<1>WHY LOCATION-BASED STUDIES OFFER NEW OPPORTUNITIES FOR A BETTER UNDERSTANDING OF SOCIO-DIGITAL INEQUALITIES

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<2>INTRODUCTION

Research on digital inequalities has emphasized the links between ICT access, skills and use and traditional inequalities (Helsper, 2012; Ragnedda & Muschert, 2018; Van Dijk, 2005). Over the last twenty years, empirical work has shown that those who have been historically disadvantaged in socioeconomic and/or sociocultural terms are also less likely to engage in a broad variety of ways with information and communication technologies (ICT) (DiMaggio, Hargittai, Russell Neuman, & Robinson, 2001; Morales, Antino, De Marco, & Lobera, 2016; Nishijima, Ivanauskas, & Sarti, 2017; Robinson et al., 2015; Van Deursen, van Dijk, & ten Klooster, 2015). Explanations for these inequalities are sought in the characteristics of households or individuals and the resources and status associated with them in wider society. Two important developments have taken place in research and thinking about these links between social and digital inequalities. The first is a shift in focus away from emphasizing inequalities in access toward emphasizing inequalities in outcomes of the use of ICT in everyday life (Van Deursen, Helsper, Eynon, & Van Dijk, 2017). The second is more recent and is a shift away from thinking about this as a phenomenon based on individual characteristics and exclusion towards a more contextualised, location-based understanding of socio-digital inequalities and, therefore, of effective interventions (Courtois & Verdegem, 2016; DiMaggio & Garip, 2012; Helsper & Van Deursen, 2017; Katz & Gonzalez, 2016; Mossberger, Tolbert, Bowen, & Jimenez, 2012; Pick & Sarkar, 2015; Rains & Tsetsi, 2017;

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Skaletsky, Galliers, Haughton, & Soremekun, 2016). The objective of present article is to explain these related shifts and illustrate, through case studies in Los Angeles (USA) and London (UK), how location-based approaches can further research into and policies targeted at socio-digital inequalities.

<3>Shifts in emphasis from access to outcomes

As the debate about digital inequalities has developed, it has moved from thinking about digital divides in terms of inequalities of access to focusing on differences in the tangible benefits of ICT use. Differences in available infrastructure and access between various sociodemographic groups, the so-called first-level digital divide, continue to be important obstacles for equal engagement with ICT. That is, those who have been traditionally disadvantaged are less likely to have access to high-speed connections and the quality of the access that they have is lower. This puts them at a further disadvantage in societies where services, commerce and social life are increasingly mediated through digital technologies. Without access there is no use, and with limited access (e.g., low-speed, mobile only) there is limited use. It is important to make a distinction between *potential access* (i.e., the availability of infrastructure and devices to access the digital world) and *actual access* (i.e., the personal ownership and use of devices). Research has shown that potential access does not mean actual access, especially for the elderly and the poor.

As shown by the other chapters in this publication, access on its own is not enough. Even when there is infrastructure available and individuals have some type of access, they do not automatically use it, and they do not necessarily use it for a broad variety of purposes. The latter is the *second level* of digital inequalities, which lies in the differences between individuals with different socioeconomic and sociodemographic backgrounds in the *competencies* that they have to use ICT and in the ways in which they *use* them (Hargittai,

2002; van Deursen & van Dijk, 2015b). At this level, factors that were less relevant at the first level come to play a more important role in determining inequalities. While socioeconomic factors such as poverty, household income and age play an important role in acquiring access, sociocultural factors related to ethnicity, gender and level of education are more strongly related to inequalities in skills and uses of ICT (Bertrand & Simplice, 2016; Dixon et al., 2014; Jara et al., 2015; Martinez-Cantos, 2017; Simoes, Ponte, & Jorge, 2013; Van Deursen & Van Dijk, 2015a).

The latest development in thinking about and measurement of digital inequalities closes the gap between traditional types of disadvantages and uses of ICT. The *third level* of digital inequalities refocuses our attention on inequalities in the opportunities and risks that people from different backgrounds encounter in everyday life. That is, it emphasizes inequalities in the positive and negative outcomes that people achieve from their access to and ability to use ICT in various ways. The little research that has been conducted in these areas has shown that traditional inequalities of various kinds are amplified, especially in relation to these outcomes (Helsper, 2017a; Helsper & Smahel, 2019; Pagani, Argentin, Gui, & Stanca, 2016; Van Deursen & Helsper, 2015; Van Deursen et al., 2017). This is the case for beneficial outcomes such as establishing positive relationships, feeling respected, saving money, finding jobs, and being empowered to participate in civic and political life (Van Deursen & Helsper, 2017), but is even more so for harmful outcomes such as financial fraud, identity theft, discrimination, and bullying (Helsper & Smahel, 2019) . This leads to the argument that if a policy or intervention increases access, digital skills and engagement levels with ICT, but does not lead to real gains in benefits from this use in everyday life, then they should not be considered successful. Inequalities in outcomes is what is truly important and should, therefore, be what digital inclusion interventions and public policies are held accountable for.

The provision of content, access, skills training and awareness campaigns have not led to the hoped-for decreases in the inequalities of use of ICT, even when targeted to traditionally disadvantaged or vulnerable groups. Some of this has been put down to lack of integration of intersectional approaches in digital inequalities research. That is, it is not just ethnicity, gender, socioeconomic status or age that make someone likely to be excluded in the digital world, but a combination of these factors. While Van Deursen et al. (2017) explored the digital aspect of intersectionality inequalities by incorporating interactions between different skills and use disadvantages, they did not really look at intersectionality in terms of non-digital characteristics. It is clear that intersectionality, that is, understanding how a combination of characteristics of the individuals situated within specific social contexts, would be a useful addition to the theoretical and empirical toolkit of digital inequalities researchers (Alper, Katz, & Clark, 2016; McMillan Cottom, 2017). This leads, via a detour to the topic underpinning this publication, an explanation of why digital inequalities researchers are changing their methodologies and objects of study towards location-based approaches.

<3>Shifts in objects of investigation and sites for interventions

Most research has used one of two approaches to studying how digital inequalities manifest and what the causes and solutions might be of the widening inequalities that have accompanied the increased digitisation of societies. One takes a more individualistic, psychological and behavioural approach and the other sees the root cause of digital inequalities as being societal, structural and systemic. The individual approach finds its basis in the first- and second-level digital inequalities paradigms and is aligned with a focus on improving people's access, motivation and skills, and to some extent, different types of engagement. The societal approach emphasises structural inequalities based on sociocultural factors such as gender, ethnicity and socioeconomic status.

The problem is that the existing models are not adequate to understand what is effective in ameliorating inequalities in digital societies. In arguing for intersectional approaches, digital inequalities research and interventions started to build on neighbourhood and network effect theories (see DiMaggio & Garip, 2012; Galperin, Bar, & Kim, 2017; Mossberger et al., 2012). Network and neighbourhood effect models have been more widely applied in traditional inequalities research and interventions to explain why some people with characteristics traditionally associated with disadvantage are willing and able to overcome these disadvantages and achieve better outcomes than expected (e.g., Sampson, 2011; Sampson, 2017).

The emphasis on the importance of geographical and social positioning reflect ideas of intersectionality because they argue that it makes a difference whether you are a woman within a specific network or neighbourhood or live your daily life in a different location in terms of how you see yourself and your engagement with ICT. Based on this, the author has argued that digital inequalities researchers have been ignoring important explanations of digital inequalities because people do not live in society at large and they do not exist in isolation with purely individual needs and abilities. Rather, they live their everyday lives in specific social and physical contexts (Helsper, 2017b, in press). These social contexts are the collective norms, values and practices around ICT in their social networks. Individuals pick these up through observation and informal learning as they interact with others. Physical context refers to the availability and visibility of technology and infrastructures in the neighbourhoods, workplaces, schools, and private and public spaces where they hang out.

To illustrate with an everyday situation: It makes a difference if a woman of colour lives in a socioeconomically homogenous neighbourhood where infrastructure is adequate, people are seen to be engaging with ICT while going about their everyday lives, and women like her are using technologies extensively. If the same woman lived in a similar neighbourhood, but

women were not actively engaged in using ICT, or were perhaps implicitly discouraged from doing so, then she would be much less likely to use these technologies. If the same woman worked in an environment where everyone was expected to be digitally savvy and technologies were widely available, she would be more likely to improve her digital skills and broaden her use of ICT.

<3>Shifts in methodological approaches

This shift in thinking about objects of study requires a different methodological approach, first because the level of analysis and intervention is different. We must move from the macro-societal and micro-individual levels to the meso-social level. Methodologies based on multi-level analysis using counterfactual case studies will help our understanding of how socio-digital inequalities are related to this different level of analysis. Traditional counterfactuals compare engagement between two individuals with very similar sociodemographic and socioeconomic characteristics who are living in very different neighbourhoods or moving in different social circles (DiMaggio & Garip, 2012). However, answering the question of which aspects of physical and social environments drive unexpected digital exclusion or inclusion can also be done using neighbourhood-level data, comparing neighbourhoods with similar sociodemographic characteristics but different incidences of digital engagement, allowing deeper examination of policies and interventions and social and physical space effects. One advantage is that a variety of data sources can be used (e.g., data on infrastructure, open or commercial data measuring use linked to location indicators, census data, different surveys of individuals), instead of relying on data being collected from the same individual.

This publication is unique in providing detailed location-based analysis around a variety of socio-digital inequalities using Brazil's regions and Sao Paolo's districts as exploratory case studies.

Another advantage of location-based studies is related to the cause-and-effect problem: Whether technology-related change can lead to social change, or social change is needed for inequalities to diminish instead of increase in societies that are digitizing. The best methodology for studying this would be longitudinal panel research that includes a sufficient sample of different disadvantaged individuals where one studies the effect of improving ICT access, skills, motivation and use on individuals' socioeconomic and sociocultural well-being and vice versa. This type of research is expensive and not currently available. Randomized controlled trials where some disadvantaged individuals participate in skills training or get access and others do not would also improve understanding. However, this would be extremely difficult, since there is no random assignment to access provision or skills training, and because the factors described earlier in relation to individuals' social and physical environments are not under the control of the researcher. Research taking specific locations such as neighbourhoods as the unit of analysis could lend a helping hand. One reason is that interventions, even those based on national policies, take place in specific locations, and the effects are likely to be distributed in those locations based on network effects (Katz & Gonzalez, 2016; Mossberger et al., 2012). Another reason is that it is easier to collect longitudinal data on changes in socioeconomic and sociocultural makeup and ICT infrastructure, access, skills and use characteristics of residents at the neighbourhood level than at the individual level.

In summary, to understand how we might counter socio-digital inequalities we need to look beyond individual characteristics towards people's socio-digital ecologies, including the

neighbourhoods in which they live. This will allow for a better grasp of whether and which technological changes and interventions can improve ICT access, skills, dispositions, use and outcomes achieved among the most vulnerable populations.

<2>ANALYSIS

I will present descriptive analyses of unexpected cases of inclusion and exclusion for London (UK) and Los Angeles (USA), where projects similar to the one presented for Sao Paolo in this publication have been running for a number of years.

<3>Los Angeles

In Los Angeles, the Connected Cities and Inclusive Growth project has been mapping different aspects of digital inclusion against socioeconomic and sociocultural characteristics of neighbourhoods since 2016 (Galperin et al., 2017). For the digital exclusion indicators, two factors of inequalities in access were available: access to cellular data plans only; and no Internet subscriptions. Besides these potential access indicators, no other digital exclusion indicators were available for the Los Angeles heatmaps of exclusion, so the analysis and compound indicators do not include actual access, skill or engagement measures.

Table 1 Correlations between social and digital inequalities indicators in Los Angeles[2]

	(1)	(2)	(3)	(4)
Poverty	1			
White population	-0.55**	1		
Education	0.82**	-0.79**	1	
Cell only	0.75**	-0.68**	0.82**	1
No Internet	0.76**	-0.56**	0.77**	0.60**

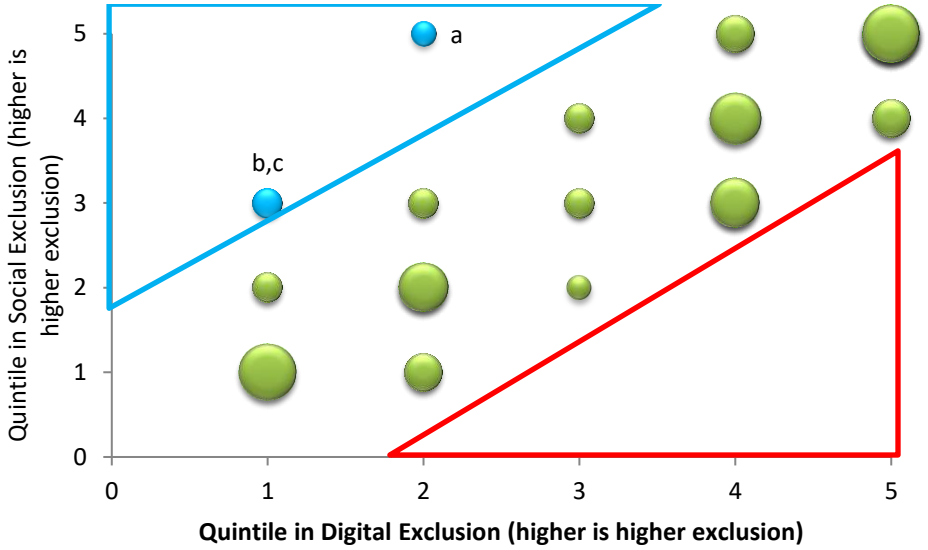
Source: Data from Connected Cities and Inclusive Growth Heatmaps for 69 LA Neighbourhoods (see http://arnicusc.org/research/connected-cities/).

[2] Age was left out of the analysis because it was related to neighbourhoods with more white residents, higher levels of education, and less poverty, which confounded the influence of this variable.

Note: Poverty= % below 100% of the poverty level; White population= % White only, not Hispanic or Latino; Education=% that didn't graduate from high school; Cell only =% cellular data plan with no other type of Internet subscription; No Internet = % without an Internet subscription.

The relationship between social and digital inequalities indicators were as expected for all indicators in Los Angeles: neighbourhoods whose residents were poorer, had less education and had larger ethnic minority populations rely more on cell phones and a larger proportion of their population has not used the Internet (see table 1). There are, however, exceptions.

Figure 1 Quintile compound social and digital exclusion levels for Los Angeles



Source: Data from Connected Cities and Inclusive Growth for 69 LA Neighbourhoods (see http://arnicusc.org/research/connected-cities/).

Note I: Larger markers indicate more neighbourhoods falling in this category based on compound social and compound digital exclusion indicators (calculated using the indicators in table 1).

Note II: Neighbourhoods in the red triangle are unexpectedly excluded, those in the blue triangle unexpectedly included.

While most neighbourhoods in Los Angeles fall within the expected patterns of links between socioeconomic and digital inclusion, there are three areas that have unexpected potential access levels based on the social exclusion level in their neighbourhood (see Figure 1).The following cities/areas are unexpectedly included: La Puente and Industry (a in Figure 1); Diamond Bar and La Habra Heights (East); and Rowland Heights and some areas in Los Angeles (North Central/Granada Hills & Sylmar) (b & c in Figure 1).

Figure 2a Social exclusion indicators for unexpectedly included neighbourhoods in Los Angeles

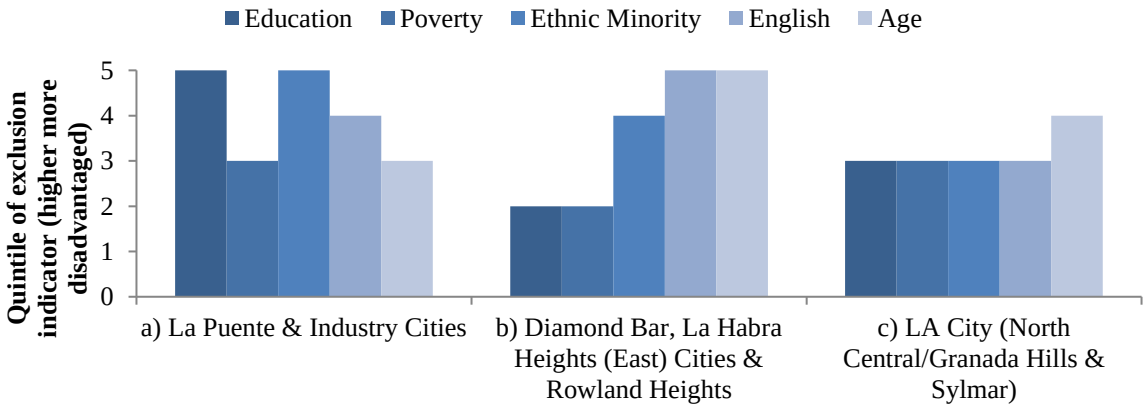
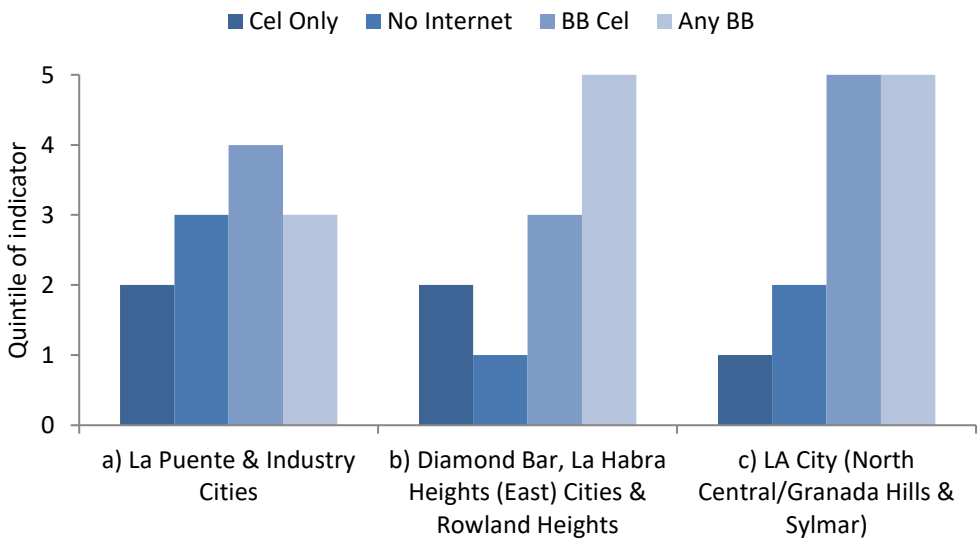


Figure 2b Digital exclusion indicators for unexpectedly included neighbourhoods in Los Angeles



Source: Data from Connected Cities and Inclusive Growth Project for 69 Los Angeles Neighbourhoods (see http://arnicusc.org/research/connected-cities/).

Note: Education=% did not graduate from high school; Poverty= % below 100% of the poverty level; Ethnic Minority= % not White only; English= % who speak English less than "very well"; Age = Median age (years). Cell only =% cellular data plan with no other type of Internet subscription; No Internet = % without an Internet subscription; BB= % Broadband of any type; BB Cell= Broadband cellular data plan.

The three unexpectedly included areas are all slightly different in their sociodemographic makeup: the area that includes La Puente & Industry cities has a large ethnic minority population (82% Latino; 31% do not speak English very well), and low levels of education (32% did not graduate from high school), but it is not as poor as might be expected (medium income $24,276, 12% under 100% poverty level), and the neighbourhood is relatively young (36 years). It has low levels of cell phone only access (8%) and average levels of no Internet subscribers (15%) and broadband access (79%). The other two areas are socioeconomically better off. Diamond Bar and La Habra Heights (East) Cities & Rowland Heights do well on education (9% non-high school graduates) and poverty (9% in poverty) levels, even though they have a larger-than-average ethnic minority (20% Latino, 35% speaking poor English) and older population (41 years). In terms of connectivity, they do well with low levels of non-subscribers and cell phone only users and many who are connected to broadband. The LA City neighbourhood (area c in Figure 1) is average on all indicators of social exclusion except age: it has a slightly older population (38.6 years). In terms of digital inclusion, it is very connected through a broad variety of connections and devices compared to other LA neighbourhoods. The most interesting for a counterfactual case study is the area of La Puente and Industry cities, because it scores very high on social exclusion, but is highly included

digitally. Based on this case, one explanation might be a combination of the neighbourhood being relatively young with a less-educated entrepreneurial population who have managed to generate reasonable incomes despite their potential immigrant status. There is a hint of the American (digital) dream in this profile and it would be fascinating to compare it with similar neighbourhoods in the top right corner of Figure 1 (i.e., those with similar levels of social exclusion) to understand what makes this neighbourhood different. Of course, these conclusions are speculative and require in-depth case studies, including a review of the local policies and initiatives around digital inclusion as well as the socioeconomic and sociocultural characteristics of these neighbourhoods.

<3>London

The available heatmaps for the United Kingdom are based on national relative measures of exclusion[3]. In contrast to Los Angeles, they do incorporate indicators of infrastructure, access, skills and use. Since London is on average wealthy and well-connected compared to the rest of the country, these national measures are not useful to describe the inequalities in social and digital exclusion within the city. The thresholds for inclusion have to be different. For example, having what at the national level might be considered a decent income will buy you a parking spot in London, and having nationally average digital skills will be unlikely to land you a job in London, considering that the competition is much higher. For this publication, measures relative to London were created, including those traditionally associated with social exclusion and those that measure the full range of the digital exclusion spectrum, with the exception of outcomes of use (see Table 3).

Table 2 Correlations between social and digital inclusion indicators for London Neighbourhoods

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
No BB								
No Mobile	0.46**							

[3] See http://heatmap.thetechpartnership.com

No Access	0.45**	0.32						
Skills*	-0.40*	-0.22	-0.53**					
Uses*	-0.32	-0.07	-0.48**	0.98**				
Age	0.07	0.55**	0.12	-0.10	-0.03			
Education	0.54**	0.39*	0.50**	-0.75**	-0.65**	0.12		
Income*	-0.49**	-0.20	-0.49**	0.75**	0.70**	0.27	-0.76**	
Illness	0.44*	0.69**	0.54**	-0.53**	-0.38*	0.32	0.82**	-0.55**

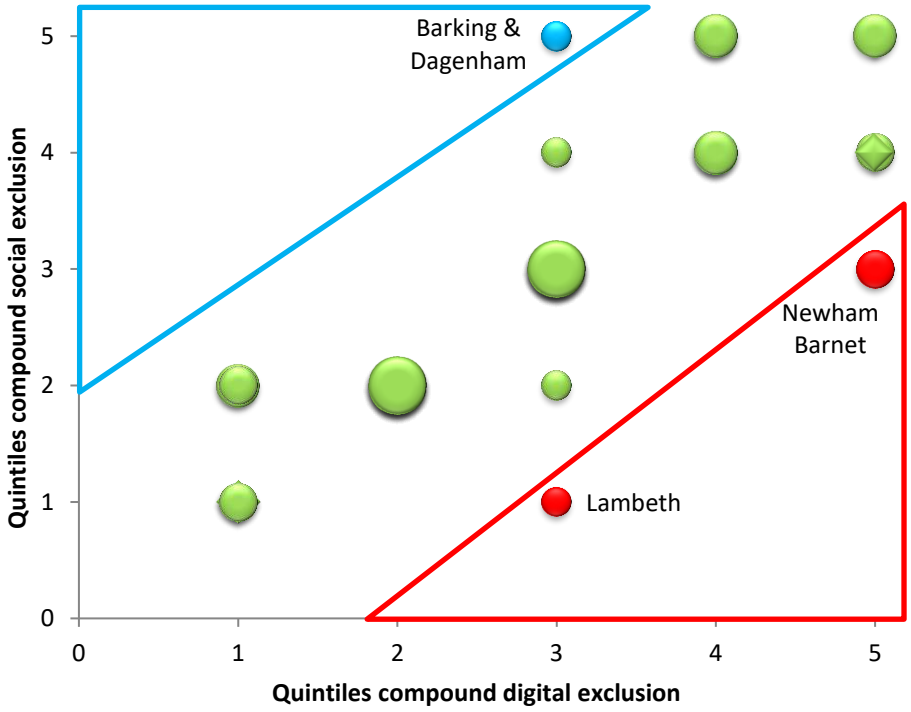
Source: Data for 33 London Boroughs based on http://heatmap.thetechpartnership.com

*Higher means less excluded

Notes: 1) No BB= Proportion with no broadband at 10MB/sec or more, 2) No mobile = % with no access to mobile 4G; 3) No access= % that never use the Internet, 4) Skills= % with all 5 basic digital skills, 5) Uses = % who have used all 5 basic digital skills; 6) Age=% of adults over 65; 7) Education= % of adults with no qualifications or no Level 1 qualifications; 8) Income = Average income per taxpayer; 9) Illness=% of adults with long-term illness or disability.

Digital and social exclusion levels of neighbourhoods in London are also strongly related (see Table 2). A larger proportion of individuals with lower levels of education, income and health is related to all digital exclusion indicators in the expected direction (worse infrastructure, lower use, skills and breadth of use). The only aspect for which traditional predictors of digital exclusion are less helpful is age; the proportion of elderly individuals in a neighbourhood is only related to lack of mobile 4G connections and to nothing else.

Figure 3 Compound digital and social exclusion in London neighbourhoods



Source: Heatmaps of exclusion in a Digital Britain 2017 (see Helsper & Kirsch, 2015 for methodology)

Note: Any neighbourhoods in the red triangle are unexpectedly excluded, any in the blue triangle are unexpectedly included.

When looking at compound digital and social exclusion indicators (see Helsper & Kirsch, 2015 for details on methodology), the area that includes Barking and Dagenham shows up as unexpectedly included, and Barnet, Lambeth, and Newham as unexpectedly excluded (see Figure 3).

Figure 4a Social exclusion for unexpectedly included and excluded London neighbourhoods

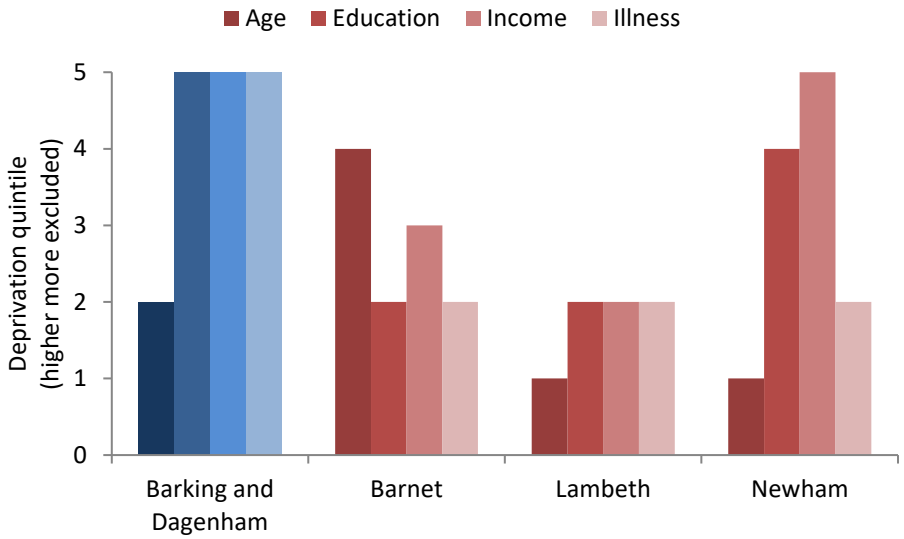
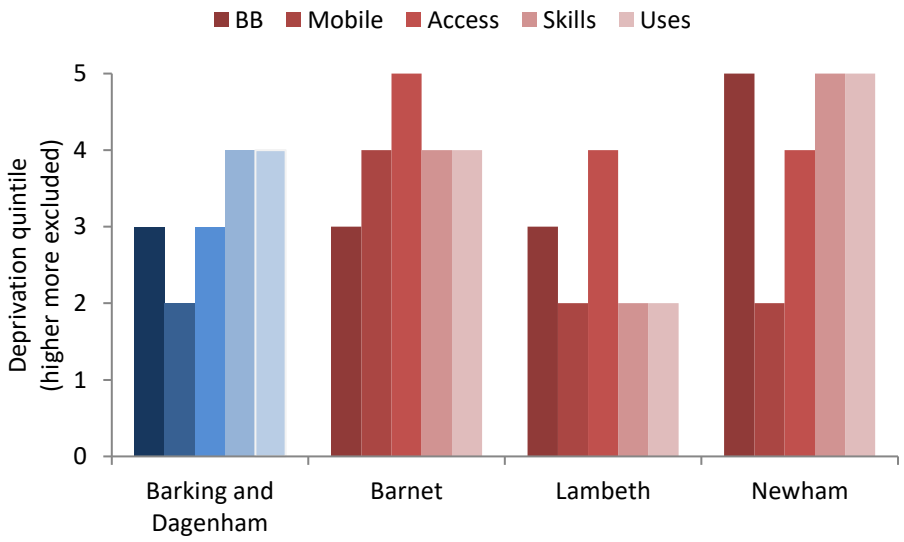


Figure 4b Digital exclusion for unexpectedly included and excluded London neighbourhoods



Source: Heatmaps of exclusion in a Digital Britain 2017 (see Helsper & Kirsch, 2015 for methodology)

Note: Blue is unexpectedly included, Red is unexpectedly excluded.

Notes II: Age=% of adults over 65; Education= % adults with no qualifications or no Level 1 qualifications; Income = Average income per taxpayer; Illness=% of adults with long-term illness or disability; BB= Proportion with no broadband at 10MB/sec or more, Mobile = %

with no access to mobile 4G; Access= % that never use the internet, Skills= % with all 5 basic digital skills, Uses = % who have used all 5 basic digital skills.

Barking and Dagenham, the unexpectedly included neighbourhood, is only average on digital inclusion. It is in fact excluded for skills (only 78% has all five basic skills) and use (only 40% has used all five skills), does well on mobile access (all households have 4G), and is average on access (6.7% has never used the Internet) and broadband (1% does not have access to 10Mb/s). Looking at the sociodemographics of this area, it scores high for socioeconomics (43% without qualifications, average income is £22,100) and health deprivation (16.4% has a long term illness or disability), but it has a very young population (only 9% are over 65). It could be hypothesised that, while a younger population in the context of socioeconomic deprivation leads to higher take-up and improved infrastructure (see also the unexpectedly included case in Los Angeles), socioeconomic deprivation dampens that advantage in terms of actual access, skills and engagement, and improvements in education, income and health are needed for real inclusion to take place.

However, the unexpectedly excluded neighbourhoods are all very different. None have health issues, excluding this as an explanation for their digital exclusion. Barnet is high on almost all digital exclusion indicators and has on average a relatively older and slightly poorer population. It is highly excluded on all indicators with only average levels for broadband. Lambeth is relatively included on all social indicators, with a very young population, and it is particularly excluded on infrastructure (potential access) and actual access (i.e., Internet use) showing that youth in better-off areas do not stimulate take–up by others. Newham is very excluded in terms of income and education, with a young population, and it is very excluded on all but the mobile infrastructure indicator, replicating, for potential access, the digitally unexpectedly included La Puente and Industries cities are in Los Angeles.

<2>CONCLUSION

This chapter looked at the usefulness of location-based approaches in furthering understanding of the causes and consequences of digital inequalities. It argued that change happens in everyday life, in the digital and social spaces that people live in and move through, and that therefore research and interventions to increase equality need to study and understand these contexts. Researchers, policymakers and organisations interested in combating socio-digital inequalities need to study these contexts and design interventions that are relevant to these specific contexts. Engagement with ICT is a manifestation of the relationship between technologies and the structural and interpersonal relationships in which they are embedded. Therefore, it cannot be understood by just looking at an individual's skill or access level and their own sociodemographic characteristics, but needs to be understood within the social and physical contexts where these individual characteristics and structural factors come together. Key spaces of these kinds are the neighbourhoods in which people live and work. This is where they learn whether, how, and for what to use ICT by observing what others do and what is available to people like them. The relatively simple analyses presented here show two aspects that indicate the value of location-based, in this case, neighbourhood-based, approaches. First, they show that an intersectional approach to socio-digital inequalities is indispensable. This is exemplified by the different effects of age within socially excluded and included neighbourhoods. Also, comparing unexpectedly excluded or included counterfactual cases in different cities generates new hypotheses through these intersectional approaches. These approaches also account for the digital part of exclusion: Comparing the Los Angeles and London findings shows that researchers need to look, not just at potential access, but also at actual use, skills and breadth of engagement, because compound social disadvantages can have opposite results when looking at digital access and

digital engagement outcomes. Second, there is much to be gained from in-depth counterfactual case studies of areas that follow the trend of strong connections between social and digital inequalities and those that do not and have similar social or digital characteristics. The differences between areas that were unexpectedly excluded in London demonstrated that there are no easy answers in this regard and that a closer look at location-specific interventions and a broad set of social indicators are needed. This was not possible within the confines of this introduction, nor was it possible compare changes over time, which is another area for future exploration.

This introduction and the rest of this publication are an exciting start of a new direction in socio-digital inequalities research, an approach that will push researchers and policymakers to step away from individualistic approaches, which have had only limited success and steer them towards contextual approaches that focus on how and where people live their actual lives. Ultimately, these approaches should allow us to find better answers to questions about which interventions are going to have the most effect for which people in which neighbourhoods.

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