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The Compoundness and Sequentiality of Digital Inequality

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Through a survey with a representative sample of Dutch Internet users, this article examines compound digital exclusion: whether a person who lacks a particular digital skill also lacks another kind of skill, whether a person who does not engage in a particular way online is also less likely to engage in other ways, and whether a person who does not achieve a certain outcome online is also less likely to achieve another type of outcome. We also tested sequential digital exclusion: whether a lower level of digital skills leads to lower levels of engagement with the Internet, resulting in a lower likelihood for an individual to achieve tangible outcomes. Both types of digital exclusion are a reality. Certain use can have a strong relation with an outcome in a different domain. Furthermore, those who achieve outcomes in one domain do not necessarily achieve outcomes in another domain. To get a comprehensive picture of the nature of digital exclusion, it is necessary to account for different domains in research.

Keywords: digital inequality, digital divide, social inequality, Internet skills, Internet use

The digital divide concept stems from a comparative perspective of social inequality and depends on the idea that Internet access has benefits and lack of access has negative consequences. The original notion focused on individuals' access to Internet infrastructure (Newhagen & Bucy, 2005). As more and

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more people obtained access, second-level divides in skills and usage patterns drew attention (e.g., Dimaggio, Hargittai, Celeste, & Shafer, 2004; Helsper & Eynon, 2013; Van Deursen & Van Dijk, 2011, 2014; Zillien & Hargittai, 2009). Current digital divide research uses multifaceted conceptualizations, spanning motivation, access, skills, and use (e.g., Lee, Park, & Hwang, 2015; Pearce & Rice, 2013; Van Deursen & Van Dijk, 2015). *Motivation* refers to attitudes and reasons for (not) using the Internet; *access* refers to the quality, quantity, and ubiquity of digital media; *skills* consist of medium- and content-related elements; and *use* involves engaging with and creating digital content. What remains unclear is how access, skills, and types of use result in different kinds of outcomes of using digital media. For example, it seems reasonable to argue that insufficient skills might play a role in a person's failing to turn an online activity (e.g., job seeking) into a desired outcome (e.g., employment)—yet how this process works in practice has rarely been explored. Inequalities in the tangible outcomes achieved from Internet use can be referred to as the third-level digital divide (Van Deursen & Helsper, 2015). Research into the third-level divide seeks to understand who benefits in which ways from Internet use as regards a broad range of offline outcomes. Although Internet access, skills, and use are often studied as indicators of digital inclusion, attempts to chart gaps in returns to Internet usage across multiple life realms remain scarce. In most cases, the focus is on one particular outcome, such as political participation.

To gain a deeper and broader understanding of the third-level digital divide and its repercussions for offline inequalities, this study investigates the paths from skills to types of use to tangible outcomes. We are specifically interested in how skills facilitate different types of use and whether inequalities in use are apparent in the outcome stage. Rather than assuming that more digitally advantaged users will automatically enjoy greater offline benefits across life realms, the strength and character of the links between skills, use, and offline outcomes are treated as factors that potentially vary across domains of activity. Where existing digital divide research does touch on the third-level divide, it suggests that Internet use will confer greater benefits to users who already have significant offline resources in that particular realm (Hargittai & Hinnant, 2008).

Through a survey with a representative sample of Dutch Internet users, we aim to answer whether digital exclusion is (a) compound and (b) sequential. Compound exclusion is understood as a cumulative disadvantage within one type of digital divide. That is, a person lacking one particular digital skill also lacks another digital skill, a person not using the Internet in a certain way is also disengaged in other ways, and a person who does not achieve one type of outcome from his or her Internet use also fails to achieve other types of outcomes. In sequential exclusion, one type of digital exclusion depends on another. When a person lacks digital skills, he or she is unable to use the Internet in a variety of ways, which subsequently leads to an inability to achieve outcomes.

Theoretical Background

Digital Inequality

Research on digital inequality studies how different social groups access technologies and how this access contributes to offline advantages and disadvantages (Chen, 2013). There are two contrasting theoretical perspectives concerning long-term outcomes. The normalization hypothesis suggests that

resources trickle down from people with high status to those with low status (Norris, 2001). The underlying economic idea is that because resources have lower prices over time, gaps between social categories will decline relatively, thereby normalizing the digital divide in access and use. The stratification hypothesis suggests that the process of Internet use replicates existing social inequalities because digitally mediated networks replicate offline structures and because offline human capital carries over to the online world (DiMaggio & Garip, 2012; Norris, 2001). Two important mechanisms behind the stratification hypothesis are amplification and the power law. Amplification suggests that the Internet is primarily a magnifier of existing stratification. Thus, when inequality in society rises, the Internet tends to reinforce this trend. The power law is a statistical law that, in the case of digital inequality, would suggest a polarized distribution in which a growing number of people use the Internet for increasingly varied purposes on high-quality devices, whereas a growing number of people experience this process comparatively slowly, for example, because they use lower quality devices. The greater one's capacity, the more the Internet delivers, and the lesser one's capacity, the less value the Internet has. This leads to a widening gap between the rich and poor (Helsper, 2012). To get a clearer picture of the mechanisms at play, a theoretical framework is needed of domains in which the Internet has potential outcomes.

Theorizing Domains of Digital Inequality

The current contribution builds on traditional classifications of potential areas of exclusion in its theorization. Four key domains from which an individual can be excluded offline have corresponding domains of exclusion in the digital world: economic, cultural, social, and personal (Helsper, 2012). The first three domains are familiar to scholars who build on Bourdieu's (1986) theory of capital in which people's economic, cultural, and social assets are theorized. The conceptualization of these domains was adjusted by Helsper (2012) to reflect recent empirical work and critiques of Bourdieuan approaches. Resources related to exclusion from the offline economic domain relate to capital and wealth and are often measured by indicators such as income, employment, and financial assets. We also consider education as part of economic capital, as a resource that gives the opportunity to acquire income, jobs, and wealth (material meaning). When Bourdieu (1986) considers education as part of cultural capital, he primarily means the objectified and institutionalized form of diplomas providing status in society. Resources in the cultural domain are operationalized by referring to identity categories associated with certain beliefs and the interpretation of information and appropriate activities as learned through socialization (Maccoby, 2007). Gender, ethnicity, and religion have all been considered immaterial indicators of identities with different cultural resources. More sophisticated operationalizations measure not only belonging to but also identification with particular sociocultural groups that share a specific type of socialization or acculturation. Resources in the social domain reflect attachment to networks that give a person access to support from others (Portes, 1998). Informal networks build on common interests, activities, family, or other ties that join people together. This can be operationalized by the quantity and the quality of the ties a person has (Haythornthwaite, 2002; Kadushin, 2012; Lin, 2001). Although several scholars see civic and political participation as separate domains (e.g., Bossert, D'Ambrosio, & Peragine, 2007), here they are included in social resources because participation in political and civic organizations was an important element of Putnam's (1995) original classification of social capital (Wuthnow, 1998). Operationalizations of formal social resources relate to group membership and having one's voice heard in a wider community. This includes voting, advocacy group membership, power within the community, and the ability to influence

unknown others in relation to interests that lie outside the personal sphere. The fourth personal domain integrates personal agency as theorized in Giddens's (1984) framework of structuration and consists of individual characteristics with an emphasis on personality, aptitudes, and well-being. Personal resources have been operationalized as interests (e.g., leisure), IQ, and psychological (e.g., confidence) and physical well-being (e.g., health). Economic, cultural, social, and personal domains are conceptually and empirically separate but interrelate in practice because of wider underlying power structures that concentrate (dis)advantage in certain groups (Helsper, 2012). Those who lack resources in the personal domain (e.g., health) are likely to lack resources in the economic and social domains, but conceptually, personal, economic, and social domains of resources constitute different spheres within an individual's life.

Covering a wider range of outcomes is important if we want to get a thorough understanding of the ways in which different people benefit from going online and to locate the Internet's most important contributions to improving everyday life. Not representing one of the domains leads to an incomplete understanding of the complex set of factors that determine the paths from offline to online inclusion (i.e., sequential) and the ways in which different resources create the multifaceted nature of exclusion (i.e., compound) at different stages on these paths. This multiple-outcomes approach furthermore promotes an understanding of individuals as moving among contexts, taking the person's life as the field of observation even when focusing on a specific situation.

Internet Skills, Uses, and Outcomes

Van Deursen, Helsper, and Eynon (2016) conceptualized, operationalized, and validated an Internet skills framework consisting of four types of skills. The division of different skills provides opportunities to investigate how Internet skill levels are distributed among segments of the population and how different skills relate to Internet uses and outcomes. Operational skills are the basic technical skills required to use the Internet, often referred to as *button knowledge*. Information-navigation skills relate to searching for information, including the ability to find, select, and evaluate sources of information on the Internet. Operational and information-navigation skills relate to Web 1.0 activities, fundamental for skills for Web 2.0 activities: social and creative skills. Social skills encompass the ability to use online communication and interactions to understand and exchange meaning, entailing searching, selecting, evaluating, and acting on contacts online; attracting attention online; profiling; and the social ability to pool knowledge and to exchange meaning. Creative skills are the skills needed to create content of acceptable quality to be published or shared with others on the Internet. This regards textual, music and video, photo, multimedia, and remixed content, but also the more basic level of uploading material. All skills combined provide an elaborate view of what is required for the general population to function well in an online environment.

The focus on inequalities in different types of use as a way to study digital divides has led to a plethora of classifications (Blank & Groselj, 2014; Van Deursen & Van Dijk, 2014). The normative assumption is that some Internet uses are more beneficial than others because they offer users more chances and resources in moving forward in their careers, jobs, education, and societal positions than other uses that are mainly consumptive or entertaining. In terms of the discussed domains, users also build more economic, social, cultural, and personal capital and resources. Unfortunately, such varied

classifications cause a lack of comparability between studies, mainly because they lack a priori theoretical justifications. Similar conclusions can be drawn for tangible outcomes. Although there is a wide variety and availability of studies that focus on specific areas in which Internet use may be beneficial, most research focuses on measuring engagement or various uses of the Internet and assumes that activities performed online result in corresponding offline outcomes. It is productive to use a classification that positions various Internet uses and outcomes within the domains identified by traditional social exclusion literature (i.e., economic, cultural, social, and personal). This makes it possible to theoretically and empirically understand the links between online and offline exclusion. In this study, measures asking about specific uses and outcomes were theoretically constructed for each domain, allowing us to test whether normalization or stratification models of digital exclusion fit the relationships between offline and digital resources. We take the use of multifaceted conceptualizations one step further by building on the traditional classifications of potential areas of exclusion and applying this to the theorization and measurement of tangible outcomes of Internet use.

Compound and Sequential Digital Exclusion

When thinking about how first-, second-, and third-level divides relate, we suggest that a distinction can be made between compound and sequential digital deprivation. Compound digital exclusion is present when a person who lacks one digital resource also lacks other digital resources of the same type. We expect compound exclusion to surface in skills because of the conditional nature, but also in the four domains of Internet use and outcomes because they are often linked in practice. We hypothesize:

H1: Compound digital exclusion is stronger between resources within one domain of uses or tangible outcomes than between resources in different domains (e.g., those who are less engaged with one type of economic Internet use are also more likely to be disengaged from other economic uses than they are to lack engagement with activities in other domains; those who are unable to achieve one type of cultural outcome are also unlikely to achieve other types of cultural outcomes).

Sequential digital deprivation occurs when a person's digital exclusion of one type (e.g., lack of skills) leads to exclusion of a different type (e.g., low levels of Internet use). Several multifaceted considerations of the digital divide have revealed that skills strongly affect types of use (e.g., Helsper & Eynon, 2013; Pearce & Rice, 2013; Van Deursen & Van Dijk, 2015). The conceptual model in Figure 1 postulates that lacking operational and information-navigation skills leads to lacking social and creative skills, which leads to undertaking fewer online activities. The link between the uses and outcomes is evident because one needs to perform a specific use to achieve the corresponding outcome. We therefore hypothesize that:

H2: Sequential deprivation is strongest within each of the four domains (e.g., a lack of engagement with economic digital resources has stronger effects on economic outcomes than on personal outcomes).

H3: Operational, information-navigation, social, and creative skills relate to the sequential deprivation paths in all fields.

The digital divide is generally studied in relation to a specific set of sociodemographic characteristics linked to offline resources. To test the premise of compound and sequential digital deprivation, we focus on the five most frequently used indicators. Education and employment are considered for economic resources. Gender and age are considered for cultural resources because they reflect behaviors associated with identity and belonging. Disability is considered a personal resource because it refers to the ability to take advantage of new opportunities independent of economic or cultural background. Bringing the previous hypotheses together, we argue that characteristics traditionally associated with first- and second-level divides are at the beginning of the sequential digital deprivation process (starting with skills) and relate to compound exclusion within skills, uses, and outcomes. We hypothesize that:

H4: Those who are lower educated, unemployed, women, elderly, or disabled will suffer from compound (H4a) and sequential (H4b) exclusion.

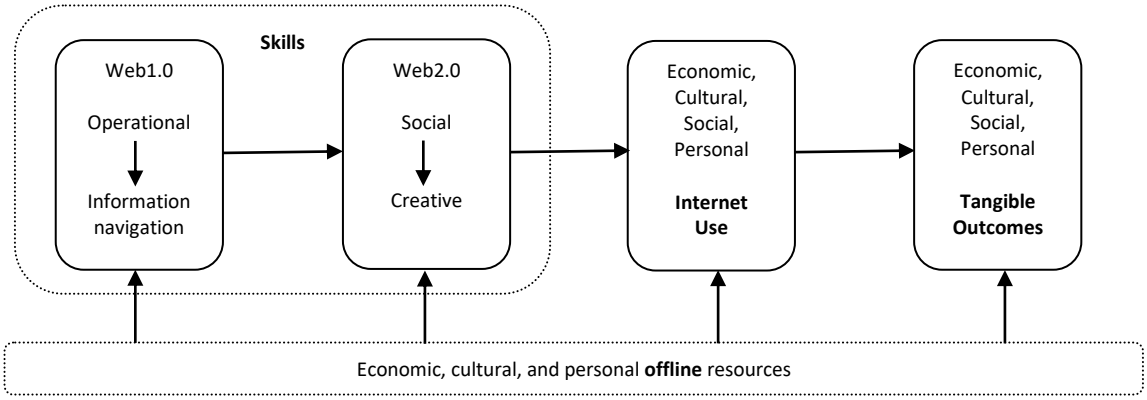

Figure 1. Model of compound and sequential digital exclusion.
Note. Arrows indicate sequential exclusion and boxes compound exclusion

Method

Sample

We conducted an online survey in the Netherlands over two weeks in November 2014. To obtain a representative sample of the Dutch adult population, we made use of a professional market-research organization with a panel of more than 108,000 people. Members received a small monetary incentive for every survey they completed. Because the panel is a representative sample of the Dutch Internet-user population, it contains beginners and advanced Internet users. Invitations were sent out in three waves to

ensure that the final sample represented the Dutch population for gender, age, and education. In the Netherlands, 94% of the population uses the Internet (CBS Statistics Netherlands, 2016), making the user population very similar to the general population. In total, we obtained complete responses from 1,101 individuals (response rate 27%). We used external aggregate data (i.e., the national population census) to estimate calibration weights based on age, gender, and education. Table 1 summarizes the demographic characteristics.

Table 1. Demographic Profile (N = 1,101).

	N	%
Gender		
Male	513	46.4
Female	588	53.6
Age		
16–30	145	13.1
31–45	281	25.4
46–60	356	32.7
60+	319	28.8
Education		
Low (primary)	309	27.9
High (secondary/tertiary)	792	72.1

Measures

The survey was presented in two rounds. The first round comprised 30 cognitive interviews. Cognitive interviewing concerns systematically developing survey questions through investigations that intensively probe the thought processes of individuals who are presented with those inquiries (Willis, 2005). Questions that surfaced as problematic were evaluated. The second round consisted of online survey pilot tests with the specific aim of testing for reliability and other characteristics of the constructed scales. The time required to complete the final survey was approximately 25 minutes.

Internet skills were measured using a 20-item instrument for operational, information-navigation, social, and creative skills (Van Deursen, Helsper, & Eynon, 2016). The psychometric properties were proven to be satisfactorily reliable and valid across sociodemographic and cultural contexts. Items were scored on a 5-point agreement scale and exhibited high internal consistency (Table 2).

Table 2. Descriptions and Cronbach's Alphas for Internet Skills.

	M	*SD*
Operational skills (α = .84)	4.40	0.85
I know how to open downloaded files	4.32	1.14
I know how to download/save a photo I found online	4.60	0.95
I know how to use shortcut keys (e.g., CTRL-C for copy)	4.18	1.26
I know how to open a new tab in my browser	4.66	0.93
I know how to bookmark a website	4.33	1.29
Information-navigation skills (α = .88), averages from recoded items		
I find it hard to decide what the best keywords are to use for online searches	3.57	1.11
I find it hard to find a website I visited before	3.73	1.40
I get tired when looking for information online	3.82	1.32
Sometimes I end up on websites without knowing how I got there	3.54	1.39
I find the way in which many websites are designed confusing	3.11	1.32
Social skills (α = .87)	4.30	0.88
I know which information I should and shouldn't share online	4.28	1.10
I know when I should and shouldn't share information online	4.10	1.12
I am careful to make my comments and behaviors appropriate to the situation I find myself in online	4.31	1.03
I know how to change who I share content with (e.g., friends, friends of friends, or public)	4.33	1.05
I know how to remove friends from my contact lists	4.48	0.99
Creative skills (α = .89)	3.00	1.24
I know how to create something new from existing online images, music, or video	3.13	1.52
I know how to make basic changes to the content that others have produced	3.19	1.50
I know how to design a website	2.51	1.55
I know which different types of licenses apply to online content	3.00	1.46
I would feel confident putting video content I have created online	3.17	1.48

Internet usage types were developed based on an extensive review of the literature and previous surveys. Our starting point was the mapping of specific types of uses in economic, cultural, social, and personal domains. In developing items, we moved between uses and outcome measures to make sure that activities could be mapped onto outcomes and outcomes onto activities. Economic types of uses are categorized as income (savings, earnings), employment (productivity, promotions, jobs), finance (investments, contracts), and education (grades, degrees). Cultural types of uses consisted of items measuring belonging (i.e., how the Internet facilitates an understanding of the self as part of a sociocultural group) and identity (uses related to issues of gender, ethnic, generational, or religious identity). The uses in the social domain were based on political and civic participation and on research into strong and weak or bridging and bonding ties. In the personal domain, we considered items concerning health, leisure, and self-actualization (e.g., discussing personal interests with others). Respondents were asked to indicate to what extent they use the Internet for various activities using a 5-point scale (1 = *never*, 5 = *daily*) as an ordinal-level measure. We replicated the factor structure by using confirmatory

factor analysis. The suggested 12-factor solution adequately fit the data for 36 items: $\chi^2(527) = 1823.21$; $\chi^2/df = 3.46$; SRMR = .04; TLI = .94; CFI = .95; RMSEA = .05, 90% CI [.04, .06]. Scores on the scales exhibited high internal consistency (Table 3).

Table 3. Descriptions and Cronbach's Alphas for Internet Usage Types.

	M	*SD*
Economic use: property (α = .87)	2.13	1.04
Look for information on the price of a product	2.06	1.19
Respond to people's requests for information about a product or service you want to sell	2.14	1.19
Put up a product for sale	2.18	1.10
Economic use: finance (α = .86)	1.83	0.79
Look for information on insurance policies	2.00	0.88
Purchase insurance online (car, health, life, or other)	1.71	0.83
Look for information on interest rates	1.77	0.96
Economic use: employment (α = .83)	1.55	0.92
Integrate tools or apps you have downloaded into the way you work	1.58	1.10
Look for a different job online	1.62	1.12
Create or share a CV on a professional and work-related site (e.g., LinkedIn)	1.45	0.95
Economic use: education (α = .93)	1.27	0.69
Look for information about a course or course provider	1.32	0.76
Check others' opinions about a course or place to study	1.24	0.68
Download course materials	1.26	0.73
Cultural use: identity (α = .67)	1.81	1.05
Come across information about differences between men and women (e.g., in their lives, behavior, or attitudes)	1.58	1.11
Interact with people who share your ethnicity	1.71	1.17
Come across adult sites with sexual content	2.15	1.72
Cultural use: belonging (α = .71)	1.53	0.79
Read information about raising your children	1.49	0.96
Arrange with other people to go out	1.79	1.14
Log in on a website with religious or spiritual content	1.31	0.87
Social use: informal networks (α = .81)	2.81	1.33
Comment on the updates friends or family put online (e.g., e-mail, status/photos on social networking sites)	2.97	1.64
Talk to family or friends who live farther away	2.89	1.61
Share pictures of you with your family or friends	2.58	1.43
Social use: formal networks (α = .76)	1.82	0.98
Look for information on (online or offline) clubs or societies	2.02	1.20
Interact with people who share your personal interests and hobbies	1.92	1.35
Comment about a political or societal issue	1.52	1.03

Social use: political networks (α = .83)	1.83	0.78
Look for information about national government services	2.20	0.90
Ask a representative of a public institution for advice on public services	1.81	0.88
Look for information about an MP, local councilor, political party, or candidate	1.48	0.90
Personal use: health (α = .83)	1.69	0.91
Talk to others about your lifestyle	1.93	1.04
Look up information on how to improve your fitness	1.49	1.01
Use exercise or nutrition programs/apps	1.65	1.13
Personal use: self-actualization (α = .79)	1.80	0.95
Exchange information about events or concerts with others	1.65	1.04
Look up information to understand problems or issues that interest you	2.11	1.19
Consult others' opinions on problems or issues that interest you	1.64	1.14
Personal use: leisure (α = .68)	2.88	1.29
Play games	2.90	1.77
Listen to music	2.91	1.64
Watch videos/TV programs	2.83	1.51

We constructed separate Internet outcome scales based on the classified usage types. We aimed to create measures asking about different tangible—that is, externally observable—outcomes in the four domains. In developing the items, we gave behavioral outcomes preference over attitudinal outcomes whenever possible. The outcomes questions were formulated in such a way that they could only be the direct result of a specific type of online use. For example, using the Internet for job hunting could result in the outcome of finding a better job, or online dating might result in finding a potential partner. Use clearly always precedes tangible outcomes. This allowed us to investigate the possibility of "unintended benefits," meaning that when people use the Internet for an activity that could be mostly classified as, for example, economic, tangible outcomes in other domains might also occur. The scales consist of items using a 5-point agreement scale as an ordinal-level measure. We added a zero to the outcome variables for which respondents never engaged with a corresponding use, thus creating a variable with a 0–6 scale for each outcome (Table 4).

Table 4. Descriptions of Internet Outcomes.

	M	*SD*
Economic outcome: property	3.14	1.45
I save money by buying products online	3.58	1.51
I sell goods that I would not have sold otherwise	2.70	1.90
Economic outcome: finance	1.71	1.53
The information and services I found online improved my financial situation	1.84	1.69
I bought insurance online that I would not have bought offline	1.58	1.75
Economic outcome: employment	1.15	1.46
The things I found online influenced how I do my job	1.42	1.79
I found a job online that I could not have found offline	1.51	0.89
Economic outcome: education	0.40	1.15
I got a certificate that I could not have gotten without the Internet	0.40	1.15

Cultural outcome: identity	1.19	1.28
The things I came across on the Internet made me think about the differences between men and women	1.24	1.43
Through the Internet I learned new things about my ethnic group	1.14	1.38
Cultural outcome: belonging	1.27	1.23
Through the Internet I found people of a similar age that share my interests	1.55	1.73
Because of the information I found and people I have met online, I feel more connected with religion or spiritual beliefs	0.90	1.19
Social outcome: informal networks	2.13	1.36
I have a better relationship with my friends and family because I use the Internet	2.29	1.67
I am in touch with my close friends more because I use the Internet	2.62	1.72
I have more friends because I use the Internet	2.09	1.60
People I meet online are more interesting than the people I meet offline	1.54	1.35
Social outcome: formal networks	0.94	1.23
I became a member of a hobby or leisure club or organization that I otherwise would not have found	1.05	1.47
I became a member or donor of a civic organization I would not have become a member or donor of otherwise	0.84	1.23
Social outcome: political networks	1.21	1.32
I have discovered online that I am entitled to a particular benefit, subsidy, or tax advantage that I would not have found offline	1.61	1.80
Online, I have better contact with my MP, local councilor, or political party	0.80	1.27
Personal outcome: health	1.51	1.38
I am fitter as a result of the online information, advice, or programs/apps I have used	1.23	1.55
I have made better decisions about my health or medical care as a result of the information/advice I found online	1.56	1.70
Information I found online gave me more confidence in my lifestyle choices	1.74	1.70
Personal outcome: self-actualization	2.97	1.18
My knowledge increased because of the Internet	4.32	0.86
Using the Internet helps me to form opinions about complex social issues I would not fully understand otherwise	1.89	1.74
Personal outcome: leisure	2.06	1.42
Online entertainment made me feel happier	2.26	1.74
I go to events and concerts I would never have otherwise considered	1.86	1.72

To measure age, respondents were asked for their year of birth (M = 50.2, SD = 15.4). Gender was included as a dichotomous variable. To assess education, data regarding degrees earned were collected and used to create two groups: low (28%) and high educational achievement. Employment was included as a dichotomous variable by asking people whether they have a part-time or full-time (56%) job. Disability was included as a dichotomous variable by asking people whether they have a health issue or handicap that hinders them in their daily activities (21%).

Data Analysis

We checked all variables for skewness, which was likely to occur among the tangible outcome variables because these could only result if a corresponding use was performed. The positively skewed outcomes for the economic (finance, employment, and education), social (formal and political), cultural (identity and belonging), and personal (health) domains were log transformed, adding a small positive constant (1) to the responses because they contained values of zero. Before applying a log transformation to the negatively skewed economic–property and personal–self-actualization domains, we reflected the variables. Not skewed are outcomes for the social–informal and personal–leisure domains. We used correlation analysis to test H1, whether the strongest relationships within the uses and within the outcomes domains are between resources within similar domains (compound deprivation), and to test H2, whether the relationships between uses and outcomes are stronger within specific domains (sequential deprivation) than in different domains. To test H3 and H4, we applied path analysis using Amos 20.0 to determine whether the conceptual model (Figure 1) explains the relationships between skills, uses, and outcomes. For each domain, we conducted separate analyses. To achieve an extensive model fit, we included the following: χ^2-statistic, the ratio of χ^2 to its degree of freedom (χ^2/df), the standardized root mean residual (SRMR < .08), the Tucker-Lewis index (TLI > .90), comparative fit index (CFI > .95), and the root mean square error of approximation (RMSEA < .06; Hair, 2006). We included gender, age, education, employment, and disability. Covariates were added between usage and between outcome variables. Correlations between skills, usage, and outcome variables were not high enough to cause concerns about multi-collinearity.

Results

Compound Digital Exclusion

This section consists of a technical description of results and testing of hypotheses; interpretation is provided in the discussion section.

Table 5 shows that all uses are significantly related to each other and effect sizes are considerable, ranging from r = .15 to .68. The strongest correlation within the economic uses is between property and finance (r = .46), whereas the strongest correlation with any economic use is between finance and social: political uses (r = .61). Cultural uses correlate strongly with most other uses but most strongly between each other (r = .64). The within-domain correlations for social uses are strongest for formal and political uses (r = .62). Nevertheless, the strongest correlation with any social use was between formal and personal; self-actualization uses (r = .65). Personal uses correlate most strongly within the domain through the correlation between self-actualization and leisure uses (r = .68).

Table 5. Pearson Product-Moment Correlation Coefficients for Uses and Outcomes.

Uses	2	3	4	5	6	7	8	9	10	11	12
1. Economic: property	.46**	.35**	.26**	.41**	.35**	.28**	.41**	.40**	.45**	.43**	.21**
2. Economic: finance	1.00	.40**	.30**	.58**	.45**	.28**	.50**	.61**	.53**	.52**	.19**
3. Economic: employment		1.00	.34**	.49**	.40**	.31**	.44**	.44**	.43**	.40**	.23**
4. Economic: education			1.00	.30**	.28**	.24**	.29**	.26**	.34**	.31**	.15**
5. Cultural: belonging				1.00	.64**	.42**	.58**	.55**	.62**	.64**	.33**
6. Cultural: identity					1.00	.47**	.56**	.50**	.56**	.55**	.38**
7. Social: informal						1.00	.45**	.32**	.48**	.42**	.36**
8. Social: formal							1.00	.62**	.65**	.60**	.37**
9. Social: political								1.00	.60**	.58**	.32**
10. Personal: Self-actualization									1.00	.68**	.42**
11. Personal: health										1.00	.39**
12. Personal: leisure											1.00
Outcomes	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1. Economic: property	.35**	.25**	.17**	.25**	.23**	.28**	.23**	.22**	.31**	.27**	.31**
2. Economic: finance	1.00	.32**	.18**	.36**	.39**	.36**	.37**	.43**	.30**	.42**	.34**
3. Economic: employment		1.00	.31**	.34**	.33**	.27**	.28**	.28**	.27**	.34**	.31**
4. Economic: education			1.00	.21**	.22**	.18**	.17**	.15**	.19**	.21**	.20**
5. Cultural: belonging				1.00	.75**	.53**	.55**	.46**	.37**	.51**	.42**
6. Cultural: identity					1.00	.48**	.51**	.48**	.39**	.55**	.43**
7. Social: informal						1.00	.40**	.40**	.41**	.51**	.51**
8. Social: formal							1.00	.49**	.26**	.47**	.39**
9. Social: political								1.00	.35**	.49**	.38**
10. Personal: self-actualization									1.00	.46**	.55**
11. Personal: health										1.00	.57**
12. Personal: leisure											1.00

**$p < .01$

Sequential Digital Exclusion Between Uses and Outcomes

Table 6 shows correlation coefficients between uses and outcomes. In the economic uses and outcomes, the relationship is the strongest within the domain and between corresponding uses and outcomes. The highest correlation is between education uses and outcomes *(r* = .71), followed by employment *(r* = .68), finance *(r* = .52), and property (*r* = .49). For cultural uses and outcomes, the strongest relationship was found within the domain. The highest correlation concerned belonging (*r* = .57; for identity, *r* = .49). The strongest path with noncorresponding outcomes was within the domain between belonging and identity (*r* = .54). The strongest relationship between corresponding social uses and any outcomes could also be found within the domain, between informal uses and outcomes (*r* = .56). Formal uses were strongly correlated with the corresponding outcomes (*r* = .52) and with cultural: belonging (*r* = .58). Political uses were strongly correlated with the corresponding outcomes (*r* = .52). For personal uses, the sequential deprivation is strongest within the domain for all uses and with the corresponding outcome

for health (r = .68) and leisure outcomes (r = .48). Self-actualization uses had strong paths with health (r = .56) and leisure outcomes (r = .51). Overall, these findings provide evidence for sequential digital exclusion. In almost all cases, the strongest relationship was found between a corresponding use and outcome, followed by other within-domain relations, offering support for hypothesis H2.

Table 6. Correlations Between Uses and Outcomes.

Uses \ Corresponding Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
1. Economic: property	.49**	.34**	.26**	.18**	.37**	.35**	.27**	.35**	.32**	.26**	.30**	.27**
2. Economic: finance	.29**	.52**	.27**	.19**	.39**	.41**	.29**	.43**	.41**	.28**	.38**	.30**
3. Economic: employment	.21**	.29**	.68**	.27**	.38**	.36**	.27**	.32**	.32**	.24**	.30**	.26**
4. Economic: education	.18**	.21**	.29**	.71**	.26**	.26**	.19**	.25**	.21**	.21**	.25**	.22**
5. Cultural: belonging	.25**	.37**	.37**	.25**	.57**	.54**	.43**	.49**	.42**	.31**	.47**	.39**
6. Cultural: identity	.21**	.32**	.32**	.21**	.50**	.49**	.44**	.40**	.34**	.33**	.43**	.39**
7. Social: informal	.27**	.27**	.26**	.20**	.41**	.34**	.56**	.28**	.25**	.35**	.37**	.37**
8. Social: formal	.26**	.33**	.36**	.20**	.58**	.51**	.45**	.52**	.45**	.37**	.47**	.42**
9. Social: political	.24**	.39**	.33**	.19**	.44**	.46**	.33**	.44**	.52**	.32**	.43**	.35**
10. Personal: self-actualization	.31**	.40**	.39**	.31**	.55**	.55**	.50**	.49**	.47**	.51**	.56**	.55**
11. Personal: health	.26**	.37**	.35**	.23**	.54**	.54**	.46**	.52**	.42**	.36**	.68**	.44**
12. Personal: leisure	.17**	.18**	.17**	.10**	.31**	.29**	.30**	.21**	.21**	.29**	.35**	.48**

**p < .01

Within-Domain Sequential Exclusion

The results obtained from testing the validity of the path models all show adequate fit. The economic model (Figure 2): $\chi^2(25) = 134.24$; $\chi^2/df = 5.37$; SRMR = .03; TLI = .90; CFI = .98; RMSEA = .06, 90% CI [.05, .07]. The cultural model (Figure 3): $\chi2(14) = 59.46$; $\chi^2/df = 4.96$; SRMR = .03; TLI = .93; CFI = .99; RMSEA = .06, 90% CI [.05, .08]. The social model (Figure 4): $\chi^2(17) = 59.90$; $\chi^2/df = 3.15$; SRMR = .02; TLI = .95; CFI = .99; RMSEA = .04, 90% CI [.03, 0.05]. The personal model (Figure 5): $\chi^2(13) = 101.11$; $\chi^2/df = 5.62$; SRMR = .03; TLI = .90; CFI = .98; RMSEA = .06, 90% CI [.05, .08].

The paths between the skills are similar in all models. Having operational skills is directly related to having information-navigation, social, and creative skills. Having information-navigation skills directly relates to having social skills and indirectly relates to creative skills. Figure 2 shows that within the economic domain, social skills do not relate to any of the uses, and creative skills are related to all. Within the cultural domain (Figure 3), social skills relate to belonging uses and creative skills to belonging and identity uses. Within the social domain (Figure 4), social skills relate to informal uses and creative skills to all three uses. Within the personal domain (Figure 5), social skills are related to leisure uses and creative skills to all three uses. Overall, the sequential digital exclusion path runs from all skills to uses to achieving tangible outcomes, offering support for H3.

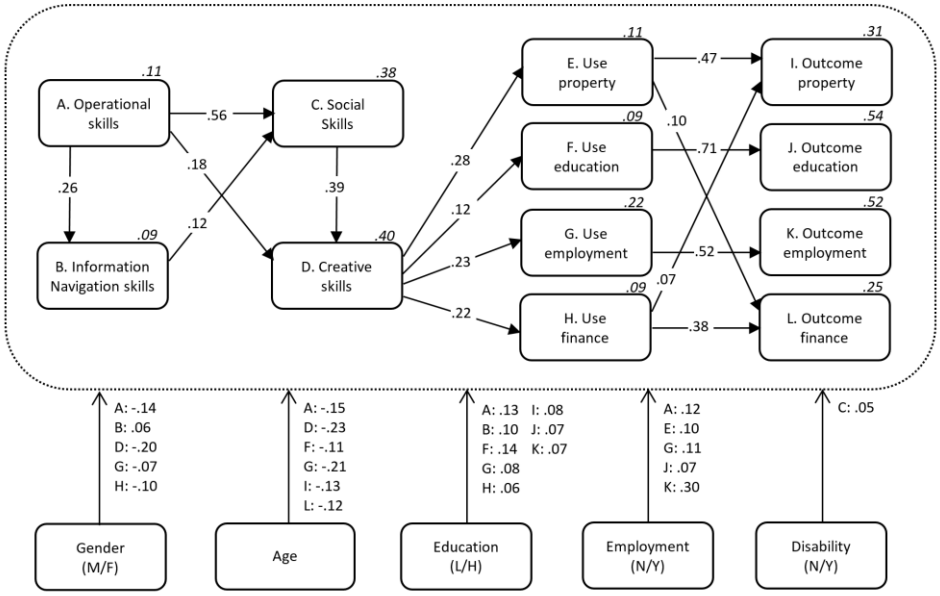

Figure 2. Economic outcome model.

Note. Paths are significant at .05; nonsignificant paths are not shown. R^2 values are italic.

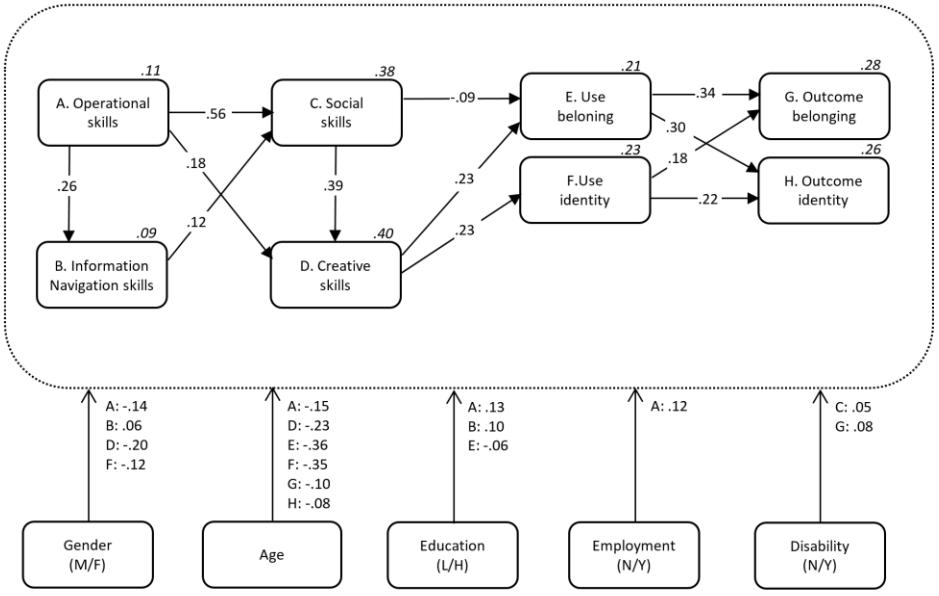

Figure 3. Cultural outcome model.

Note. Paths are significant at .05; nonsignificant paths are not shown. R^2 values are italic.

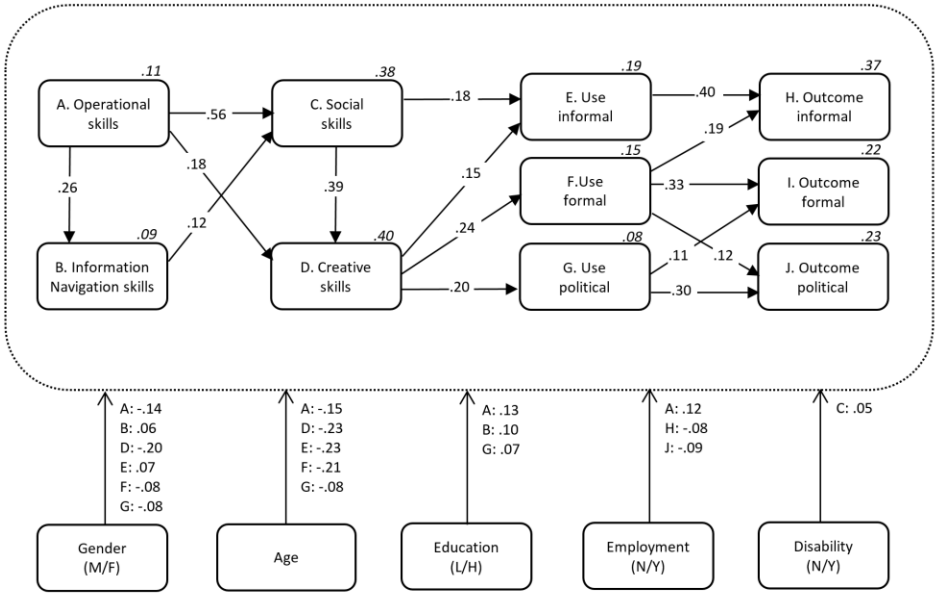

Figure 4. Social outcome model.

Note. Paths are significant at .05; nonsignificant paths are not shown. R^2 values are italic.

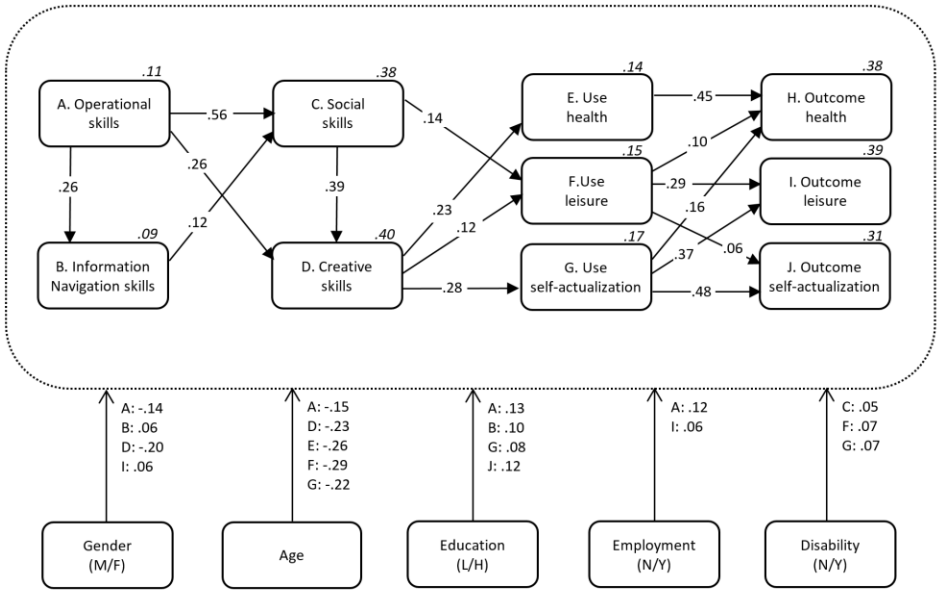

Figure 5. Personal outcome model.

Note. Paths are significant at .05; nonsignificant paths are not shown. R^2 values are italic.

Across the domains, men have higher operational and creative skills, and women higher information-navigation skills. Age is related negatively to operational and creative skills. Education is positively related to operational and information-navigation skills. Employment results in higher operational skills, and disability is related positively to social skills. In the economic domain, gender is negatively related to employment and finance uses. Age is related negatively to education and employment uses and to property and finance outcomes. Education is positively related to all uses except property and to all outcomes except finance. Employment is related positively to property and employment uses and to education and employment outcomes. In the cultural domain, gender is negatively related to identity uses. Age is negatively related to all uses and outcomes. Education is positively related to belonging uses, and disability to belonging outcomes. In the social domain, gender is positively related to all informal uses and negatively to formal and political uses. Age is negatively related to all uses. Education is positively related to political uses, and employment is negatively related to informal and political outcomes. In the personal domain, gender is negatively related to leisure outcomes. Age is negatively related to all uses. Education is positively related to self-actualization uses and outcomes, employment to leisure outcomes, and disability to leisure and self-actualization uses.

The constructed path models reveal that there are significant direct and indirect relationships between offline resources, skills, uses, and tangible outcomes. The beginning of the sequential digital deprivation process starts at the level of skill that individuals from different groups have, followed by different types of Internet use and subsequently the achieved outcomes, offering support for hypothesis H4a. Furthermore, exclusion at different stages in the sequence is compound for individuals from different groups, offering support for hypotheses H4b.

Discussion and Conclusion

This article aims to provide a comprehensive approach to digital exclusion with respect to inequalities in how individuals are able to translate digital skills and Internet activities into tangible beneficial outcomes in everyday life. Our study was theory driven by focusing on how inequality can manifest itself in economic, cultural, social, and personal domains in the Netherlands, a country with very high household Internet penetration and a high level of educational attainment by citizens. The study finds evidence of compound and sequential forms digital inequality among Dutch Internet users. Those who achieve outcomes in one domain do not necessarily achieve outcomes in another domain. This confirms the necessity to account for different domains in research if we want to get a comprehensive picture of the nature of digital exclusion. We cannot assume that closing the digital divide in one area automatically transfers to less digital inequality in another area. Furthermore, a person who lacks one type of skill is also likely to lack another, and those who lack a particular type of engagement are likely to lack another, within and across specific domains. This echoes Bourdieu's (1986) and Hill's (1974) frameworks of thinking about social inequalities and exclusion as multifaceted. The results also provide evidence for sequential digital exclusion: There are strong relationships between uses and outcomes within each domain. In several cases, the relationship between uses and outcomes are also very strong outside the domain, suggesting unexpected benefits. For example, engaging with the Internet in formal social ways also strongly relates with cultural belonging outcomes.

Several of the Internet skills included in this study were related to specific economic, cultural, social, and personal uses. Operational and information-navigation skills are related to having social and creative skills, which in turn relate to the different uses. Social and creative skills have only recently been incorporated into digital divide research—the focus was previously on technical or information-seeking skills—and this study demonstrates that they are important when considering different types of Internet uses and, as a consequence, in gaining outcomes from Internet use. The sequential digital exclusion path runs from all skills to uses to tangible outcomes of Internet use.

The results revealed several direct and indirect relationships between offline resources and skills, uses, and tangible outcomes. When sociodemographic characteristics traditionally associated with first- and second-level divides were included in the analysis, the results showed that these characteristics stand at the beginning of the sequential digital deprivation process relating to the levels of skill that individuals from different groups have. Women, the elderly, those with lower levels of education, and the unemployed lack skills and are, therefore, less equipped to engage with various activities online and subsequently are less likely to achieve outcomes that increase offline resources. Yet, sequential deprivation is not the only story, because the relationships between offline resources and uses and outcomes were not only indirect via skills. There are also several direct effects of gender, age, education, employment, and disability on uses and outcomes. The elderly had fewer skills, engaged less, and achieved fewer outcomes for all domains. Women were directly disadvantaged in terms of skills, most uses, and some outcomes. Besides being disadvantaged concerning economic uses and outcomes, those with lower levels of education also engage less in cultural: belonging, social: political, and personal: self-actualization uses. Unemployed individuals had less social: informal and political outcomes. Results for disabled individuals were contradictory, leading in the personal and cultural domains to higher levels of inclusion. More work is required to fully examine and theorize the relationships between personal well-being, Internet use, and social inclusion, as this study had access only to disability as an indicator. There is some evidence that exclusion at different stages in the sequence is compound for individuals from different groups. The elderly suffer compound digital exclusion for skills, uses, and outcomes. Women show compound exclusion mostly in relation to operational and creative skills and economic and social uses. Those with lower levels of education suffer compound disadvantage mostly in relation to Web 1.0–related skills, but also in economic uses and outcomes. The unemployed suffer compound disadvantage related to social uses and economic outcomes.

The independent effect of demographics on uses and outcomes could be explained because besides different skill levels, other factors are likely to play a role in choosing the activities we perform online. Important personal preferences and motivations might be important in determining different types of engagement. For example, even if people have the necessary skills to engage with political uses, if they are not interested in politics, it is unlikely they will engage in these uses. These motivations can be based on personal resources, such as general interests or hobbies, or linked to socialization patterns of what is appropriate for certain people in certain groups—that is, cultural resources. This study was limited by the indicators of offline resources it has measured and could not test the full range of theorized domains of potential offline exclusion. More and better direct indicators for economic, cultural, social, and personal resources need to be included in future research, as do measures for motivations related to ICT use. We

also need a better understanding of deep exclusion, or how different aspects of traditional inequality interact (Alvi et al., 2007; Atkinson, Cantillon, Marlier, & Nolan, 2002).

The finding that digital exclusion is compound and sequential in nature fits stratification theories and the amplification mechanism (Kraut et al., 2002; Kvasny, 2006; Toyama, 2011) of digital exclusion, suggesting that the Internet is a magnifier of existing offline inequalities. The greater an individual's existing offline resources, the more the Internet delivers, and conversely, the fewer resources a person has, the less value the Internet has within and across domains. Furthermore, we expect the relationship to be bidirectional. Those who are marginalized in important domains are likely to also be marginalized in their digital skills and uses of technology, creating a vicious cycle where historically marginalized groups are further marginalized by technology. We stress the importance of examining the independent and intersecting roles of domains in digital divide research to understand how offline and digital exclusion relate to each other. Policies that attempt to address digital deprivation face additional challenges when considering sequential and compound digital exclusion within domains of exclusion. Most indicators were related to skills, uses, and outcomes. Improving specific skills alone will not be enough; we need to get a better idea of how sociocultural, socioeconomic, and personal factors influence people's interactions with different online activities and, separately, how these factors lead to differences in tangible outcomes. Not only should policies incorporate a multifaceted approach to digital divides that goes beyond skills, they should also come to the understanding that achieving digital inclusion in one type of engagement with and outcome of Internet use does not necessarily translate into engagements and outcomes of a different type. After these complex relations between offline and online divides have been investigated, focused policies can be developed, for example, between political motivations and support for the needed skills and particular political uses to enhance political outcomes. General policies to disentangle these complex and compound substantial inequalities in the studied domains seem impossible. So far, mainly general digital divide policies are developed that focus on addressing issues of access, skills, or usage. At the same time it is important for policy makers to critically consider the extent to which it is reasonable or appropriate to push responsibility onto individuals rather than to address inequalities at a societal level when developing inclusion policies in this domain.

Considering the general nature of the conceptual apparatus used in this study, there is no reason to think that the results of this study would apply only to the Netherlands. As the Netherlands is a country with high household Internet penetration and intensive Internet use, it might be considered a forerunner of trends to come for other countries that have fast-growing Internet penetration. Maturing Internet use and experience of skills and uses in all domains of society increase the chances that compound and sequential inequalities arrive in these domains. Maturation of use is a driver of the trend that the Internet is a magnifier of existing offline inequalities. Such assumptions should be tested in future international and longitudinal research.

Future research should go beyond using correlation measures for testing compound deprivation. Latent class analysis, for example, can be applied to test for clusters of individuals in relation to theoretically derived outcomes. Furthermore, more details on how skills, uses, and outcomes show sequential deprivation paths across economic, cultural, social, and personal domains is desired. Future research should also extend the study of sequential and compound digital exclusion by incorporating other

indicators theorized in conceptualizations of the digital divide. The inclusion of motivation and sophisticated access measures is especially needed. For example, using certain skills might be more difficult on one device than on another, and certain activities might be better suited to a particular device. Similarly, strong motivations to engage with ICTs might override disadvantages in access to and skills in using the Internet and achieving beneficial outcomes.

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