SMARTPHONES IN EVERYDAY LIFE: HOW SMARTPHONE DEPENDENCIES SHAPE INTERNET USE AND OUTCOMES

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Abstract
The distinct characteristic of smartphones is their flexible ability to be personalized to their owners' needs, goals and lifestyles. How they are personalized can lead different people to depend on them to attain very different goals. Drawing on media system dependency theory we describe three routine uses of smartphones: orientation, play, and escape dependency. These dependencies are associated with different subpopulations and they are major contributors to amount and variety of internet use. All three also shape internet outcomes but in different ways: orientation dependency has a positive influence on the benefits of use, while play and escape dependencies have a negative influence. The results show that the ways in which people incorporate smartphones into their lives have a strong impact on how they use the internet and what benefits they enjoy. We explore the implications for future theory of smartphone use.

Keywords
smartphones, smartphone use, media system dependency, motivation, internet use, internet outcomes, digital inequality

Smartphones in Everyday Life:
How Smartphone Dependencies Shape Internet Use and Outcomes

In 2007, Apple Inc. introduced the iPhone, a touchscreen-based, internet-enabled mobile phone, a smartphone. Smartphones have come to play a central role in everyday internet use (Blank et al., 2020); smartphones are now the most common device for accessing the internet, more common than PCs (Ofcom, 2023). The root of their popularity and their most distinctive characteristic is that they may be the most flexible consumer product ever produced. By selecting apps different people can fit smartphones into their everyday life routines differently. This has reconfigured the ways in which people access and use online services (Grošelj, 2021). This illustrates why it is important to examine the role that smartphones play in everyday digital engagement.

Compared to PCs, tablets, gaming devices or internet-connected TVs the flexibility of smartphones means that their material affordances have relatively less influence on how they are used (Bertel, 2018), which also creates ambiguity for researchers. Therefore, we need a "robust conceptual clarity of mobile media as metamedium" (Wei, 2023, p. 27). Haddon illustrates:

> Thinking of the smartphone as enabling the 'mobile internet' draws attention to all things internet-related about the device, while conceptualizing it as a 'platform' perhaps evokes the 'Swiss-army knife' metaphor and may sensitize researchers to think more about apps. Even the word mobile has connotations, suggesting we consider its use in different locations outside the home, when in fact 'at hand' is an equally appropriate good characterization of the device given that sometimes the smartphone is used as a more convenient alternative to the personal computer, laptop, or tablet in the home. (Haddon, 2020, p. 18)

It is exactly the diversity of how people use smartphones and how they supplement or complement other internet-enabled devices that makes comprehensive research into

smartphones difficult (Wang & Liu, 2024). No clear understanding of how smartphone use fits into broader patterns of online engagement has been established.

We can categorize studies that examined how people use smartphones into two categories: studies that compared smartphone-only with other types of internet access (e.g. Wang & Liu, 2024; Correa et al., 2024; Tsetsi & Rains, 2017) and studies that develop typologies of smartphone use (e.g. Wenz & Keusch, 2023; Sell et al., 2014). The first stream of research focuses on limiting affordances of smartphones, while the focus of the second stream of research is on specific types of apps and their use. The results of such studies provide useful insight into current uses of mobile media, but their stability and generalizability are limited. Frequently updated, products and apps change their capabilities and affordances. They tend to be ephemeral. Therefore, scholars have suggested that research on digital communication should focus on practices of engagement that are more stable: the motivations, goal attainment, habits and meanings that users ascribe to their engagement with digital media (Wei, 2023; Flanagin, 2020).

To better understand how smartphones fit into everyday internet use, we follow the data to disentangle the underlying motivations of smartphone use and their impact on larger patterns of internet engagement. We do not focus on specific apps (e.g. banking, maps or games), instead our goal is to understand the underlying *meaning* of use. For example, some people may use Instagram to have fun or pass time, others to find information or learn about different lifestyles, and still others pursue a combination of different goals. Our aim is to further our understanding of the role of smartphone use in everyday internet use by exploring typical ways that users depend on their smartphones and how these differences are reflected in their larger patterns of internet use and outcomes. We do so in four parts. We begin by describing our use of media system dependency theory (MSD) (Ball-Rokeach & DeFleur, 1976) and reviewing previous research. We use MSD to interpret the empirical results in the

next three sections. The second section empirically describes the different goals users attain by smartphone use. Third, we examine whether different dependencies are shaped by users' socio-demographic characteristics. Finally, we explore how smartphone dependencies shape internet use and positive outcomes, controlling for a range of factors, such as internet access and technical ability.

Smartphone Dependency

Drawing on the MSD (Ball-Rokeach & DeFleur, 1976) we develop the concept of smartphone dependency. MSD describes peoples' interactions with many media; in this paper we focus solely on smartphones as media used to access the internet. The key to dependency is how central the medium is to an individual's day-to-day goal attainment (Haddon, 2011). Dependencies are not the same as addictions; in MSD theory dependencies have no negative connotation.

MSD theory understands individuals as active agents who use media to achieve their goals. All people rely on media but they do not all rely on the same media. For example, there are multiple media that people could depend on to find news—a newspaper, TV, PC browser, social media or smartphone app—but people usually settle on particular media and their use becomes a habit. Therefore, we understand the dependencies people form with smartphones as habits that facilitate attainment of specific goals. Dependencies around particular technologies simply reflect the ways in which people integrate these technologies into their daily life routines (see also de Reuver, Nikou & Bouwman, 2016). Following MSD theory we use the term "smartphone dependency" to emphasize our focus on how people situate smartphones in their everyday lives, rather than referring to "smartphone dependence", which is the term some authors use to talk about smartphone-only internet access (e.g. Tsetsi & Rains, 2017). Smartphone dependencies reflect repeated patterns of customary use and as such describe how smartphones are situated in people's everyday lives.

In this paper we investigate which smartphone dependencies exist and how they are shaped by their social environment.

Ball-Rokeach (1985) proposes that dependency stems from three types of goals: understanding, orientation, and play. Understanding goals involve how we make sense of our social and personal environment through relationships, work and hobbies. Orientation goals entail searches for information to guide behavioural choices or consumption of goods and services. Finally, play goals aim at relaxation or stress relief and positive enjoyment of leisure activities either as solitary play or in interactions with family and friends (Ball-Rokeach, 1985). A single platform can serve to meet different goals. For example, some could watch funny videos on Instagram for entertainment, a play dependency, while others could use it for gathering interior decoration ideas, an orientation dependency. The three dimensions of goals are used to operationalize media dependency. The logic is that the more individuals achieve their goals using a particular medium, the greater their dependence on that medium (Grant, 1996). We draw on MSD theory to identify specific dependencies that internet users form with their smartphones.

Ball-Rokeach (1998) suggests dependency relationships with media could be shaped by three factors: individual characteristics; personal environment (e.g., one's living situation); and interpersonal environment (e.g., one's interpersonal networks). Put differently, how central individual media become in a person's daily life depends on the range of things they can do with it, its adoption and use by others in one's social networks, and the degree to which a person habitually organises parts on their daily life around it (Haddon, 2011). We use these factors as one basis to select our independent variables.

Digital Inequalities

Smartphone dependencies are related to the standard, three-level digital inequality framework (van Dijk, 2020). The first level involves differences in motivations/attitudes and material access, the second level differences in skills and usage, and the third level differences in outcomes (Helsper, 2021). Digital inequalities exist on all three levels shaped by individuals' socio-demographic backgrounds and social contexts, while at the same time the three levels of digital inequalities are interrelated and driven by complex underlying mechanisms that taken together may amplify social inequalities (see Robinson et al., 2020). Smartphone dependencies are mechanisms that motivate and shape people's use of the internet. This follows the digital inequality framework where motivation is antecedent to uses and outcomes (van Dijk, 2020; Reisdorf & Groselj, 2017). In the context of digital inequality, smartphone dependency reflects the presence of a technology in everyday life (1st level) that drives differentiated use (2nd level), which may result in differentiated outcomes (3rd level). In digital inequalities research, motivation is often equated with attitudes (Wang & Lui, 2022), but as Baker (1992) has pointed out, motivation is goal specific, whereas attitudes are object specific. Moreover, Flanagin (2020, p. 31) proposes that "communication technologies must be understood to be the objects engaged by people in their pursuit of particular goals", and therefore—connecting MSD to digital inequalities—we understand smartphone dependency as motivation for goal attainment.

Smartphone Use

Early research on smartphones originated in mobile communication studies, a field primarily concerned with interpersonal communication using mobile phones. The research has provided considerable evidence of distinct uses of smartphones. Their portability and convenience expanded the times and locations of internet access (Nielsen & Fjuk, 2010). For example, mobile internet access affords access to information "just in time" (Rainie & Fox,

2012; White, 2011), enhances ongoing conversations in social settings (Cui & Roto, 2008), and helps to kill time or make otherwise lost time useful (Verkasalo et al., 2010). This research found various ways in which smartphones may shape internet use but three weaknesses limit its explanatory power: (1) early studies were mainly qualitative, offering rich descriptions of mobile activities but lacking generalizability; (2) many studies focused solely on mobile internet use, overlooking that smartphone use often complements internet use on other devices (Dutton & Blank, 2014; Grošelj, 2021); and (3) initial research often emphasized internet use on the go, whereas recent findings suggest that the mobile-stationary dichotomy does not correspond to the way users think about access, as some users think there is "no need to differentiate between the internet and the mobile internet" (Humphreys et al., 2013, p. 496).

Some shortcomings of mobile communication research have been addressed by digital inequalities research where mobile internet use has been mainly examined as a separate mode of internet access. Several studies examined how access with different types of connections and different combinations of devices are related to differences in socio-economic characteristics and differences in patterns of online engagement. In Korea, Lee and colleagues (2015) found that socio-demographic characteristics were important especially in explaining non-use of smartphones, which was related to reduced participation in communication, leisure and financial activities. In Armenia (Pearce & Rice, 2013), Chile (Correa et al., 2020) and America (Tsetsi & Rains, 2017) mobile-only use was associated with lower economic well-being and younger age. Mobile-only use was also related to lower levels of skill (Correa et al., 2020; Correa et al., 2024) as well as to less diverse use (Correa et al., 2020; Pearce & Rice, 2013) and more social activity (Tsetsi & Rains, 2017) compared to those who were both mobile and computer users. Similarly, Reisdorf et al. (2022) found that having a mobile data plan was associated with using the internet for social media, music,

news, and shopping, but not for getting health or school- and work-related information. Finally, in the highly digitalized Netherlands, van Deursen and van Dijk (2019) found that smartphone- or tablet-only users were more likely to be younger, have children, and have less favourable internet attitudes.

There are a few prior attempts to categorize smartphone use. Several segmentation studies are designed for marketing research (e.g. Petrovčič et al., 2018; Sell et al., 2014), but by incorporating selling points (e.g. the importance of being "trendy", or wanting to be "among the first ones to try out mobile services") they are less helpful for understanding use. Beyond segmentation studies, Wenz and Kreusch (2023) apply latent class analysis (LCA) to 14 variables measuring frequency of use, smartphone skills and specific activities to identify 6 types of smartphone users: advanced users, broad non-social media users, broad non-commercial users, social media and information users, basic general users, and camera users. Like all reduction of dimensionality procedures, for the output of an LCA to be valid the input must be a theoretically consistent set of variables. Wenz and Kreusch do not do this; they conflate independent dimensions. For example, camera users combine a frequency component ("several times a week or less") with a type of use (taking photos). This scheme has no place for someone who takes photos daily. Similar theoretical weaknesses exist for their other categories (cf. Blank & Groselj, 2014). By applying LCA to data on frequency of engagement in 11 different activities Elhai and Contractor (2018) identified "heavy" and "light" smartphone users. Similarly, Beneito-Montagut et al. (2022) explored clusters of "regular smartphone users" age 55+ in four countries (Canada, Netherlands, Spain, Sweden). Using tracking log data they examined participation in 15 categories of apps, and derived two dimensions: percentage of participants using an app use category and frequency of use. Both studies share a weakness of developing categories with little theoretical value.

Qualitative research offers further insight into the role of smartphones in internet use. Humphreys et al. (2013) compared smartphones to laptops. Smartphones were associated with "extractive usage" such as checking email, maps and finding information. Laptop usage was characterised as "immersive", such as doing work or surfing online, and usually lasted longer than mobile use. Respondents experienced immersive use of smartphones when bored or filling time. Pavez and Correa (2020) explored mobile-only and hybrid (mobile and PC) internet use in Chile. Mobile-only users valued the accessibility and portability of smartphones. They saw no need to use more complex PCs because they believed that they would not add any useful capability. By contrast, hybrid users selected a smartphone or PC based on their particular goals and needs. Finally, Grošelj (2021) found that different practices of re-domestication reflect differences in the role that internet technologies play in individuals' daily lives, and differences in the availability of offline resources. For example, for some users, one device becomes the dominant way they go online whereas for others the choice of a particular device depends on the contextual factors of internet use.

Taken together, previous research offers considerable evidence that smartphone use is related to specific socio-demographic characteristics of internet users, and it shapes patterns of internet use and outcomes. Generally, mobile-only internet access is perceived as inferior, used by socially excluded individuals, and it is associated with specific internet use patterns directed at social and informational uses. While previous quantitative research offers valuable insight into the specific position of smartphones within the internet access repertoire and qualitative research provides more nuanced understanding of specific perceptions that form around smartphone use, we are missing a broader perspective about how smartphone use is situated in people's everyday internet use.

Moreover, previous research suffers from a key conceptual problem: it treats all smartphones as identical devices with common affordances. But smartphones are highly

personalized and used in very different ways. Personal selection of apps makes each smartphone different (Humphreys et al., 2018), so we would expect the effects of smartphone use to differ depending on the ways that users depend on them. This study seeks to provide a differentiated understanding of the roles that smartphone use plays in everyday internet use and to explore how these relate to socio-demographic characteristics, internet use and outcomes. The empirical heart of this study proceeds in three parts following the framework of three levels of digital inequality. We seek to answer four research questions:

- **RQ1:** What dependencies do users form with smartphones?
- **RQ2:** What are the socio-demographic characteristics of people who form different smartphone dependencies?
- **RQ3:** How do different smartphone dependencies shape the amount and variety of internet use?
- **RQ4:** How do different smartphone dependencies influence beneficial outcomes of internet use?

Data and Measurement

The Oxford Internet Survey (OxIS) collects data on British internet users and non-users. Conducted biennially since 2003, the surveys are nationally representative random samples of about 2,000 individuals aged 18 and older in England, Scotland, and Wales. Interviews were conducted face-to-face and the response rate for 2019 was 47%. The dataset uses post-stratification weights to match census proportions for age, gender, region, Acorn group, urban-rural and household size. The analyses below are based on 1,343 smartphone users out of the full 2019 sample of 1,818 respondents of which 1,487 were internet users. Because of missing data the tables below have fewer than 1,343 cases.

First, we examined the 12 items asking about reasons why people use their phones. The introduction to these items was “People use their phones for many reasons. Please tell me

how much you agree or disagree with the following statements about the way you use your phone". All items were measured using identical five-category Likert scales ranging from "Strongly disagree" to "Strongly agree". Examples of two of the items are: 'People tell me I spend too much time on my phone' or 'My phone helps me escape from things I would rather not deal with' (see Appendix Table A1).

Following Blank and Groselj (2014), we conceptualize internet use as a property space of three independent dimensions: amount of use, variety of use, and types of use. The advantages of this approach are that it distinguishes different ways of engaging with the internet and it allows nuanced understanding of internet activity. People can vary independently on each dimension. We focus on amount and variety of use. Respondents can have different amounts of use, which refers to sheer frequency of engagement. When they are online, they can do many different activities or just a few, a question of variety. Amount and variety of use were measured using 43 variables asking about internet activities. The introduction to these items was: 'Now I'd like you to think about the different things people do online. Please think about devices like your smartphone, desktop, laptop or tablet and about activities like social media, messaging, or email. How often do you go online for the following purposes?' Examples of two of the items are: 'Read a blog' and 'Find the location of a house, office, store, or restaurant'. Each variable is measured on a 6-point Likert scale, ranging from 'never' to 'more than once per day'. The sum of the variables measures the total amount of internet use. Variety is measured by the count of the number of different activities that a respondent does more than never.

We measured respondents' internet outcomes with four variables. One item asks about positive economic outcomes ('saved money'), one queries social benefits ('found out about an event'), the third refers to health-related benefits ('found information that helped improve my health'), and the fourth asked about jobs ('looked online for information to help

find a job'). Each variable is a four-category Likert scale, 'never' to 'often'. We used the mean to produce a benefits scale ranging from zero to three.

Two variables measure access and skills as dimensions of digital inclusion. Number of devices is a count of the number of internet-enabled devices that the person owns. In addition to PCs, smartphones, and tablets it included internet-connected TVs, wearable tech, and smart speakers. It ranges from 1 to 9. Technical ability is a self-reported, five-category Likert scale item ranging from 1 'bad' to 5 'outstanding'.

We include sociodemographic variables as controls. Race is coded into two categories: white and non-white. Place is coded as urban versus rural. Marital status has five categories: single, married, living with partner, divorced or separated, and widowed. Income is an eight-category interval-level variable, where each category increases by about £10,000; the eighth category is '£80,000 or more'. We experimented with entering it as seven categorical dummy variables but that does not change the results and to simplify our models, we entered it as a single interval-level variable. We use three levels of educational attainment: secondary education degree or less, further education, and university undergraduate degree or postgraduate degree. We also include gender, age, number of adults in the household, and whether the household contains children.

Results

Smartphone Dependencies

First, we examine whether distinct types of smartphone dependencies exist. We did the principal components analysis (PCA) of the 12 variables asking users about the way they use their smartphones. After varimax rotation and Kaiser normalization, three components had eigenvalues greater than 1.0, see Table 1. The eigenvalues show that the variance is widespread among the 12 variables.

Table 1

Smartphone Dependency Types, Factor Loadings from PCA

	Orientation dependency	Play dependency	Escape dependency
Saves time	0.508	-0.263	
Easy to find information	0.483		
Keep up with news	0.434		
Keep in touch	0.336		
Organize my life	0.304		
Waste too much time		0.601	
Spend too much time		0.502	
Play games		0.416	
Frustrating to use	-0.285		0.566
Not feel lonely			0.510
Use to avoid talking			0.433
Helps me escape			0.398
Eigenvalues	2.51	2.06	2.02

Note. N = 1,227. Varimax rotated factor loadings from principal components analysis. Loadings less than 0.2 are omitted. See Appendix Table A1 for item wording.

The first component is dominated by items related to the effectiveness and usefulness of smartphones as a tool for saving time and finding information, as well as items related to helping people stay organized and keep up with news. In the MSD schema of dependencies and goals, these items refer to orientation goals to guide our actions and interactions. For example, maps, lists, search engines, and other applications can help users take more informed actions in their daily lives. We call this factor orientation dependency.

Three items load primarily on the second component and they relate to the enjoyment of playing games and the perception of spending and wasting too much time on the smartphone. These perceptions may relate to the use of smartphones for leisure and communication, which may be focused on stress relief or simply positive enjoyment. We refer to this component as play dependency.

The four items loading on the third component differ from the items in the first two components in that they concern a more personal attachment to the smartphone that might

reflect introversion. This component groups items that suggest that smartphone use is frustrating, but that it helps avoid conversations with family or friends, escape from things one does not want to deal with, and overcome loneliness. Since three out of four items include tendencies to escape from situations, we call this component escape dependency.

Socio-demographic Predictors

Next we explore RQ2, whether different dependencies are associated with distinct socio-demographic characteristics, physical access to the internet and technical ability. Table 2 contains the six hierarchical regressions predicting the three smartphone dependency variables constructed from PCA factor scores. Because we want to compare the relative strength of different coefficients, all coefficients in Table 2 and later tables are standardized beta coefficients. Each dependency variable has two regressions: one with only demographic variables and the second adding technical ability and number of devices. Notice first that age is always significant, large, and negative. It is not surprising that older people are less dependent on smartphones. This is the only consistent pattern across all six regressions. For orientation dependency, both technical ability and number of devices are highly significant. People with technical skill and access to more devices find it easier to develop an orientation dependency: they use their phone in instrumental ways, and find it easy-to-use and a time-saver.

The play dependency pattern is more complex. Neither technical ability nor number of devices is significant. Number of adults in the household is significant and positive, suggesting that more adults may provide partners or opponents for games. Non-white and urban are significant and positive. Both income and education are negative meaning people with lower incomes or less education are more likely to play on their smartphones.

Table 2

Smartphone Dependency Regressions

	Orientation dependency		Play dependency		Escape dependency	
	(1)	(2)	(1)	(2)	(1)	(2)
Age	-0.378***	-0.307***	-0.333***	-0.342***	-0.493***	-0.465***
Female	-0.009	-0.006	-0.003	0.002	0.066*	0.076**
N of adults in house	-0.031	-0.051	0.080*	0.092**	0.020	0.021
Children in house	0.052	0.038	0.057	0.071	0.028	0.027
Non-white	0.048	0.059*	0.109**	0.125***	0.036	0.050
Urban	0.010	0.015	0.088**	0.085**	0.081**	0.083**
Income	0.127***	0.038	-0.090**	-0.085*	0.051	0.012
Marital status						
Married	0.040	0.056	-0.026	-0.021	0.009	0.018
Living with partner	0.018	0.015	-0.039	-0.044	0.013	0.016
Divorced/separated	0.008	0.013	0.010	0.015	0.002	0.007
Widowed	-0.039	-0.031	0.011	0.017	0.021	0.037
Education						
Further education	-0.010	-0.019	-0.098**	-0.083*	-0.079*	-0.081*
Higher education	-0.013	-0.045	-0.051	-0.048	-0.062	-0.075*
Technical ability		0.137***		-0.044		0.065*
N of devices		0.142***		-0.020		0.057
N	1102	1069	1102	1069	1103	1069
Adjusted R^2	0.168	0.183	0.186	0.192	0.270	0.274

Note. Standardized beta coefficients. * p<0.05, ** p<0.01, *** p<0.001. Omitted categories are male, no children in house, white, rural, single, secondary education degree or less. Dependent variables are factor scores from PCA in Table 1.

For escape dependency, number of devices is not significant and, while technical ability is significant, it is less important than either of the education variables. Both education variables are negative, meaning people with more education are less likely to depend on their phone for escape. Finally, urban is also significant. In a crowded urban environment there are many situations where people are surrounded by anonymous others, like public transportation or waiting in public squares, and being able to escape by using their smartphone can provide a respite from the noise and crowds.

Generally, our results show that people who develop different smartphone dependencies have different demographic characteristics. People who have an orientation

dependency tend to be younger with considerable technical ability and many devices, and they are non-white. People with play dependency are younger, female, urban, less educated and with some technical ability. People with escape dependency are younger with more adults in the household, non-white, living in urban areas, with lower incomes, and somewhat less education.

Amount and Variety of Use

The hierarchical regressions predicting amount and variety of internet use are in Table 3 (RQ3). Looking at the three amount of use regressions, the first model uses only demographic predictors, the second model adds the dependency variables and the final model adds technical ability and number of devices. We focus on the final model which has an excellent adjusted R^2 of 44.4%. The strongest variable is age, which is predictably negative; older people use the internet less. The education coefficients are positive, indicating that better educated people use the internet more. All the dependency variables are important: significant and positive, indicating that being habitually dependent on a smartphone increases amount of use of the internet. Orientation dependency is the second strongest coefficient in the model, showing that using a smartphone as an orientation device has a major impact on amount of internet use. Orientation dependency is even stronger than education. Both technical ability and number of devices are significant and positive, indicating they increase the amount of internet use.

The variety of internet use regressions are also in Table 3. Again, the final model has an excellent adjusted R^2 of 42.1%. Interestingly the strongest variable in these models is orientation dependency. Using a smartphone as an orientation device tends to increase the variety of things a respondent does on the internet. Again, the orientation dependency coefficient is stronger than the education coefficient. Age is the second strongest coefficient,

and it is (as always) negative. The other two dependency variables are positive and significant, as are technical ability and number of devices.

Table 3

Amount and Variety af Internet Use Regressions

	Amount of use			**Variety of use**		
	(1)	(2)	(3)	(1)	(2)	(3)
Age	-0.498***	-0.300***	-0.270***	-0.489***	-0.292***	-0.265***
Female	-0.061*	-0.065*	-0.054*	-0.066*	-0.068*	-0.058*
N of adults in house	0.032	0.025	0.000	0.020	0.014	-0.007
Children in house	-0.014	-0.043	-0.059*	-0.031	-0.061*	-0.074*
Non-white	0.009	-0.024	-0.019	0.026	-0.007	-0.004
Urban	0.024	0	-0.002	0.029	0.006	0.005
Income	0.112***	0.085**	0.032	0.101**	0.073*	0.027
Marital status						
Married	0.012	0.002	0.022	0.053	0.043	0.061
Living with partner	-0.010	-0.012	-0.011	0.003	0.001	0.002
Divorced/separated	0.043	0.037	0.039	0.024	0.018	0.020
Widowed	0.031	0.032	0.027	0.025	0.027	0.023
Education						
Further education	0.110***	0.127***	0.110***	0.107**	0.123***	0.108***
Higher education	0.196***	0.214***	0.187***	0.184***	0.202***	0.178***
Orientation dependency		0.293***	0.251***		0.315***	0.278***
Play dependency		0.124***	0.104**		0.103**	0.086**
Escape dependency		0.104**	0.133***		0.105**	0.131***
Technical ability			0.137***			0.127***
N of devices			0.112***			0.093**
N	1069	1069	1068	1069	1069	1068
Adjusted R^2	0.284	0.415	0.444	0.261	0.399	0.421

Note. Standardized beta coefficients. * p<0.05, ** p<0.01, *** p<0.001. Omitted categories are male, no children in house, white, rural, single, secondary education degree or less.

Table 3 addresses RQ3; how different smartphone dependencies shape the amount and variety of internet use. All three dependencies are significant and generally strong predictors of both amount and variety. Orientation dependency is a more important predictor of variety of use than amount. Play dependency is more important as a predictor of amount of internet use than variety. Smartphone dependency makes important contributions to internet use, increasing the R^2s by about 13 percentage points.

Positive Internet Outcomes

Table 4 contains hierarchical regressions predicting whether smartphone dependencies are related to respondents' ability to achieve positive outcomes from their use of the Internet (RQ4). The first regression uses only demographic predictors; the second adds smartphone dependency variables; the third adds technical ability, number of devices and amount of use (we cannot include both amount and variety in the same model because of collinearity; one coefficient is always non-significant). This discussion will focus primarily on the final model, with an adjusted R^2 of 32.9%. By far the strongest variable in the model is amount of use; alone it increases the adjusted R^2 by 14 percentage points. This says that the more people use the internet the more they reap the benefits. Neither technical ability nor number of devices are significant. All smartphone dependency variables are significant. Orientation dependency is the second strongest coefficient in the model. People who use the internet to orient themselves are more likely to benefit. Both play dependency and escape dependency are significant but negative. To the extent that people use the internet for escape or play, they are less likely to benefit. This is consistent with these people finding the internet frustrating and a source of wasted time. Interestingly, income is significant but negative after we control for amount of use. Being female, white, in partnership or separated increases the likelihood of positive internet outcomes.

Table 4

Positive Internet Outcomes Regressions

	(1)	(2)	(3)
Age	-0.301***	-0.200**	0.046
Female	0.054	0.073*	0.113***
N of adults in house	-0.044	-0.048	-0.045
Children in house	0.024	0.003	0.022
Non-white	-0.062**	-0.075*	-0.059*
Urban	-0.039	-0.042	-0.044
Income	-0.006	-0.033	-0.073*
Marital status			
Married	0.089	0.075	0.081
Living with partner	0.086*	0.084*	0.087**
Divorced/separated	0.079*	0.066*	0.051
Widowed	-0.009	-0.016	-0.026
Education			
Further education	0.120***	0.126***	0.057
Higher education	0.215***	0.237***	0.113**
Orientation dependency		0.250***	0.118***
Play dependency		-0.035	-0.182**
Escape dependency		0.015	-0.074**
Technical ability			0.056
N of devices			-0.016
Amount of use			0.503***
N	1065	1031	1030
Adjusted R-squared	0.126	0.174	0.329

Note. Standardized beta coefficients. * p<0.05, ** p<0.01, *** p<0.001. Omitted categories are male, no children in house, white, rural, single, secondary education degree or less. Dependent variable is the mean of four possible positive outcomes: saving money, finding out about events, finding health information, finding job information.

Discussion

Mobile internet access has become ubiquitous. The vast majority of internet users go online daily with their smartphones (Blank et al., 2020; Ofcom, 2023); evidence that most internet users have developed habitual uses of their smartphones as part of their larger repertoire of internet activity. This study examined the different dimensions by which internet users position their smartphone use and how these dimensions affect their internet use

patterns and outcomes. Our overall conclusion is that smartphone dependencies are important in explaining digital inequalities. In particular, how smartphones are positioned in everyday internet use helps explain their internet use patterns and outcomes. We discuss the results regarding each research question in turn.

RQ1 asked what smartphone dependencies users form. We found three distinct dependencies: orientation, play and escape. They capture habitual ways in which smartphone users position their mobile internet use. Smartphone dependencies reflect goals that users attain through smartphone use. Two of the three dependencies—orientation and play—correspond to the original schema of dependencies in MSD theory (Ball-Rokeach, 1985); escape dependency is new. This dependency may be specific to digital media as Ball-Rokeach and colleagues developed MSD theory based on mass media. Previous research on internet-related dependencies suggested other dependencies beyond the understanding, orientation and play dependencies originally discussed by MSD theory; for example, communication dependency, related to interpersonal communication (Grošelj, 2021), and expression dependency, which pertains to presenting thoughts, feelings and opinions via digital media (Kim & Jung, 2017).

Escape dependency is in line with previous research on smartphones. Wei (2023, p. 28) argues that our dependency on smartphones has deepened, and although we tend to rationalize it by referring to convenience and comfort, the "vulnerability associated with habits tied to mobile media use" such as playful and mindless behaviour has risen. Similarly, Lukoff et al. (2018, p. 22:1) found that even "meaningless" smartphone use could sometimes be "meaningful in the context of broader life as a 'micro escape' from negative situations".

Internet users who form different smartphone dependencies have different socio-demographic profiles (RQ2). Not surprisingly, age is a strong negative predictor of all types of dependency. By the time smartphones began to permeate our daily lives, older individuals

already had established routines using other media for orientation, leisure, and dealing with feelings of loneliness and avoidance, so they domesticated smartphones differently. Beyond age, a pattern is that more socially excluded individuals tend to form stronger smartphone play and escape dependencies than those who are better off. Escape dependencies are more likely among women, the less educated and urbanites. The social exclusion dimension is particularly clear for play dependency, which is more common among individuals who are less-educated, urban, non-white, have lower incomes and live in households with more adults. These patterns may be problematic because they suggest that socially excluded individuals rely more on their smartphones to play alone and escape socially. Non-social characteristics of smartphone use have been associated with depression, anxiety, and problematic smartphone use (Drouin et al., 2015; Elhai et al., 2017).

Interestingly, items measuring internet access and technical ability have no effect on play dependency and ability has a relatively small positive effect on escape dependency. This suggests that play and escape dependencies are more related to smartphone users' socio-demographic profiles (and perhaps also to their personalities) than to their levels of digital inclusion measured by access and skills. In contrast, orientation dependency is driven by smartphone users' inclusion in digital activity. Apart from age and a small positive effect of race, orientation dependency is strongly related to users' technical ability and breadth of access. This is not surprising given that effective use of the items measuring orientation dependencies requires proficient and effective use of smartphones.

RQ3 asked how internet use is shaped by different smartphone dependencies. All three types of dependency shape patterns of online engagement; smartphone users with stronger dependencies use the internet more, and for more varied activities. Indeed, orientation dependency is the strongest predictor of variety of use and the second strongest predictor of amount of use. Play and escape dependencies have slightly smaller but also

positive effects. Interestingly, the other two indicators of digital inclusion—technical ability and number of devices—have similarly strong effects. This result suggests that different facets of digital inclusion are equally important in explaining patterns of online engagement.

It empirically echoes Helsper's (2021) theoretical proposition that motivation/attitudes, access, and skills all mediate the influence of offline exclusion on digital exclusion. This suggests a guide for future research on digital inequality—to paint a comprehensive picture of digital inequality, a range of mediators should be included in empirical models. Moreover, the significant and substantial effects of smartphone dependencies in our internet use models suggest that the concept of internet dependency is a fruitful concept to capture why people use the internet. The way people integrate internet technologies into their daily lives helps explain patterns of use. While this relationship has been previously established qualitatively (Robinson, 2009; Scheerder et al., 2020), applying MSD theory can help us translate this mechanism into quantitative methodologies.

The fourth research question asked about the relationship between smartphone dependencies and internet outcomes. Although amount of use is by far the strongest predictor of internet outcomes, the next strongest predictor is orientation dependency, and escape and play dependency are significant. The relationship between smartphone dependencies and internet outcomes is very interesting: orientation dependency has a positive effect, while play and escape dependencies have negative effects that become significant only after controlling for amount of use. The positive effect of orientation dependency is not surprising, especially considering the way internet outcomes were measured. They ask about concrete actions such as saving money and finding health information, which are conceptually related to orientation dependency.

The negative effect of play and escape dependency is surprising and important. Although theoretically justified—use of media to attain play and escape goals does not

translate into economic or informational benefits—it demonstrates a digital division in which socially excluded individuals tend to domesticate internet technologies in ways that do not improve their ability to find a job or save money. Our focus on dependencies expands the mechanisms that Zillien and Hargittai (2009) identified where high-status people used the internet to enhance their economic, social and cultural capital but low status people did not. The link to social status is also similar to Blank's (2013) finding about content production; political content tends to be produced by high status elites which enhances their influence in the political system. Social and entertainment content is produced by low status people, which may be personally gratifying but does not link them to the larger society. This finding highlights the importance of understanding how smartphones are integrated and situated in individuals' everyday lives. This is an ongoing process in which certain orientations, beliefs, routines and habits are formed that guide the long-term use of technologies. The fact that different habitual routines result in different outcomes suggests that digital inequalities' researchers should examine not only how demographic variables and different modalities of internet access (e.g., smartphones, PCs, etc.) shape digital inclusion, but also the specific roles these technologies play in users' daily lives. The flexibility of smartphones makes this complicated. Smartphones are not a single material object; smartphone use is a complex set of possibilities.

This has a methodological implication: since smartphone habits vary widely across individuals, it is not enough for researchers to simply ask whether or not a respondent uses a smartphone, researchers also must ask *how* they use it; they must ask about dependencies. This may not be welcome news to survey researchers concerned about respondent burden because it might mean adding ten or more questions that explore different possible dependencies. This is particularly important given that although all three smartphone

dependencies examined were strongly associated with concrete but different outcomes: some were positive, and others were negative.

The policy implication is that interventions should broaden their focus beyond internet access and skills and help digitally excluded individuals to find ways to meaningfully weave the use of capital-enhancing online activities into their everyday online routines. Loges and Jung (2001, p. 538) emphasise that the digital divide is not just a problem of having material access but also "an issue about how central the internet is or could be in achieving various essential goals in individuals' everyday lives". To expand the digital engagement of low internet users their (non)existing internet dependencies need to be considered in order to teach them internet skills that they will find relevant. Motivations and attitudes are key to overcoming digital exclusion.

This research has limitations that suggest avenues for future research. The observed relationships between smartphone dependency, internet use, and outcomes are consistent and strong. This suggests there could be important research benefits from developing the concept of smartphone dependency. Methodologically, measures of smartphone dependency need development. We were limited by the items available in OxIS which did not include communication dependency. To create a comprehensive schema of internet dependencies, more refined items and a broader range of items would be needed. It is not clear how much granularity is useful, but based on previous research on internet use in general (Blank & Groselj, 2014), it may be possible to identify as many as 10 dependencies.

Conclusion

Development of concepts like smartphone dependency would contribute to a theory of mobile media. A fully developed theory requires more research "on the novel processes of social and communicative change" (Flanagin, 2020, p. 31), but we can contribute to this project by highlighting some important properties that distinguish smartphones from other

media. First, smartphones are not a single technology, application, or process (Wei, 2023). Smartphone users load apps to watch TV and videos, listen to radio or podcasts, read news, play games, and communicate with other people. In an extremely flexible, single platform they incorporate most other media forms. Which forms to incorporate are a personal choice. More than any other device smartphones can be customized to meet the personalized needs, goals and desires of their owners. The affordances of the device are less important than they are with other media.

Second, many have commented that "information is power". In part, this is a mass media issue, where media organizations are in control and can choose the information that they present to their audiences. How a media organization influences content is less relevant in a media environment where individuals can pick and choose apps to install or delete quickly and easily. By contrast, other media have a sort of take-it-or-leave it feel and cannot be customized to the same degree. Individual choice is central to smartphones in a way that is not true of mass media. This underlines the value of researching everyday practices, habits and routines that people develop with their smartphones. Smartphone dependencies are therefore crucial for understanding the psychological, social and behavioural mechanisms that drive mobile media use (see also Flanagin, 2020). Research needs to go beyond understanding what people do on their smartphones and understand motivation to disentangle the meaning of their engagement (see also Lukoff et al., 2018).

Furthermore, smartphones provide many avenues for interpersonal communication. Apps allow voice or video calls, texts, pictures and videos to be exchanged easily and largely cost-free. Since people carry their smartphones with them, they are always available. This dramatically expands the range of possible interactions with friends, family, co-workers and others, where people exchange opinions, preferences, and information. Possibly this will

increase the influence of social networks in setting individual goals. This suggests a reciprocal relationship between mobile media and the social environment.

A set of stable categories are the fundamental building blocks of theory. The diverse capabilities of smartphones make theorizing difficult. Smartphone capabilities and apps are ephemeral; they are introduced, enhanced, or modified with each new version. Ephemeral features are not suitable for study because they are not stable. The path out of this dilemma is by examining dependencies. Dependencies are smartphone characteristics that are lasting and stable. As MSD points out, part of the reason they are stable is that dependencies are linked to personal goals which transcend the characteristics of any media, not just smartphones

We have identified a set of smartphones dependencies that support patterns of internet use, and showed how they are related to social structure and outcomes of online engagement. The flexibility and variety of available apps vastly expand the range of potential dependencies for a single device. Thus, the three dependencies that Ball-Rokeach (1985) identified are unlikely to be exhaustive for smartphones. Indeed, we identified a fourth dependency and suggested there may be others. Further research on smartphone dependencies would expand our understanding of mobile media and these categories can form the basic building blocks of a theory of the role of smartphones in everyday life.

Data Availability Statement

The 2019 wave of the Oxford Internet Survey is available from the UK Data Archive, dataset Study Number 9146, DOI: 10.5255/UKDA-SN-9146-1.

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Appendix

The smartphone dependency items in Table A1 were introduced with the following question: "People use their phones for many reasons. Please tell me how much you agree or disagree with the following statements about the way you use your phone."

Table A1

Exact Wording of Smartphone Dependency Items.

Name in Table 1	Complete item text
Spend too much time	People tell me I spend too much time on my phone
Saves time	Using my phone helps me save time
Frustrating to use	My phone is frustrating to use
Use to avoid talking	I sometimes look at something on my phone to avoid talking with friends or family
Waste too much time	I waste too much time on my phone
Easy to find information	Information is easy to find using my phone
Not feel lonely	When I am on my phone I don't feel as lonely
Helps me escape	My phone helps me escape from things I would rather not deal with.
Keep in touch	Looking at personal photos and videos on my phone helps me stay in touch with family & friends
Keep up with news	I use my phone to keep up with news and current events
Play games	I like to play games on my phone
Organize my life	I keep appointments or lists on my phone and use it to organize my day