02	0,02	0,04	0,02	0,03	0,01	0,04	0,06	0,04	0,05	0,01	0,01	0,05	0,04	0,02	0,02	0,01	0,03	0,02
SMAL	0,12	0,11	0,11	0,08	0,11	0,14	0,10	0,11	0,15	0,13	0,10	0,11	0,13	0,10	0,18	0,16	0,14	0,12	0,11	0,12	0,09
TEEN	0,19	0,27	0,16	0,21	0,18	0,18	0,16	0,18	0,25	0,16	0,19	0,21	0,23	0,19	0,16	0,22	0,20	0,22	0,19	0,19	0,21
ADUL	0,10	0,10	0,08	0,18	0,05	0,02	0,16	0,02	0,07	0,05	0,19	0,15	0,11	0,18	0,06	0,05	0,02	0,15	0,14	0,01	0,20
OECD1	14835	15016	16727	6177	20229	24559	9089	17667	9379	25261	8601	3608	10724	12317	23149	20185	28486	3953	8142	18783	6393
NOC	36432	2257	1899	1360	2919	1506	1729	2000	1503	2052	2566	1685	2046	1207	1552	2364	2036	2110	1511	1999	1519

Table 1 Descriptive Statistics

(Source: ESS 2002/03. Data weighted by design and person weights.)

Legend: all =All Countries; at=Austria; be=Belgium; cz= Czech republic; de= Germany; dk= Denmark; es = Spain; fi= Finland; fr=France; gb= Great Britain; gr = Greece; hu=Hungary; ie=Ireland; it= Italy; lu= Luxembourg; nl= The Netherlands; no= Norway; pl= Poland; pt= Portugal; se=Sweden; si= Slovenia;

	all	at	Be	cz	de	dk	es	fi	fr	gb	gr	hu	ie	it	lu	nl	no	pl	pt	se	si
EDU	**1,76**	**1,73**	**1,89**	**2,63**	**2,02**	**1,86**	**2,41**	**1,77**	**1,70**	**1,91**	**2,56**	**2,25**	**1,80**	**2,43**	**1,59**	**1,71**	**2,10**	**2,52**	**1,54**	**1,52**	**3,05**
AGE	0,93	0,93	0,93	0,92	0,92	0,93	0,93	0,91	0,94	0,94	0,93	0,89	0,94	0,94	0,92	0,93	0,92	0,88	0,99	0,92	0,90
SEX	0,70	0,50	0,60	0,70	1,03	0,68	0,53	1,15	0,49	0,78	0,51	0,60	0,88	0,36	0,53	0,59	0,60	0,82	0,70	0,62	0,71
MNRT	0,70	1,49	0,64	0,08	0,53	0,35	0,31	0,93	0,30	0,69	0,13	0,26	1,38	0,20	1,30	0,36	0,72	1,62	0,10	0,55	1,39
SMAL	0,93	0,88	1,17	0,33	0,98	1,41	0,72	0,65	0,98	1,09	0,82	0,35	0,85	1,29	0,76	0,73	1,18	0,23	1,08	1,16	0,64
TEEN	1,54	1,64	1,45	1,26	1,61	1,65	1,58	1,19	2,40	1,34	1,01	0,72	1,76	1,42	1,95	1,24	1,69	1,33	1,29	1,68	2,09
ADUL	0,95	1,02	1,38	1,25	1,12	0,27	0,77	1,67	1,87	1,57	0,79	1,07	1,61	0,97	1,03	0,58	1,27	2,17	1,75	1,22	1,75
OECD1	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Const	1,25	5,65	1,69	0,74	1,90	3,93	0,27	6,95	0,71	1,20	0,12	2,10	0,59	0,51	5,04	9,27	2,75	1,35	0,19	14,6	0,49
CS R^2	0,33	0,28	0,34	0,25	0,31	0,31	0,32	0,39	0,33	0,34	0,24	0,29	0,30	0,27	0,34	0,27	0,36	0,33	0,08	0,37	0,40
NOC	37820	2257	1899	1360	2919	1506	1729	2000	1503	2052	2566	1685	2046	1207	1552	2364	2036	2110	1511	1999	1519

Table 2 Odds Ratios for Using the Internet in 2002 in Europe

(Source: ESS 2002/03. Data weighted by design weights, Cox-Snell R-square.)

Legend: all =All Countries; at=Austria; be=Belgium; cz= Czech republic; de= Germany; dk= Denmark; es = Spain; fi= Finland; fr=France; gb= Great
Britain; gr = Greece; hu=Hungary; ie=Ireland; it= Italy; lu= Luxembourg; nl= The Netherlands; no= Norway; pl= Poland; pt= Portugal; se=Sweden; si= Slovenia;

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