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Dimensions of Internet use: amount, variety, and types

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We examine the dimensions of Internet use based on a representative sample of the population of the UK, making three important contributions. First, we clarify theoretical dimensions of Internet use that have been conflated in prior work. We argue that the property space of Internet use has three main dimensions: amount of use, variety of different uses, and types of use. Second, the Oxford Internet Survey 2011 data set contains a comprehensive set of 48 activities ranging from email to online banking to gambling. Using the principal components analysis, we identify 10 distinctive types of Internet activities. This is the first typology of Internet uses to be based on such a comprehensive set of activities. We use regression analyses to validate the three dimensions and to identify the characteristics of the users of each type. Each type has a distinctive and different kind of user. The Internet is an extremely diverse medium. We cannot discuss 'Internet use' as a general phenomenon; instead, researchers must specify what kind of use they examine.

Keywords: Internet use; typology; principal components analysis; Oxford Internet Survey; activity types

In 2011, 73% of the British population were online (Dutton & Blank, 2011). However, online activities are extremely diverse, ranging from sending emails to gambling to selling products, to name only a few. The diversity of uses is related to the interactive nature of the Internet as a medium where users – audiences – make active decisions about how to engage with the breadth of possible uses of the Internet (Ruggiero, 2000). On the one hand, this poses a challenge to researchers – how to capture the diversity of Internet uses with, for example, a survey instrument where each additional item is costly. On the other hand, too much detail makes it harder to detect regular patterns in Internet use.

These issues call for a comprehensive study into the diverse uses of the Internet with the goal of reducing the plethora of Internet activities to a smaller number of internally consistent and meaningful categories. A set of Internet use categories is valuable for two reasons. It will help us more clearly determine where Internet use has the largest impact on people's everyday lives. Second, it is a starting point to help identify the social locations and characteristics of people who differ along various dimensions of Internet use.

Previous researchers have recognized this and several typologies of Internet users have been constructed (Brandtzæg, 2010; Horrigan, 2007; Livingstone & Helsper, 2007). Yet, these typologies have often resulted in conceptually incoherent categories. For example, Brandtzæg synthesizes results from 22 studies and proposes eight user types. Among the eight are two

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categories that distinguish between sporadic users and entertainment users. However, 'sporadics' is a category related to amount of use, whereas entertainment use is a certain type of use. Brandt-zæg's typology does not account for people who may be entertainment users of different frequencies (including sporadic) and, conversely, that sporadic users may engage in many different activities (some of which might be entertainment-related). Similar comments apply to Brandt-zæg's other six categories, as well as most other existing typologies. Such typologies conflate elements that are conceptually separate dimensions. There seems to be theoretical confusion about the logical dimensions of Internet use across the literature. We suggest that dimensions of Internet use must first be specified theoretically and then all possible variations and combinations can be spelled out in the categories of a typology. Empirical work has to follow the theory. In the following paper, we first describe three dimensions along which Internet use will vary in theory. These are amount of use, variety of use, and types of use. Second, we review how previous research has handled these dimensions. Third, using a representative data set, we describe these dimensions in Britain, particularly focusing on the different types of Internet use. Finally, we validate that these are unique dimensions by showing that each dimension is characterized by users with distinctive demographic characteristics.

Theoretical framework

Our thinking about dimensions of Internet use is grounded in Barton's (1955) idea of property space. Barton describes a property space as a combination of properties along which a phenomenon is characterized. Each property represents a logically independent dimension, which means that individuals can be located on any one dimension without regard to their location on other dimensions. For example, people can be characterized by their scores on mathematical and linguistic ability tests. These two scores locate them in a 'property space' with the two dimensions of mathematical and linguistic ability. This can also be thought of as a mapping of each individual onto a coordinate system along pre-defined axes.

We can design a property space of Internet use using this approach. We identify properties which describe meaningful patterns of use. These properties constitute dimensions which construct a space of Internet use where any individual can be located based on their 'score' on each dimension. Such conceptualization of Internet use prevents us from arbitrarily excluding some combinations of dimensions of Internet use, a common weakness of previous studies (see next section). However, in order to do so, we also need to identify the boundaries of variation of each dimension.

Drawing on our conceptual thinking about the Internet as well as a critical assessment of previous typologies presented below, we identify three properties of Internet use. The goal is to identify broad dimensions along which Internet use can vary, and that can be used to locate any user. The properties we propose are (1) amount, (2) variety, and (3) type of Internet use.

We call the first dimension the amount of Internet use. This is a continuous variable measuring the frequency of Internet use in day-to-day life, not the length of time someone has been using the Internet. Amount of use (in previous research often called 'frequency of use') is a relevant property since Internet users can vary extensively in how much time they spend online – some people use it for many hours each day, others only once a week.

The second dimension is variety of Internet use. This is an interval variable measuring the number of different activities that individuals undertake online (in previous research some authors refer to it as 'breadth of use'). Variety is a separate property of Internet use, since users may undertake one or several Internet uses. Variety is logically distinct from amount of use. For example, someone can log onto Facebook in the morning and use it for the entire day.

We would describe their amount of use as very high, but, since they only did one activity, their variety of use is low.

The third dimension is type of Internet use. This is a series of nominal variables describing different activities people engage in online. Activities include anything from sending emails to investing in stock to making travel reservations to gambling. These activities are discrete categories and, since people can do many different things, individuals may be located in more than one category.

Types of use need to be defined on a conceptual level. This means it is important to move beyond the detail of specific, individual activities (e.g. using email, watching videos, ordering groceries) to more abstract categories. This gives us a relatively limited number of conceptual units to deal within the property space. Thus, one aim of the data analysis is to identify a relatively small, manageable set of internally consistent types of Internet use. Type of use is logically distinct from either amount or variety of use. For example, one person could be an intensive gambler and email user while another person is an intensive user of social network sites and email. In terms of our three dimensions, both would (1) score high on amount of use and have (2) the same variety of use – 2 activities – but have (3) a different combination of use types. Any combination of amount, variety, and types is possible. The point of the property space is that people can vary independently along all three of these dimensions.

The value of defining a property space of Internet use for future research is (at least) three-fold. First, by identifying meaningful dimensions of Internet use beforehand we avoid the confusion and inconsistency in describing Internet users. Second, by drawing on such a theoretical framework we will not overlook empirically existing possibilities of Internet use, which some previous typologies do. Third, by allowing independent variation among the dimensions, the proposed framework is more flexible than prior work. Each dimension can vary independently. This can be valuable in comparative research, either cross-national or longitudinal, where the exact conjuncture of empirically existing users may vary in different locations or across time. For example, in cross-national research, some countries could have different types of use, while others could share the same types but vary in their variety. This approach allows more precise identification of where the differences are located. A similar argument applies as Internet use changes longitudinally over time. In the next section of the paper, we review previous research on dimensions of Internet use.

Dimensions of Internet use in previous research

Table 1 summarizes previous studies that created a typology of Internet users or uses. The table includes only those studies based on a sample representative of a population. We acknowledge the contributions that papers based on convenience samples make to our understanding of Internet use. Yet, here we review only studies which used data representing a population because we are interested in Internet use without the unknown biases of non-representative samples.[1] We exclude papers that create typologies as part of a discussion of the digital divide or another topic (van Deursen & van Dijk, 2013). Their primary focus is not on the characteristics or quality of the typology but on their substantive topic. The purpose of this review is identifying dimensions of Internet use.

Overall, amount, variety, and types of Internet use are the most common dimensions identified in previous research (not usually using these names, see Table 1). The most commonly used dimension is amount of Internet use, measured either as a frequency of going online on a Likert-type scale (Brandtzæg et al., 2011; Howard et al., 2001; Livingstone & Helsper, 2007; Selwyn et al., 2005), as a frequency of engagement in different online activities (Eynon & Malmberg, 2011; Holmes, 2011; Horrigan, 2007; Ortega Egea et al., 2007), or as total years of Internet

Table 1.   Summary of previous studies.

Reference	Population	Method	Typology	Named dimensions
Howard, Rainie, and Jones (2001)	United States (N = 10,253)	Descriptive statistics	*Netizens*: Daily use, 3+ years	Frequency of logging on
			Utilitarians: Daily use; 3+ years; less intense	
			Experimenters: Daily use; 1–3 years	Years of Internet use
		28 use vars	*Newcomers*: Use 1 year or less	
Selwyn, Gorard, and Furlong (2005)	4 UK regions (N = 1001)	Descriptive statistics	*Broad frequent users*: Frequent use, 3+ purposes	Frequency of Internet use
			Narrow frequent users: Frequent use, 1–2 purposes	
		# use vars unknown	*Occasional users*: Occasional use	Range of use
			Non-users: Not used in past 12 months	
Ortega Egea, Recio Menéndez, and Román González (2007)	15 EU countries (N = 30,336)	Two-step cluster analysis	*Laggards*: Occasional use; don't use eGovernment	Frequency of access
			Confused and Adverse: Intermediate, high variability of use; don't shop	
		23 use vars	*Advanced Users*: Frequent users; eGovernment, shopping	Degree of innovativeness
			Followers: Frequent use; eGovernment, don't shop	
Horrigan (2007)	United States (N = 4001)	Cluster analysis	*Omnivores*: Own many ICTs, use Web 2.0	
			Connectors: Frequent use; ICTs to connect to people and content; satisfied	
			Lacklustre Veterans: Frequent use; not thrilled with ICT-enabled connectivity	
			Productivity Enhancers: Strong positive views that technology helps productivity	
		8 assets vars; 1 connection type var; 17 ICT use vars; 12 attitudes vars	*Mobile Centrics*: Use mobile phones; like how ICTs connect them	Assests
			Connected but Hassled: Find connectivity intrusive and information a burden	Actions
			Inexperienced Experimenters: Occasional use; might do more if had more experience	Attitudes
			Light but Satisfied: Have some ICTs, but do not play a central role in daily life	
			Indifferents: Use ICTs intermittently, find connectivity annoying.	
			Off the Network: Have neither a cell phone nor Internet connection	

Heim and Brandtzæg (2007)	Austria, Germany and Norway (N = 24,468)	Cluster analysis	*Non-users*: Don't use ICTs	
			Average users: Occasional use; low skills	
		48–73 vars to generate 12 use-and-skills vars included in the analysis	*Instrumental users*: Frequent use; for utility or information acquisition	ICT usage
			Entertainment users: Frequent use; for entertainment activities	ICTs
			Advanced users: Most frequent use; for many different purposes	
Livingstone and Helsper (2007)	UK; children (N = 1511)	Descriptive statistics	*Basic Users*: 1–3 activities; esp. information seeking	
			Moderate users: 4–5 activities; information, communication, entertainment	Frequency
		15 use vars	*Broad users*: 6–7 activities; peer-to-peer activities	Breadth
			All-rounders: 8+ activities; wide range of uses	
Brandtzæg (2010)	Literature review	Does not analyse data	*Non-users*: No media use	
			Sporadics: Low use and variety; no particular activity	
			Debaters: Medium use and variety; discussion and information activities	Frequency
			Entertainment users: Medium use and variety; gaming, videos, UGC, shopping	Variety
			Socializers: Medium use and variety; socializing, keeping in touch	Content/activity preference
			Lurkers: Medium use; low variety; lurking, time-killing	Media platform/ service
			Instrumental users: Medium use and variety; information, work-related purposes	
			Advanced users: High use and variety; all activities (games, e-government, shopping, etc.)	
Brandtzæg, Heim, and Karahasa-nović (2011)	Norway, Sweden, Austria, UK, Spain (N = 12,666)	Cluster analysis	*Non-users*: Don't use the Internet	
			Sporadic users: Occasional use of email and some specific tasks	Frequency
			Instrumental users: Goal-oriented activities (information search, banking, commerce)	Variety
		23 use vars	*Entertainment users*: Internet radio, TV, music, chat, downloading games	Content preferences
			Advanced users: Varied and broad Internet use	

Table 1.   Continued.

Reference	Population	Method	Typology	Named dimensions
Eynon and Malmberg (2011)	UK; young people (N = 804)	Latent profile analysis	*Peripherals*: Low levels of all types of uses	
			Normatives: Average on information seeking, communication and entertainment	Intensity of use
			All-rounders: Above average levels of use of all types	
		21 use vars; pre-defined uses	*Active Participators*: Most frequent level of use of all uses; heavy in participating online	Activity
Holmes (2011)	UK; children (N = 561)	Latent class analysis	*Information focus*: Weekly use; school-work, information search.	Engagement/ frequency
			Recreational focus: Weekly use; IM and online music; informational activities	
		4 use vars	*Low users*: Use for school, 1–2 activities weekly	Activity

Note: ICT, information and communication technology.

use (Horrigan, 2007; Howard et al., 2001). This is often conflated with either variety or one or more categories containing types of use. For example, Holmes' (2011) category 'recreational focus' combines both a frequency component ('weekly use') and two types of use ('informational activities' and 'IM and online music'). His scheme has no place, for example, for people who use the Internet less than weekly and also use it for 'IM and online music'. In general, these typologies share similar shortcomings: by conflating amount or variety with types of use, they cannot capture the full range of Internet use.

There is little theoretical discussion of appropriate dimensions of Internet use in the previous literature. Brandtzæg (2010) is a notable exception calling for a multidimensional view (as also advocated in the digital divide literature, e.g. van Deursen & van Dijk, 2013; Zillien & Hargittai, 2009). Brandtzæg's literature review identifies four dimensions used in the previous literature: frequency of use, variety of use, content preferences, and media platform.[2] Brandtzæg (2010) finds eight user types in the previous literature and Brandtzæg et al.'s (2011) cluster analysis of users (cases) results in five user categories. Taking the 2011 results as an example, two categories of users are primarily described by amount of use (non-users and sporadic users), two categories are described by their typical activities (entertainment users and instrumental users), whereas the final category is characterized by variety of use (advanced users). This is a confusing set of categories because it combines amount (e.g. 'sporadic') and type of use (e.g. 'entertainment') into a single dimension. These categories are not mutually exclusive and single users, like a sporadic entertainment user, can fit into two categories. This is a strong clue that there are separate dimensions. The source of the problem is the variables in the cluster analysis. Cluster analysis results are totally dependent on the variables included, and Brandtzaeg et al. (2011, p. 128) have included variables measuring all three dimensions of use. This initial theoretical confusion results in confused output. If the cluster analysis results are to be meaningful, the analysis must begin with a theoretically consistent set of variables. Despite his promising start, both of Brandtzæg's typologies end up with exactly the same weakness as other studies that collapse several theoretical dimensions of Internet use in a single empirical dimension with multiple categories (Eynon & Malmberg, 2011; Heim & Brandtzæg, 2007; Horrigan, 2007; Howard et al., 2001; Ortega Egea et al., 2007; Selwyn et al., 2005).[3]

The analysis of the literature summarized in Table 1 and beyond leads us to conclude that there is a great deal of confusion about the dimensions of Internet use. Existing typologies are inconsistent, rigid, and primarily data-driven. By contrast, we argue that before engaging with the data, the nature of Internet use has to be theorized along meaningful dimensions. These dimensions should have three characteristics: They should embrace a logic of how Internet use can reasonably vary, they should be separate, and the boundaries of their variation should be defined. In essence, this paper takes a step back to the discussion of important dimensions of Internet use with an aim of helping future research avoid conflating theoretically distinct aspects of Internet use. Below we move beyond theorizing the property space of Internet use to operationalize and analyse each of the three proposed dimensions – amount, variety, and type of use – empirically.

Data and measurement

The Oxford Internet Surveys (OxIS) collect data on British Internet users and non-users. Conducted biennially since 2003, the surveys are nationally representative random samples of over 2000 individuals aged 14 and older in England, Scotland, and Wales. Interviews are conducted face-to-face by an independent survey research company. The analyses below are based on the 73% of the respondents who were Internet users in 2011, $N = 1498$.

Table 2. Internet activity variables.

Type	Name		Item
Entertain	Movies	*	How often do you: Watch movies or films online?
Entertain	TV	*	How often do you: Watch TV programs on the Internet?
Entertain	Dl music	*	How often do you: Download music?
Entertain	Listen music	*	How often do you: Listen to music online?
Entertain	Videos	*	How often do you: Watch videos online?
Entertain	Dl video	*	How often do you: Download videos?
Commerce	Buy	*	How often do you: Buy a product online?
Commerce	Travel res	*	How often do you: Make travel reservations/bookings?
Commerce	Pay bills	*	How often do you: Pay bills?
Commerce	Banking	*	How often do you: Use your bank's online services?
Commerce	Compare	*	How often do you: Compare products and prices?
Commerce	Food	*	How often do you: Order groceries or food online?
Commerce	Selling	*	How often do you: Sell things online?
Info seek	Facts	*	How often do you: Find or check a fact?
Info seek	Definitions	*	How often do you: Look up a definition of a word
Info seek	Topics	*	How often do you: Investigate topics of personal interest
Socialize	IM	*	How often do you: Do instant messaging?
Socialize	Chat	*	How often do you: Participate in chat rooms?
Socialize	Photos	*	How often do you: Post pictures or photos on the Internet?
Socialize	SNS	*	How often do you: Check or update your profile on a social networking
Email	Email	*	How often do you: Check your email?
Email	Attach	*	How often do you: Send attachments with your email?
Email	List	*	How often do you: Use a distribution list for email?
Blog	Phone	*	How often do you: Make or receive phone calls over the Internet?
Blog	Read blog	*	How often do you: Read a web-log or blog?
Blog	Write blog	*	How often do you: Write a web-log or blog?
Blog	Website	*	How often do you: Maintain a personal website?
Production	Ul video	*	How often do you: Post a video or video clip?
Production	Ul creative	*	How often do you: Post writing, stories, poetry or other 'creative' work
Production	Jokes	*	How often do you: Get jokes, cartoons or other humorous content
Production	Ul files	*	How often do you: Upload videos or music files?
Cl Media	News	*	How often do you: Look for news - local, national, international
Cl Media	Events	*	How often do you: Get information about local events?
Cl Media	Sports	*	How often do you: Look for sports information?
Cl Media	Travel plan	*	How often do you: Make travel plans?
Schl-work	Seek job	*	How often do you: Look for jobs, work?
Schl-work	School	*	How often do you: Get information for school
Schl-work	Work	*	How often do you: Get information for work
Schl-work	Distance ln	*	How often do you: Online distance learning for academic degree/job training
Vice	Gambling	*	How often do you: Bet, gamble or enter sweepstakes?
Vice	Adult	*	How often do you: Look at 'adult' sites with sexual content?
	Board		How often do you: Post messages on discussion or message boards?
	Games		How often do you: Play games?
	Invest		How often do you: Invest in stocks/bonds/funds?
	NewsPap		How often do you: Read any newspaper or news service on the Internet
	Health		How often do you: Find information about health or medical care
	Google		How often do you: Find information about other people?
	Location		How often do you: Find location of a house, office, store, restaurant?

Notes: Total: 48 variables; *, included in PCA (41 variables). Cl, classic mass media; Dl, download; Ul, upload; SNS, social network site; IM, instant messaging; ln, learning.

OxIS contains measures of all three dimensions of Internet use. The analysis is based on 48 variables asking about Internet activities, see Table 2. For the first dimension, we want to measure total amount of use. Each variable is identically measured on a 6-point Likert scale, asking respondents how often they do the activity where 'never' = 0 and 'more than once per day' = 5. This supplies a measure of how much any respondent does each activity. The sum of the variables measures the total amount of Internet use. Our variable is continuous, with a theoretical range from zero to 240. The second dimension is the variety of Internet use. Variety is measured by the count of the number of activities that a respondent does more than never, with a theoretical range from zero to 48. The third dimension is based on extracting types of use from the individual activities listed in Table 2.

We also use standard demographic variables. We use four education categories: no degree, secondary, further, and university education. Race is coded as white versus non-white. Place is coded as urban versus rural. Lifestage is a four-category variable: students, employed, unemployed, and retired. Marital status has five categories: single, married, living with partner, divorced, and widowed. We also include gender and age.

Results

The distribution of variety of use is plotted in Figure 1. The average Internet user reports doing 25 different activities, a surprisingly large number. The actual mean is 24.6 and the median is 25. A major point that the histogram illustrates is that the distribution shows no evidence of any gaps or breaks that could support splitting it into the three or four categories typical of some other studies of Internet use.

Figure 2 displays the distribution of amount of Internet use. It ranges from one to 180, with a mean of 56 and a median of 53. The number is somewhat arbitrary since it is based on the sum of the Likert scales, but we can gain some feel for what it means if we divide the median amount, 53, by the median variety, 25. This yields slightly over 2. On the Likert scales, 2 corresponds to an average frequency of the use of 'Monthly'. The distribution of amount of use is largely symmetric
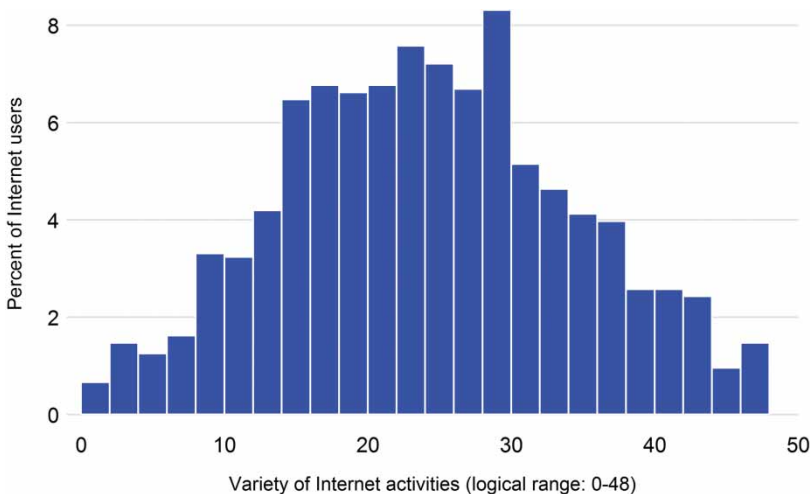

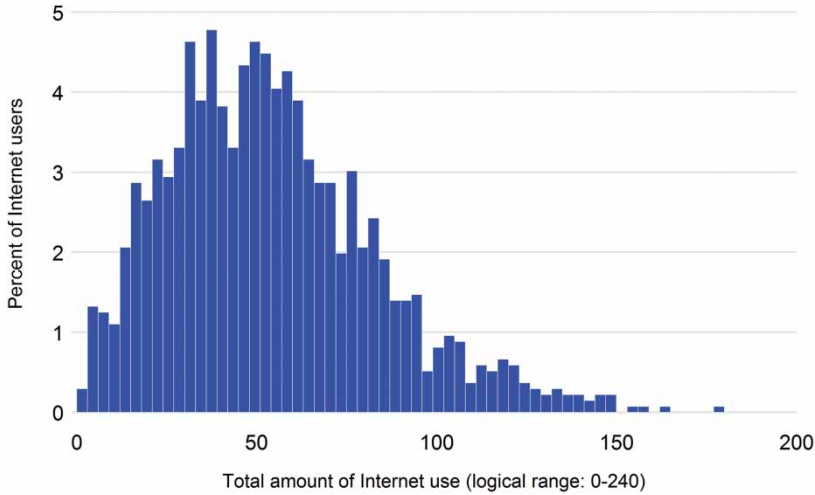
Figure 1.   Variety of Internet use.

Figure 2.   Amount of Internet use.

with a slight left skew, but slightly less symmetric than variety of use (Figure 1). Like variety of use, the distribution of amount of use is also smooth and continuous with no natural breaks that would justify creation of multiple categories.

For the third dimension, we want to find distinct types of online activities. We did the principal components analysis (PCA) of the 48 activity variables.[4] After eliminating seven variables that did not load above 0.3 on any component, we used 41 variables in the final PCA. After varimax rotation and Kaiser normalization, the result was that 10 components had eigenvalues greater than 1.0, see Table 3. The eigenvalues show that the variance is widespread among the 41 variables. The first component was dominated by watching movies and television, listening to music, and downloading and watching videos. All involve being entertained, so we named it *entertainment*. The second component involved buying, selling, comparing prices, making travel reservations, ordering groceries online, and paying bills. Since all of these are commercial activities, we named this *commerce*. Loading on the third component are looking up facts or definitions and pursuing topics of interest. We named this *information seeking*. The fourth component is composed of instant messaging, chat, posting photos, and maintaining a profile on a social network site. These are very social activities, and we named it *socializing*. The fifth component is dominated by email, the use of attachments and distribution lists. All have email in common so we named it *email*.

The 6th–10th components were named in similar ways. The sixth component involves reading and writing blogs, making Internet phone calls and maintaining a personal website. Blogs dominate so we named it *blogging*. The seventh component includes uploading videos or other files, looking for jokes and posting writing or anything 'creative'. These activities create content so we named it *production*. Loading on component eight are news, sports, and events. These are typical uses for traditional mass media, so we named it *classic mass media*. Component nine includes school- and work-related use of the Internet, so we named it *school-work*. Finally, the tenth component contains gambling and visiting adult, sex-related sites. We named it *vice*.

We can examine participation in these types of activities by creating new variables that measure participation. 'Participation' is defined as doing the activities that load strongly on the

Table 3. Internet activity types factor loadings from PCA.

Variable	Entertainment	Commerce	Info seeking	Socializing	Email	Blog	Production	Classic media	School-work	Vice
Movies	0.45									
TV	0.44									
Dl music	0.33									
Listen music	0.36			0.17						
Videos	0.41									
Dl video	0.34						0.21			
Buy		0.39								
Travel res		0.32								
Pay bills		0.37			0.23					
Banking		0.32			0.25					
Compare		0.30	0.18						−0.24	
Food		0.39								
Selling		0.39								
Facts			0.49							
Definitions			0.48							
Topics			0.44							
IM				0.45			−0.18			
Chat				0.34						
Photos				0.31			0.19			
SNS				0.52						
Email				0.21	0.34					
Attach					0.50					
List					0.49		0.27			
Phone				−0.18	0.22	0.38				
Read blog						0.47				
Write blog						0.57				
Website			−0.17	0.18		0.38				
Ul video				0.21			0.44			
Ul creative						0.21	0.43	−0.16		
Jokes							0.40	0.16		
Ul files	0.20						0.35			
News			0.18					0.36		
Events								0.45		

(*Continued*)

Table 3.   Continued.

Variable	Entertainment	Commerce	Info seeking	Socializing	Email	Blog	Production	Classic media	School-work	Vice
Sports								0.51		
Travel plan		0.20						0.35		
Seek job			−0.19	0.18				0.29	0.46	
School			0.28						0.45	
Work					0.29				0.34	
Distance learn									0.51	
Gambling										0.70
Adult										0.67
Eigenvalues	3.99	3.56	2.74	2.71	2.59	2.37	2.35	2.31	1.81	1.51

Source: OxIS (2011), *N* = 1134 Internet users.
Notes: Table contains sorted factor loadings after varimax rotation and Kaiser normalization. Dl, download; Ul, upload; SNS, social network site; IM, instant messaging. Loadings less than absolute value of 0.15 have been omitted.

Table 4. Participation in types, amount and variety of use.

Activity	Participation (per cent)	Amount (mean)	Variety (mean)
Email	93.5	58.8	4.1
Information seeking	85.7	60.9	4.3
Classic mass media	78.3	63.3	4.6
Socializing	61.2	68.1	4.9
Commerce	59.8	68.2	4.9
School and work	48.1	72.4	5.3
Entertainment	46.3	75.6	4.5
Blogging	30.1	82.3	5.9
Production	23.4	87.3	6.3
Vice	20.9	73.7	5.8

Source: OxIS (2011), $N = 1498$ Internet users.
Notes: 'Participation' is per cent who do the activity, on average, more than never. 'Amount' is the mean amount of Internet use for respondents who participate in that activity (out of 240, see Figure 2). 'Variety' is the mean number of activity types for respondents who do the activity (out of the 10 possible types, see Table 3).

component an average of more than Never; i.e. a '1' or higher on the Likert scales. By this measure, email is the most common type: 93.5% of respondents email more than Never (see Table 4). Close behind is information seeking with over 85% participation, followed by classic mass media at 78% and socializing with over 61%. At the lower end of the scale, the eighth and ninth ranking types are associated with content creation and Web 2.0: blogging and production. This is consistent with other work, where more complex, difficult activities like blogging are less popular (Dutton & Blank, 2011). The activity with least participation is vice, which remains a niche product.[5]

The Variety column in Table 4 shows the average variety of 10 types for respondents who do each type. Thus, the first line says that people who email do an average of 4.1 types of use (including email). By comparison, people who do vice do an average of 5.8 types. Similarly, the Amount column shows the average amount of Internet use for respondents who do the specific use type. These numbers are based on the sum of the Likert-scaled variables, so they are best used for comparison. Notice the inverse relationship between participation in type, and amount and variety of use. People who participate in the least popular activities – vice, production, and blogging – have both the highest variety and also the largest amount of use. This suggests that people who do niche activities are likely to be more active and do more things than people who do the popular activities.

This suggests that amount and variety of use are positively related. When we plot them in Figure 3, we see a strong relationship: higher variety is closely associated with more use. Notice also that there are respondents at both extremes of the variety (*x*-) axis. Some people do all 10 activities, others do none at all. Remember that respondents who, on average, reported Never doing the activities on a component were coded as not having done that type; these are the zeros in the lower left corner. The strength of the association is striking. For example, except for the outlier, among people participating in 10 types, the person who has the *least* amount of Internet use still participates more than the person who has the *most* amount of Internet use among people participating in four types.

Finally, we can look at the characteristics of users of each type. Table 5 contains the results of ordinary least squares (OLS) regressions using the factor scores from the PCA and total amount and variety of use as dependent variables. The predictors are seven demographic variables: age, gender, urban–rural, ethnicity, education, lifestage, and marital status.
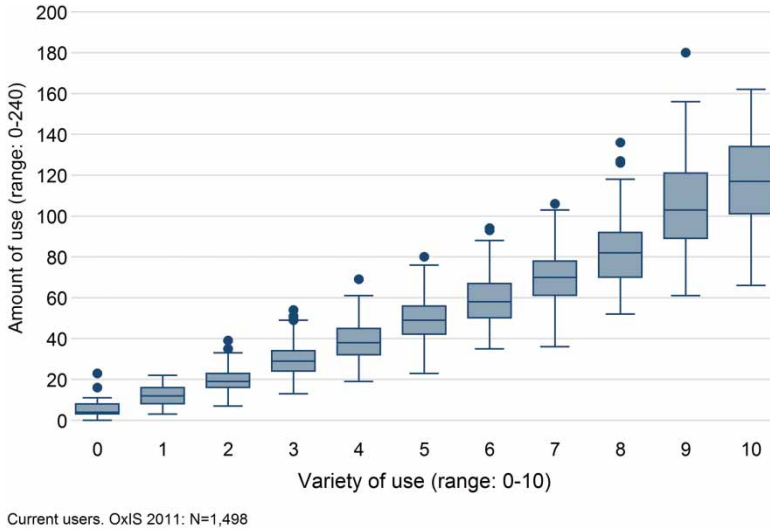
Figure 3.   Relation between amount and variety of Internet use.

Collectively, these regressions describe participants in most activities as young, well-educated, and employed. The unique predictors of each activity type are our primary concern. Below we highlight what is unique in each regression.

- *Entertainment*: This is the only type of use where lifestage has no impact. Single individuals are more likely to use the Internet for entertainment than other marital status categories.
- *Commerce*: This is the only type of use where whites are more likely to be engaged in commerce than non-whites and married people more than single individuals. Gender did not impact the likelihood of online commercial activity.
- *Information seeking*: Students are more likely to use the Internet for information seeking than employed, retired, or unemployed people. Education has its strongest effect on information seeking behaviours but marital status has no effect whatsoever.
- *Socializing*: Gender does not influence the likelihood of socializing. Employed and unemployed people are more likely to use the Internet for socializing than students.
- *Email*: This is the only regression where age has no effect. There is also no effect for marital status. Non-whites are more likely to do email than whites and education has its second strongest effect.
- *Blogging*: Non-whites are more likely to blog than whites and employed and retired are more likely than students. Gender is not a significant predictor.
- *Production*: This is more likely among urban residents. Only higher education is a significant predictor of production.
- *Classic mass media*: This has the strongest gender effect. Students are more likely to use classic mass media than respondents who are divorced or living with a partner.
- *School and work*: No marital status category has any significant effect and there is no gender effect. Students are more likely to use the Internet for school and work than any other lifestage.
- *Vice*: There is no significant education effect. This activity is more popular in urban areas. Only married people are more likely to do vice activities than singles.

Table 5. User characteristics for types, amount, variety of use (coefficients from OLS regressions).

Variable	Entertainment	Commerce	Info seeking	Socializing	Email	Blog	Production	Classic media	School-work	Vice	Amount (β coef.)	Variety (β coef.)
Age	−0.04***	−0.02***	−0.01*	−0.04***	0.00	−0.03***	−0.03***	−0.01**	−0.02***	−0.01**	−0.355***	−0.349***
Female	−0.74***	0.00	−0.21*	0.09	−0.36***	−0.16	−0.62***	−0.89***	0	−0.59***	−0.151***	−0.165***
Urban	0.26	−0.26	−0.2	0.09	0.07	0.05	0.44***	0.17	−0.05	0.26**	0.02	−0.002
Non−white	0.21	−0.55**	0.21	−0.06	0.37*	0.82***	−0.17	0.16	0.05	−0.21	0.023	0.025
Education												
Secondary	0.52**	0.65***	0.83***	0.46**	0.55***	−0.04	0.22	0.48***	0.23	−0.07	0.162***	0.145***
Further	1.13***	1.35***	1.32***	0.43**	1.15***	0.43*	0.05	0.83***	0.50***	−0.16	0.244***	0.219***
Higher	0.86***	1.56***	1.83***	0.54***	1.66***	0.51**	0.46**	1.08***	0.87***	−0.06	0.384***	0.370***
Lifestage												
Employed	0.12	1.50***	−0.46*	0.47**	0.86***	0.51**	0.50**	0.91***	−0.37*	0.54***	0.121**	0.129**
Retired	0.04	1.01**	−0.60*	0.52	−0.11	0.69*	0.54*	0.73**	−0.86***	0.52*	0.023	0.034
Unemployed	−0.1	1.08***	−0.55**	0.54**	0.18	0.27	0.45*	0.66***	−0.39*	0.64***	0.015	0.016
Marital status												
Married	−0.79***	0.51**	0.02	−0.72***	0.08	−0.15	−0.57***	−0.14	−0.09	−0.29**	−0.075*	−0.049
Living w/ part	−0.51**	0.29	−0.09	−0.43**	−0.01	−0.33*	−0.36*	−0.37*	−0.12	0.08	−0.037	−0.017
Divorced	−0.59*	0.1	−0.06	−0.33	−0.17	−0.66**	−0.29	−0.46*	0.03	0.17	−0.05	−0.032
Widowed	−0.71	0.24	0.06	−0.59	0.09	0.31	−0.06	−0.43	0.16	−0.21	−0.032	−0.016
Constant	1.42***	−1.39***	0.09	1.09***	−1.39***	0.62*	0.87***	−0.46*	0.72***	0.21	–	–
N	1097	1097	1097	1097	1097	1097	1097	1097	1097	1097	1309	1309
Adjusted R^2	0.25	0.17	0.16	0.25	0.23	0.12	0.20	0.18	0.16	0.10	0.27	0.24

Source: OxIS (2011).
Note: Omitted categories are: male, rural, white, no degree, student, single.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

The fundamental point of these regressions is that people with different characteristics do each type of activity. Even though there are only 14 independent variables (plus the constant) used to predict 10 types, no pairs of types overlap entirely. The statistically significant predictors of each type identify a unique group of people. This underscores the point that each of the 10 types is a separate dimension.

Finally, the right-most columns show regressions with amount and variety as dependent variables. Note that these columns report standardized regression coefficients. The message is simple and consistent across both variables: age and education matter, a lot. Gender also matters. Young, better educated, and male Internet users are more likely to exhibit higher amounts and varieties of use. Surprisingly, once other variables are controlled, employed tend to have both more Internet use and more varied use than students. The similarity of these two regressions corresponds to the strong relationship, as shown in Figure 3. These results mirror other findings about the effects of demographic variables and, as such, are a useful confirmation of the validity of these measures. Finally, these results underscore the importance of research focusing on variations in Internet use patterns from the perspective of digital inequalities (van Dijk, 2013; Livingstone & Helsper, 2007) and suggest that amount, variety, and types are valid and important dimensions along which the patterns of use should be further examined.

Discussion and conclusions

This paper theorizes and empirically examines dimensions of Internet use with an aim of guiding future research into patterns of Internet use. Below, we discuss theoretical and empirical implications, as well as limitations of present research.

Previous studies lack analysis of the theoretical dimensions of Internet use. Most previous researchers have published without thinking about the dimensionality of their phenomenon, thus producing typologies that are conceptually incoherent. We argue that Internet use varies along multiple dimensions. At minimum we discuss three dimensions: amount, variety, and types. These three dimensions may not be an exhaustive classification. There is surely more work to do clarifying the dimensions of the property space. Future research could profitably focus on whether additional dimensions exist. For example, a possible additional dimension is Internet skills. Hargittai and Hsieh (2011) have published suggestive measures in this area. The property space of Internet use could also be extended by a dimension of physical access (van Dijk, 2013; DiMaggio, Hargittai, Celeste, & Shafer, 2004), distinguishing various devices people use to go online, for example, by their degree of mobility.

Further theoretical development would benefit our understanding of separate dimensions and relations between them. For example, both the amount of use and variety of use as shown in Figures 1 and 2 have characteristics that seem not to have been noticed in prior research. The histograms show they have a relatively smooth distribution with a single mode. It is possible to divide either dimension into categories (Selwyn et al., 2005), but there are no gaps or other indications of 'natural' divisions that suggest that categories can be empirically identified. Amount and variety are continuous variables. While there may be no natural categories, there is often practical value in using categories so that we can talk about 'heavy' or 'light' users. When we do this, it is important to keep in mind that the researcher is creating something that does not exist empirically. Even if the researcher defines categories, it is important to recognize that they blend into each other without seams and without breaks in the distribution. Types, by contrast, are actually nominal categories. They are discrete entities. Unlike amount or variety of use, they are not 'more' or 'less' than each other (although they can be ordered according to the proportion of respondents who do the activity, as we did in Table 4).

Finally, a normative lens could be applied to the study of types of use, as suggested in the digital divide literature (van Dijk, 2013; Zillien & Hargittai, 2009). Some types of use could be preferred because they enhance social capital or other desirable characteristics (Wellman, Haase, Witte, & Hampton, 2001).

To guide theoretical development, research into the Internet's property space should include cross-dimensional analysis. This paper briefly described the relationship between type, amount, and variety of uses, but much more can be done. The nature of that relationship – linear or curved, homoscedastic or heteroscedastic, possible ceiling or floor effects – and the strength of the relationship both deserve description. Is there a sequence of types that most people follow as they use the Internet more frequently? Does a certain variety of use always mean the same types? Or do different people with similar number of uses (variety) cluster around different types? These interesting questions would help theoretically reconcile various dimensions of Internet use.

This paper also has methodological implications. First, we present an alternative measure of the amount of Internet use, based on Internet activity variables, as opposed to a single-item measure often used in previous research (see discussion of Table 1). Although the cumulative measure of the amount of use does not have intuitive units, we believe it is a better representation of how people use the Internet, accounting for multitasking and habitual behaviours (Lindley, Meek, Sellen, & Harper, 2012). Alternatively, amount of use could be measured in hours spent online, yet self-reported time use estimates are problematic in survey research (Greenberg et al., 2005).

Second, we operationalize participation in online activities (both, in single activities and in aggregated types) as more than Never. This measure can be problematic when generalizing across different activity types – while it is reasonable to expect that most people make travel reservations online less than monthly, the use of email is likely to be more frequent. This brings us to a discussion of what respondents consider *meaningful* Internet use (Eynon & Geniets, 2012). Researchers have usually assumed that they understood what is meaningful use, an assumption that is at least questionable. This deserves serious attention in future research.

Third, our analysis of types of use was based on a PCA to detect commonalities between different uses. This operated on variables. An alternative would be a PCA or cluster analysis of cases to classify users into groups sharing common attributes (see Table 1; e.g. Brandtzæg et al., 2011). While there is nothing intrinsically wrong with this approach, if the result is to be conceptually valuable, then the variables must be conceptually homogeneous. Furthermore, all the standard statistical techniques used in this area, PCA, cluster analysis, and descriptive statistics, as well as latent class analysis and latent profile analysis, share a similar weakness: they are sensitive to which variables are included. It is vital, therefore, to clarify which variables are important representatives of popular activities. Authors have worked with as few as four variables (Holmes, 2011), or have omitted variables measuring such key areas as classic media use (Brandtzæg et al., 2011; Heim & Brandtzæg, 2007), which was the third most common activity in Britain in 2011 (see Table 4). This paper suggests at least 10 areas that should be covered in future research.

One important implication of the PCA in this paper is that it is possible to capture all of the 10 activity types with many fewer than the 41 variables we used here. If a researcher used only the two variables that loaded strongest on each component in Table 3, all 10 activity types could be measured with only 20 items. This is one methodological use of the current paper. It is clear, however, that we may not have measured all of the relevant activities. The 48 variables in OxIS do not exhaust all of the possible activities. For example, we included no variables measuring involvement with political processes or e-government activities, or items measuring specific activities on social network sites. Locating other activities and defining good measures is another promising area for future research.

Categories and items are crucial. As the Internet develops, it is likely that the common activities on the Internet will change. This suggests that longitudinal studies of changes in common activities

could become one way to measure changes in the Internet. For example, some have suggested that social network site use has begun to supplant email, at least for some people. While we see no actual evidence of this in longitudinal analyses of email use (Dutton & Blank, 2011), it is certainly possible that some Internet activities may compete with other activities. As the Internet changes, activities may wax and wane in popularity for many reasons. Longitudinal studies of changes in Internet activities can be one way to measure the changing impact of the Internet.

Finally, the results of the present study have implications for digital divide research. Studies of the relation between inequality and differences in Internet use are emerging (van Deursen & van Dijk, 2013; Zillien & Hargittai, 2009). Those studies show important differences in types of Internet activity based on social status (Blank, 2013). An important first step is identifying and describing all dimensions along which Internet use can vary. We believe that the present paper makes a significant contribution to identifying dimensions of Internet use that deserve further research from the digital inequalities perspective.

The distinction between amount, variety, and types is fundamental. It is a theoretical distinction that influences which variables are measured, how they are measured, how they are analysed, and how the analysis is interpreted. It has to be built into research at the design stage.

Notes

1. We also excluded studies that contain the Internet in a more general typology of media use, and market reports or attempts to segment Internet users for marketing purposes.
2. Note, however, that Brandtzæg (2010) is not consistent in the number of identified dimensions – he proposes three separate dimensions on pages 940 and 954; and four separate dimensions on page 951 and in Table 6.
3. We identified only one study that develops a typology of Internet users based on one conceptual dimension: Livingstone and Helsper (2007).
4. Our activity variables are ordinal; Kolenikov and Angeles (2004) found that ordinal variables work effectively in a PCA. Although we present results from Pearson product-moment correlation coefficients, we also tried Spearman rank-order correlations with substantively identical results. We also did a cluster analysis which produced identical substantive results.
5. Vice activities are subject to social desirability effects. To minimize these they are not part of the regular interview, instead they are in an anonymous, self-completion questionnaire.

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