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Social theory of internet use: Corroboration or rejection among the digital natives? Correspondence analysis of adolescents in two societies

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ABSTRACT

This paper tests a theory of social uses of the Internet (López-Sintas, Filimon, & García-Álvarez, 2012), inspired by the work of Bourdieu (1984, 1986, 1989), outside the Spanish national context in which it was initially formulated. Using the OECD's PISA 2012 data for Germany and Norway, it specifically seeks to uncover differences in patterns of Information and Communication Technologies usage among fifteen-year olds and the factors structuring those differences. Simple Correspondence Analysis has been used as the method of investigation. The results of the analysis show similarities between usage spaces in Germany and Norway; where the first, dominant dimension represents the frequency of digital use and the secondary dimension represents the type of frequent digital use. Furthermore, in both countries gender, migration background, family structure, the parents' level of education, material access to the Internet at home, and the number of books at home explain no more than 8.6 percent of the variance in digital usage. At face value, these results suggest that the theory of social uses of the Internet should be rejected when applied to the adolescents in the countries under investigation. The paper argues, however, that the results should rather be interpreted as an indirect corroboration of the theory, with age being one of the most significant aspects of an individual's social standing affecting digital use.

1. Introduction

Since core economic, social, political, and cultural activities are ever more structured by and around the Internet, access to it becomes one of the important dimensions of social structure (Castells, 2004, p. 24). This growing impact of the Internet should lead sociologists to empirically investigate the emergence of new forms of cultural capital (Bourdieu, 1984), so that the contemporary understanding of this concept becomes more flexible through its association with technology and information systems to a much greater extent than was the case at the time of Bourdieu's classical definition (Prieur & Savage, 2013, pp. 247, 261). The aim of the present paper is to test a theory of social uses of the Internet (López-Sintas, Filimon, & García-Álvarez, 2012) inspired by the work of Bourdieu. More specifically, this paper – using Simple Correspondence Analysis, a method introduced to sociology by Bourdieu – empirically investigates differences in the patterns in the usage of Information and Communication Technologies (hereinafter: ICTs) among contemporary adolescents in Germany and Norway, and shows that there are no differences in those patterns and that these patterns are not structured by various social and demographical

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factors. At face value these results can be interpreted as empirical grounds for rejection of the Bourdieu-inspired social theory of Internet use. It is argued, however, that one should interpret these results rather as an indirect proof in favour of the theory: with (young) age being one of the most significant aspects of an individual's social standing which affects digital use.

2. Cultural capital, informational capital, and a theory of social uses of the internet

Prieur & Savage (2013, p. 246) begin their paper exploring the changing nature of cultural capital by acknowledging that this concept has become one of the most widely used in the social sciences since it was introduced by Bourdieu (1984). They also point out that in his later works Bourdieu suggested that, in order to give the notion of cultural capital its full meaning, one should in fact call it informational capital (Bourdieu & Wacquant, 1992, p. 119). Bourdieu himself used the notion of informational capital when he analysed the role it plays in allowing corporate banks to dominate industrial companies 'due to the fact that banks are able to accumulate the economic information that enables them to rationally direct economic strategies, by combining the scientific knowledge provided by various rationalized and organized instruments of research (brain trusts, think tank, etc.) and by economic "experience" in all its guises' (Bourdieu, 1996, p. 368). Prieur and Savage believe that the subsequent development of the information society, primarily a result of the impact of the Internet, has proven that the term informational capital may capture some new tendencies of societal development better than the concept of cultural capital, as 'familiarity with digital communication has become increasingly significant in the daily lives of the educated professional and managerial classes', and furthermore because what today 'is important, is not necessarily to have the information, but to know how to get it' (Prieur & Savage, 2013, pp. 261–262).

Bourdieu (1984, pp. 257–371) argued that in France in the 1960s and 1970s the space of social positions (social hierarchy or stratification structure) and the space of position-takings (life-styles) were homologous, i.e., structured along the same lines. The space of social positions was ordered, as a first principle, according to the overall volume of both cultural and economic capital (for a discussion on the distinction between these different forms of capital, see Bourdieu (1986)) and, as a second principle, according to the relative amount that individuals or groups possess of each of the two forms of capital (Bourdieu, 1984, p. 175 ff.). In turn, the space of position-takings was ordered in oppositions according to similar logics, such as form vs. function, quantity vs. quality, distinguished vs. vulgar (Bourdieu, 1984, pp. 1–7).

A theory of social uses of the Internet (López-Sintas et al., 2012) is one of the recent attempts to apply Bourdieusian notions and Bourdieusian methodology to the study of digital inequality. This theory integrates the concepts of the aims of consumption (scale of consumption and linkage needs) (Douglas & Isherwood, 1979) with Bourdieu's theory of taste (Bourdieu, 1984, 1986, 1989). According to the theory of social uses of the Internet, there is a homology between an individual's social standing and Internet use; in other words, social differences are reflected in different patterns of Internet use. Using a 2007 Spanish survey of 22,198 individuals aged 10 years and older, López-Sintas et al. (2012: 121–123) conclude that differences in digital use exist and will continue to exist because of differences in the social standing of individual users. Their conclusion is consistent with the results of other researchers writing on digital inequality (DiMaggio, Hargittai, Celeste, & Shafer, 2004; Mossberger, Tolbert, & Stansbury, 2003; Peter & Valkenburg, 2006; Van Dijk, 2005; Warschauer, 2003).

3. Research questions

In their definition of social standing, López-Sintas et al. (2012, p. 117) include not only social status, but also age. Age in turn, as not only their research shows, is one of the most significant aspects of an individual's social standing, in particular with respect to digital use (Bonfadelli, 2002; Fox & Madden, 2006; Zillien & Hargittai, 2009; Van Dreusen & Van Dijk, 2014). Such a strong effect of age might obscure, however, the influence that other components of social standing (i.e., social status) exert on digital usage within age groups (cf. Hjellbrekke, Jarness & Korsnes's (2015) argument about the potentially obscuring effects of age-related differences in lifestyle found in many studies of cultural consumption and participation that use Bourdieusian methodology). Thus, to deal with such a strong effect of age which might make social status seem as less important in the structuring of digital use, this paper focuses on the differences in digital use within a single age group. The age group to be studied, young people, is chosen because of the following reasons. Compared with older generations young people, or as Prensky (2001) and Tapscott (2009) call them, 'digital natives,' possess sophisticated knowledge of and skills in using information technologies (Bennett, Maton, & Kervin, 2008) and predominate among what Rogers (1995) calls 'early adopters' of technological innovations. This raises some questions. Are young people themselves, however, internally undifferentiated in their patterns of digital use? Or can one observe that also in this age category there are some differences in social standing that are translated into differences in digital use to such an extent that justifies labelling such differences as persistent inequalities (Shavit & Bolssfeld 1993)? This latter issue leads to the research question posed in this paper: Do differences in social standing among adolescents perpetuate digital usage inequality in that age group?

To answer the main research question, this paper addresses three specific problems:

1) What are adolescents' digital usage patterns?
2) Are there any national differences in adolescents' digital usage patterns?
3) If so, how are these national differences in adolescents' digital usage patterns structured, in other words: what social and demographic factors – if any – influence adolescents' digital usage patterns?

Thus, this paper seeks to uncover the main dimensions and fractions in digital usage among the adolescents living in contemporary, developed societies. It does so by constructing the space of position-takings (digital space) and superimposing onto it the social and demographic variables used as independent variables in previous research on digital inequality among adolescents (Mossberger et al., 2003; Warschauer, 2003, pp. 129–135; Van Dijk, 2005; Peter & Valkenburg, 2006; Hargittai, 2007; Mossberger, Tolbert, & McNeal, 2008, pp. 95–137; and Notten, Jochen, Kraaykamp, & Valkenburg 2009) or in research on early life conditions, education and lifetime earnings (Brunello, Weber, & Weiss, 2016). These include: parents' level of education, the number of books at home, gender, migration background (serving here as a proxy for ethnic/racial minority background), family structure, and material access to the Internet at home. Thus, these indicators of social standing represent inherited cultural capital, individual demographic characteristics, family background, and a condition necessary for development of ability to use ICTs (Van Dijk, 2005, p. 45). It is therefore argued that these indicators define social standing (within a single age group) in its multidimensionality and that they might be important resources shaping adolescents' digital use patterns.

In order to test the theory of social uses of the Internet outside the Spanish national context in which it was initially formulated, this paper investigates digital usage inequality among adolescents in Germany and Norway. These two European countries, although they share with Spain many characteristics regarding the level of economic, social, and technological development, are at the same time different enough to provide an environment in which it is not self-evident whether the theory will be corroborated, rejected, or modified.

4. Data and methods

Because this paper focuses on investigation whether differences in social standing are reflected in different patterns of Internet use among adolescents, data concerning the variables used in this paper are drawn from the 2012 PISA project. The reason for choosing the PISA project as the empirical basis for this paper is the fact that the PISA project analyses scholastic achievement and ICT-related outcomes of adolescents, or more precisely: fifteen-year olds. Reports based on the earlier findings from this project can be found in OECD (2013a; 2013b; 2013c; 2014a; 2014b; 2014c). To follow the analytical approach chosen by López-Sintas et al. (2012), Geometric Data Analysis (GDA) is used as the method of investigation.

Although the origins of GDA can be traced back to Guttman (1941), the proper development of this approach to multivariate statistics was initiated in the 1960s by Benzécri (1992). Among other techniques, GDA includes Correspondence Analysis (CA), which is applicable for investigating two categorical variables, and Multiple Correspondence Analysis (MCA), which is applicable for studying more than two categorical variables. In France, both CA and MCA became standard methods for the analysis of questionnaires during the 1970s. The work of Bourdieu contributed to the popularization of these techniques in sociology. In the English-speaking world, CA and MCA started gaining recognition with the publication of works by Greenacre (1984) and Lebart, Morineau, and Warwick (1984). For the general introduction to CA and a historical sketch of its application in the social sciences, see Blasius (1994); Van Meter, Schlitz, Cibois, and Mounier (1994); Rouanet, Ackermann, and Le Roux (2000) and Murtagh (2005, pp. 1–28). For more on the basic concepts and properties of CA and MCA, see Weller & Romney (1990); Greenacre (1994, 2007); and Clausen (1998). For a thorough introduction to CA and MCA, consult Le Roux & Rouanet (2004, 2006). For a concise introduction to CA and MCA, see Le Roux & Rouanet (2010), and for the examples of the previous use of these methods in social science research, see Bourdieu (1988; 1996; 2008); Lebaron (2001); Blasius & Thiessen (2006), Blasius & Friedrichs (2008); Hjellbrekke et al. (2007); Le Roux, Rouanet, Savage, and Warde (2008); and Carmo & Nunes (2013). The papers using CA or MCA published in this journal include: Jimoyiannis & Komis (2001); Calzarossa, Ciancarini, Maresca, Mich, and Scarabottolo (2007); Aslanidou & Menexes (2008); Barkatsas, Kasimatis, and Gialamas (2009); and Huang, Chen, and Mo (2015).

The analysis was carried out using SPSS version 22 and SPAD version 8.2.

5. Similarities and differences in national digital spaces

In each country under investigation, seventeen variables formed the basis for the construction of digital space. Each variable is a question about the frequency of using the Internet by the respondent outside of school. The first ten variables ask about non-scholastic use, whereas the last seven ones inquire about school-related use. These variables are listed in Table 1, along with the variable short names and an indication of the categories of response. Originally, in each question the respondent could choose only one of five categorical answers, ranging from 'Never or hardly ever'; through to 'Once or twice a month'; 'Once or twice a week'; 'Almost every day'; to 'Every day'.[1] To deal with the problem of the Guttman or horseshoe effect (Le Roux & Rouanet, 2004, pp. 220–221), variables were doubled (Greenacre, 1993, pp. 161–170; Murtagh, 2005, pp. 71–110), so that eventually in each country under investigation 34 variables contributed to the construction of the digital

[1] To avoid the problem with the infrequent (i.e., less than 5%) (Le Roux & Rouanet, 2010, pp. 61–62) 'Every day' category, the source school-related variables were recoded into four answers: 'Never or hardly ever'; 'Once or twice a month'; 'Once or twice a week'; and '(Almost) Every day'. The same recoding of the questions was applied to the recreational variable 'Uploading one's own created contents for sharing' in Germany. Additionally, in both countries under study, answers to the recreational variables 'Participating in social networks' and 'Browsing the Internet for fun' were recoded into four categories: 'Never or once a month', 'Once a week', 'Almost every day', and 'Every day'.

Table 1
Active source questions for the construction of digital space.

Variable short name	Question: How often do you use a computer for the following activities outside of school?	Number of categories
Games	Playing one-player games	5
Online	Playing collaborative online games	5
Email	Using email	5
Chat	Chatting online (e.g. MSN)	5
Social networks	Participating in social networks (e.g. Facebook)	5
Fun	Browsing the Internet for fun (e.g. YouTube)	5
News	Reading news on the Internet (e.g. current affairs)	5
Practical	Obtaining practical information from the Internet (e.g. locations, dates of events)	5
Music	Downloading music, films, games or software from the Internet	5
Upload	Uploading your own created contents for sharing (e.g. music, poetry, videos, computer programs)	5
School	Browsing the Internet for schoolwork (e.g. for preparing an essay or presentation)	5
Students	Using email for communication with other students about schoolwork	5
Teacher	Using email for communication with teachers and submission of homework or other school work	5
Download	Downloading, upload or browse material from my school's website (e.g. time table or course materials)	5
Announcements	Checking the school's website for announcements, e.g. absence of teachers	5
Homework	Doing homework on the computer	5
Share	Sharing school related materials with other students	5

Note: The PISA 2012 dataset.

Table 2
Variances of axes, adjusted variances of axes, modified rates, and cumulated modified rates.

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5
Germany					
Variances of axes	0.116	0.070	0.058	0.038	0.033
Adjusted variances of axes	0.008	0.002	0.001	8.72E-05	1.76E-05
Modified rates	74.60%	16.58%	7.84%	0.81%	0.16%
Cumulated modified rates	100%				
Norway					
Variances of axes	0.108	0.071	0.051	0.035	0.032
Adjusted variances of axes	0.007	0.002	0.0005	3.04E-05	5.57E-06
Modified rates	73.43%	20.69%	5.48%	0.34%	0.06%
Cumulated modified rates	100%				

Note: The PISA 2012 dataset. Own calculation.

space. Variables ending with P (e.g. gamesP) indicate the activity that is performed very frequently, variables ending with N (e.g. gamesN) indicate an activity that is not performed at all. Such categories as 'not applicable', 'invalid', and 'missing' were excluded from the analysis.

The analysis refers altogether to 4117 active individuals in Germany and 4462 active individuals in Norway. The choice of the number of axes to be interpreted is based on the cumulated modified rates[2] and the interpretability of axes (Le Roux & Rouanet, 2010, p. 51). Table 2 shows that in Germany, axis 1 accounts for 74.60% and axis 2 for 16.58% of the variance in the active questions, while in Norway, axis 1 accounts for 73.43% and axis 2 for 20.69% of the variance in the active questions. Thus, while digital space is two-dimensional, in each country under investigation axis 1 is clearly dominant.

As Benzécri (1992, p. 405) writes: 'Interpreting an axis amounts to finding out what is similar, on the one hand, between all the elements figuring on the right of the origin and, on the other hand, between all that is written on the left; and expressing with conciseness and precision the contrast (or opposition) between the two extremes.' The same applies to finding out what is similar, on the one hand, between all the elements figuring above the origin and, on the other hand, between all that is written below.

In the analysis reported below, following Le Roux & Rouanet (2010, p. 52) the average contribution 100/34 = 2.94% is taken as a baseline criterion for retaining categories for interpretation of an axis.

Fig. 1[3]. shows the 18 active frequencies (13 for recreational use, 5 for school related use) contributing most to the first axis in Germany. Together they contribute to 78.87% of the variance of Axis 1 ($\lambda_1^{adj} = 0.008$). In turn, Fig. 2 shows 9 active

[2] Greenacre's formula for the adjustment of the variance of axes (adjusted eigenvalues) gives a better assessment of the importance of axes than the raw eigenvalues (Rouanet, 2006, p. 151). The formula is given, for each raw eigenvalue equal to or greater than 1/Q, by the equation: $\lambda_s^{adj} = \left(\frac{Q}{Q-1}\right)^2 \times \left(\lambda_s^{raw} - \frac{1}{Q}\right)^2$, where s is the number of dimensions (axes) and Q is the number of variables retained for the construction of geometrical space. In turn, the modified rates are expressed as percentages of the values calculated by the following equation: modified rate $= \frac{Q}{Q-1} \times \left(\lambda_s^{adj} - \frac{K-Q}{Q^2}\right)$, where K is defined as the overall number of categories and Q is defined as above (Greenacre, 2006, pp. 67–68).

[3] All figures for this paper are presented in supplementary online material file available from the website of Computers & Education.

Table 3
Digital space in Germany: interpretation of axis 1–18 variables contributing the most to the axis; interpretation of axis 2–9 variables contributing the most to axis. Variables are ranked according to decreasing contributions. Ctr. of variables are in percentages.

Axis 1			
Orientation of Variables			
Left		Right	
Variables	Ctr. of variables pct.	Variables	Ctr. of variables pct.
chatN	8.96	*onlineP*	6.48
socialnetsN	5.28	*uploadP*	5.71
musicN	5.08	*musicP*	5.17
funN	4.30	**shareP**	3.89
newsN	3.38	**downloadP**	3.78
emailN	3.27	*gamesP*	3.71
onlineN	2.95	**studentsP**	3.65
		chatP	3.50
		newsP	3.49
		announcementsP	3.17
		teacherP	3.11
Axis 2			
Orientation of variables			
Top		Bottom	
Variables	Ctr. of variables pct.	Variables	Ctr. of variables pct.
onlineP	13.56	**announcementsP**	15.10
gamesP	7.39	**downloadP**	13.39
musicP	3.03	**studentsP**	4.74
		shareP	3.54
		homeworkP	3.40
		onlineN	3.07

Note: The PISA 2012 dataset. Own calculation. **School related** use in bold, *recreational* use in italics.

frequencies (4 for recreational use and 5 for scholastic use) contributing most to the second axis in Germany. Together they contribute to 67.77% of the variance of Axis 2 ($\lambda_2^{adj} = 0.002$).

As Fig. 1 and Table 3 show, in Germany Axis 1 is the dimension of the frequency of use. It groups together, and counterposes, the absence of digital recreational use to the left of axis from the frequent recreational and scholastic digital use to the right of the axis. Axis 2, in turn (as Table 3 and Fig. 2 show), is the dimension of the type of frequent digital use. It appears to capture a distinction between frequent recreational users at the top of the axis and frequent school-related users of the Internet at the bottom of the axis.

Fig. 3 shows the 16 active frequencies (12 for recreational use, 4 for school related use) contributing the most to the first axis in Norway. Together they contribute to 70.51% of the variance of Axis 1 ($\lambda_1^{adj} = 0.007$). In turn, Fig. 4 shows 12 active frequencies (5 for recreational use and 7 for scholastic use) contributing most to the second axis in Norway. Together they contribute to 76.34% of the variance of Axis 2 ($\lambda_2^{adj} = 0.002$).

As Fig. 3 and Table 4 show, in Norway Axis 1 is the dimension of the frequency of use. It groups together, and counterposes, the absence of digital recreational use to the left of axis from frequent recreational and scholastic digital use to the right of the axis. Axis 2, in turn (as Table 4 and Fig. 4 show), is the dimension of the type of frequent digital use. It appears to capture a distinction between frequent recreational users at the top of the axis and frequent school-related users of the Internet at the bottom of the axis.

6. Factors structuring national digital spaces

To answer the third research question, the following seven variables are introduced as supplementary variables in national digital spaces. The first one indicates the respondent's gender. The second indicates whether the respondent is indigenous in a given country or whether he or she is a first- or second-generation immigrant, while the third variable indicates whether the respondent is raised by two parents or in a single-parent household (that category also includes the respondents who do not live with their parents). Material access to the Internet is measured by the question: “Is Internet connection available for you to use at home?”, which the respondent could answer in three different ways: “Yes, and I use it”, “Yes, but I don't use it”, and “No”. Regarding cultural capital, two variables indicating the level of education of the respondent's parents are included. Both of these variables have the following response categories for each parent: 1. Primary or none (ISCED 0 and 1), 2. Lower secondary (ISCED 2), 3. Vocational upper secondary (ISCED 3B or 3C), 4. General upper secondary and post-secondary (ISCED 3A and ISCED 4), 5. Vocational tertiary (ISCED 5B), and 6. Theoretically oriented tertiary (ISCED 5A, 6) (OECD 2014d: 307). Finally, the size of the book collection held in the respondent's household is included as an indicator of objectified cultural capital (Bourdieu, 1986, p. 231). This indicator has six categories: 1. None or very few (0–10) books; 2. A shelf of (11–25) books; 3. A bookcase (26–100 books); 4. Two bookcases (101–200 books); 5. Three to five bookcases (201–500 books); and 6.

Table 4
Digital space in Norway: interpretation of axis 1–16 variables contributing the most to the axis; interpretation of axis 2 - 12 variables contributing the most to the axis. Variables are ranked according to decreasing contributions. Ctr. of variables are in percentages.

Axis 1			
Orientation of Variables			
Left		Right	
Variables	Ctr. of variables pct.	Variables	Ctr. of variables pct.
chatN	6.17	*uploadP*	7.23
musicN	5.17	**studentsP**	5.13
newsN	5.10	*onlineP*	4.66
practicalN	4.92	**shareP**	3.73
funN	4.65	*musicP*	3.52
socialnetsN	3.94	**announcementsP**	3.37
emailN	3.12	**downloadP**	3.18
onlineN	3.00	*gamesP*	3.08
Axis 2			
Orientation of variables			
Top		Bottom	
Variables	Ctr. of variables pct.	Variables	Ctr. of variables pct.
onlineP	11.99	**announcementsP**	9.81
gamesP	10.36	**downloadP**	7.03
homeworkN	3.93	**studentsP**	6.72
announcementsN	3.45	**teacherP**	5.66
		shareP	5.29
		onlineN	5.16
		gamesN	3.99
		funN	2.95

Note: The PISA 2012 dataset. Own calculation. **School related** use in bold, *recreational* use in italics.

More than five bookcases (more than 500 books). Altogether, seven questions with a total of 27 categories were chosen as supplementary variables from the PISA 2012 dataset and are listed thematically in Table 5.

This paper follows a rule of thumb stating that a scaled deviation between categories greater than 0.5 (in absolute value) is 'notable' and a scaled deviation greater than 1 (in absolute value) is 'large' (Le Roux & Rouanet, 2010, p. 71).

It turns out that following this rule, in Germany (Fig. 5), the only notable deviations are between boys and girls ($d = 0.48$ on Axis 1 and $d = 0.53$ on Axis 2), between the respondents who have and use the Internet at home and those who do not have it ($d = 0.7$ on Axis 1) or those who have the Internet connection at home but do not use it ($d = 0.7$ on Axis 1), and between the respondents who have less than 10 books and those who have more than 500 books ($d = 0.47$ on Axis 2). Girls are closer to the lack of recreational ICTs use on Axis 1 and to the frequent scholastic ICTs use on Axis 2. The respondents who do not have the Internet connection at home or who have it, but do not use it tend not to use the Internet for recreational purposes. And while the frequent ICTs users who have large libraries tend to use digital technologies for scholastic purposes, the frequent users having no or small home libraries tend to use digital technologies for recreational purposes.

In Norway (Fig. 6) the only notable deviations are between boys and girls ($d = 0.57$) on Axis 2 as well as between the respondents who have and use the Internet at home and those who have, but do not use the Internet connection at home ($d = 0.49$ on Axis 2). Among frequent ICTs users, boys and the respondents having and using the Internet connection at home tend to use digital technologies for recreational purposes, whereas girls and the respondents who have, but who do not use the Internet connection at home tend to use digital technologies for scholastic purposes.

So far, the analysis has established what are the two main axes structuring digital space in Germany and Norway: the first one is the dimension of frequency of digital use (separating no use from frequent use), the second one is the dimension of the type of frequent digital use (separating frequent recreational from frequent scholastic use). The analysis has also established which supplementary variables are associated with those axes. Let us now examine how well these supplementary variables

Table 5
Supplementary variables.

Variable	Number of categories
Gender	2
Immigrant background	2
Family structure	2
Father's education	6
Mother's education	6
Internet access at home	3
Number of books in the respondent's household	6

Note: The PISA 2012 dataset.

account for the variance of dimensions constituting national digital spaces. To pursue this, let us examine the clouds of individuals, using concentration ellipses (Cramér, 1946, pp. 283–284) and the coefficient eta-square (η^2, Le Roux & Rouanet, 2010, p. 22) as the tools for revealing the degree of overlap and separation between different categories (modalities) of the relevant supplementary variables. A concentration ellipse of a sub-cloud of individuals in a principal plane is the ellipse of variance drawn around the mean point corresponding with the modality of a supplementary variable in the cloud of modalities. The length of each half-axis of the concentration ellipse is twice the standard deviation of the sub-cloud along this direction. For a normally shaped sub-cloud, the concentration ellipse contains 86 per cent of the points of the sub-cloud. In turn η^2 is interpreted as the part (percentage) of variance of a given axis accounted for by the partition into modalities of a supplementary variable (structuring factor) (Le Roux & Rouanet, 2004, pp. 97–99; Le Roux et al., 2008, pp. 1060–1061; Le Roux & Rouanet, 2010, pp. 69–70).

As regards Germany, Fig. 7 identifies 29 respondents who have the Internet connection at home but do not use it, and 37 respondents who do not have Internet access at home and draws their concentration ellipses, showing that there is a huge overlap between these two groups in terms of their digital usage. The centres of both two sub-clouds are located almost at the same spot on the left of Axis 1, corresponding to the lack of digital use for recreational purposes. By contrast the centre of the sub-cloud of 3937 respondents having and using the Internet connection at home is located exactly at the barrycenter, meaning that the average respondent having material access to the Internet corresponds to the average respondent in German digital usage space. A look at the value of the η^2 coefficient (Table 6a) shows that the 3-modalities partition explains only 4.3% of the variance in Axis 1.

Fig. 8 identifies 2072 girls and 2045 boys showing the centre of the girls' sub-cloud being located on the left of Axis 1 and at the bottom of Axis 2, i.e., in the area indicating lack of digital recreational use and a tendency towards scholastic activities among the frequent digital users. By contrast, the centre of the boys' sub-cloud is located in the area indicating frequent recreational and scholastic use as well as a tendency towards recreational activities among the frequent digital users. However, the low values of the η^2 coefficient for Axis 1 (5.2%) and Axis 2 (5.7%) in Table 6b indicate that gender differences are not strongly associated with patterns of digital usage in Germany.

Finally, Fig. 9 identifies 363 respondents having less than 10 books at home and 430 respondents having more than 500 books at home – showing that both sub-clouds have similar shapes and that there is a large overlap between the two groups, although the centre of the group possessing fewer books is located closer toward the top of Axis 2, indicating a tendency

Table 6
Double decomposition of variances along groups and axes in Germany - total, between and within variance.

Table 6a

	Frequency	Variances on Axis 1
Internet at home: Yes, and I use it	3937	0.130
Internet at home: Yes, but I don't use it	29	0.233
Internet at home: No	37	0.256
Total		0.116
Between variance		0.005
Within variance		0.111
η^2 = between/total		0.043

Table 6b

	Frequency	Variances on Axis 1
Boys	2045	0.118
Girls	2072	0.103
Total		0.116
Between variance		0.006
Within variance		0.111
η^2 = between/total		0.052
	Frequency	Variances on Axis 2
Boys	2045	0.082
Girls	2072	0.050
Total		0.070
Between variance		0.004
Within variance		0.066
η^2 = between/total		0.057

Table 6c

	Frequency	Variances on Axis 2
0 = 10 books	363	0.096
500 + books	430	0.081
Total		0.070
Between variance		0.006
Within variance		0.064
η^2 = between/total		0.086

Note: The PISA 2012 dataset. Own calculation.

Table 7
Double decomposition of variances along groups and Axis 2 in Norway - total, between, and within variance.

Table 7a		
	Frequency	Variances on Axis 2
Boys	2265	0.072
Girls	2197	0.059
Total		0.071
Between variance		0.006
Within variance		0.065
η^2 = between/total		0.085
Table 7b		
Internet at home: Yes, and I use it	4339	0.073
Internet at home: Yes, but I don't use it	51	0.076
Internet at home: No	38	0.104
Total		0.071
Between variance		0.001
Within variance		0.070
η^2 = between/total		0.014

Note: The PISA 2012 dataset. Own calculation.

towards recreational activities among the frequent digital users; while the centre of the group possessing more books is located closer to the bottom of Axis 2, indicating a tendency towards scholastic activities among the frequent digital users. The low value of the η^2 coefficient for Axis 2 (8.6%) in Table 6c shows, however, that the differences in the possession of objectified cultural capital do not translate much into differences in the type of frequent digital usage in Germany.

For Norway, Fig. 10 identifies 2197 girls and 2265 boys, showing that there is a huge overlap between genders in terms of their digital usage, with girls tending to be more frequent users for scholastic purposes, and boys tending to be more frequent users for recreational purposes. Just like in Germany, however, gender differences do not explain much of variance in patterns of digital use, as indicated by the low value (8.5%) of the η^2 coefficient for Axis 2 (Table 7a). In turn, Fig. 11 identifies 4339 respondents having and using the Internet connection at home – showing that the centre of this cloud is located near the barrycenter, which means that the average respondent from this sub-cloud corresponds to the average respondent in Norwegian digital usage space. The centre of the sub-cloud of 51 respondents who have the Internet connection at home but do not use it is moved away from that barrycenter – towards the area indicating frequent scholastic use. Again, however, as the low (1.4%) value of the η^2 coefficient for Axis 2 shows, differences in material access to the Internet do not explain much of variance in patterns of digital use in Norway (Table 7b).

7. Discussion and conclusions

The research question posed in this paper was whether the differences in social standing among adolescents perpetuate digital usage inequality in that age group. Thus, the aim of this study was to test a theory of social uses of the Internet (López-Sintas et al., 2012, p. 119) in this age group. Adolescents were chosen as a single age group to be investigated in order to avoid the potentially obscuring strong effects of age that might make other components of social standing (i.e., social status) seem as less important in the structuring of digital use.

The theory of social uses of the Internet integrates the concepts of scale of consumption and linkage needs (Douglas & Isherwood, 1979) with Bourdieu's theory of taste (Bourdieu, 1984; 1986; 1989) and suggests that there is a homology between an individual's social standing and Internet use, in that social differences are reflected in different patterns of Internet use (López-Sintas et al., 2012, p. 121).

This paper contributes to the debate on digital usage inequality by testing the social theory of Internet use outside the Spanish national context in which it was initially formulated: i.e. in Germany and Norway. The testing was done using PISA 2012 data on digital usage by fifteen year-olds from these countries. These two European countries, although they share with Spain many characteristics regarding the level of economic, social, and technological development, are at the same time different enough to provide an environment in which it was not self-evident whether the theory would be corroborated, rejected, or modified. Moreover, while the national contexts for testing the theory might differ, the analytical approach of the present paper follows the work of López-Sintas et al. (2012) by adopting Geometric Data Analysis (Le Roux & Rouanet, 2004; Le Roux & Rouanet, 2010) as the method of investigation.

To answer the main research question, three specific problems were addressed. Firstly, what are adolescents' digital usage patterns; in other words: How are digital usage spaces built? Secondly, are there any national differences between digital usage spaces in the countries under study? Finally, how are these national digital usage spaces structured; in other words: What social and demographic factors – if any – influence adolescents' digital usage patterns?

The conducted analysis shows that in the countries under investigation digital usage spaces are similar. Both in Germany and Norway Axis 1 is the dimension of frequency of digital use, counterposing the lack of digital recreational use on the one

hand with the frequent recreational and scholastic digital use on the other hand. Axis 2 is in turn the dimension of the type of frequent digital use: counterposing the frequent recreational digital use with the frequent scholastic digital use. In both these countries, Axis 1 is the dominant dimension and Axis 2 the secondary dimension. Thus, in Germany and Norway digital usage spaces are two-dimensional and the dimensions have the same sociological interpretation.

Only few of the social and demographic variables used as independent variables in previous research – on digital inequality among adolescents (Mossberger et al., 2003; Warschauer, 2003, pp. 129–135; Peter & Valkenburg, 2006; Hargittai, 2007; Mossberger et al., 2008, pp. 95–137; and; Notten et al., 2009) and early life conditions, education and lifetime earnings (Brunello et al., 2016), such as: gender, migration background, family structure, fathers and mothers level of education, physical access to the Internet at home, and the number of books at home – turned out to be factors structuring national digital usage spaces, i.e., factors corresponding to the differences in the frequency and type of adolescents' digital use. In Germany and Norway, among the variables causing notable differences in digital usage, one finds gender and physical access to the Internet at home. There is also a notable difference between those living in a home with small (less than ten books) and large (more than 500 books) libraries in Germany.

What is crucial, however, is that even though in both countries the differences between these groups are notable, they explain only a small percentage (8.6% at most) of variance in digital usage space. Thus, one can conclude that among adolescents in the countries under study the differences in digital usage are highly individualised, or at least hard to characterize using the social and demographic variables used so far in digital usage inequality or social mobility research. It is worth pointing out that the current results are consistent with Aslanidou and Menexes's (2008) findings that already in 2004–2005 Greek adolescents' frequency and type of Internet use were not significantly affected by the educational level and profession of their parents. This, in turn, suggests that – with regard to digital usage inequality among contemporary adolescents in the countries under investigation – the Bourdieu-inspired social theory of Internet use does not have empirical support and should be rejected. The social inequalities inherited from the previous generations, or such demographic factors as family structure, gender or immigrant background either do not structure at all, or structure only very little, the patterns of digital use among adolescents in the countries under investigation. The adolescents investigated in this study were not internally differentiated in their patterns of digital use, and the differences in social standing between them were not translated into differences in digital use.

On the other hand, however, one can interpret the results reported in this paper also in the following way: Both the shape of digital usage spaces and the lack of their structuring along social and demographic factors might be interpreted as an indirect proof of the correctness of the social theory of Internet use. It is after all age, a category homogenous in this analysis and heterogeneous in López-Sintas et al.'s (2012) work, that is one of the most important factors structuring digital use in contemporary, technologically developed societies. Such an interpretation is consistent with the previous results of research on digital usage inequality (Bonfadelli, 2002; Fox & Madden, 2006; Zillien & Hargittai, 2009; Van Dreusen & Van Dijk, 2014). This interpretation is preferred over the one suggesting the rejection of the social theory of Internet use also because in no country under investigation did the analysis reveal a place in digital usage space in which the truly digitally-excluded adolescents (simultaneously both recreational and scholastic non-users) would be concentrated. In other words, the obtained results seem also to provide empirical support for the notion that adolescents are digital natives (Prensky, 2001; Tapscott, 2009) and are not split into sharply differentiated sub-groups along social or demographic lines.

The final reason for not rejecting the social theory of Internet use on the basis of the results presented in this paper is the inability to answer the question whether the so-called 'usage gap' (Van Dreusen & Van Dijk, 2014) might lose its importance in the future, as the present-day adolescents – currently undifferentiated in their digital usage profiles by standard social and demographic factors – grow older. It is entirely possible that as adolescents grow older, their (inherited or self-acquired) differences in social standing will become reflected in different patterns of Internet use. Tracking whether the (currently non-existent) 'usage gap' might emerge in the subsequent stages of life of the present-day digital natives would require conducting longitudinal studies on digital usage.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.compedu.2016.10.004.

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