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Back to the future, disability and the digital divide

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The aim of this article is to explore disability and the digital divide using a quantitative methodology. The research investigates what impact digital technologies have had in improving the life-chances for disabled people from deprived neighbourhoods in the northeast of England. The study explores how disabled people engage with digital and assistive technologies in order to overcome disabling barriers and social exclusion. Unfortunately, the analysis found no evidence that digital and assistive technologies had any impact on reducing social exclusion for disabled people. In fact, the research discovered that these technologies seemed to construct new forms of disabling barriers as a consequence of the digital divide.

Keywords: digital divide; technology; quantitative methods; social model; social exclusion; disabling barriers

Points of interest

- This article explores how disabled people engage with digital and assistive technologies compared with a general (socially excluded) population.
- The article develops a statistical approach to explore whether technology plays a significant role in reducing disabling barriers.
- The paper concludes by investigating the impact that technology has in improving the life-chances for disabled people in areas such as education, employment and health services.

Introduction

The aim of this article is to examine disabled people's experience of social exclusion and how this correlates to the digital divide within the United Kingdom. Previous studies examining this area have applied a qualitative perspective to conceptualise the relationship between disabling barriers and new forms of technology (Roulstone 1998, 2007; Goggin and Newell 2003; Sheldon 2004; Harris 2010; Watling 2011). This study endeavours to examine the digital divide using a quantitative methodology, based upon an evaluation of digital inclusion in the city of Sunderland. The article examines the relationship between disabled people's engagement with digital technologies and how digital exclusion might construct new forms of disabling barriers. In doing so this will discover whether disabled

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people are less likely to engage in new forms of technology compared with the general (non-impaired) population in socially excluded neighbourhoods.

Digital inclusion in the city of Sunderland

Sunderland is a city located in Tyne & Wear, which is a metropolitan county of the northeast of England. It is situated on the River Wear and was historically celebrated for its shipbuilding, glass-making and coalmining industries. With the decline of heavy industries in the 1980s, shipbuilding and coalmining have completely disappeared leading to high levels of unemployment. Since the 1990s, despite efforts of regeneration, deprivation and poverty remain an entrenched issue for the city. Eighty-two of the city's 188 Lower Super Output Areas (LSOAs)[1] are ranked among the 20% most deprived in England and 41 of those are ranked within the 10% most deprived nationally (Indices of Deprivation 2007).

In March 2006 the city of Sunderland (Sunderland Local Strategic Partnership) became the recipient of £3.5 million from the Department of Communities and Local Government (plus additional investment from the private sector). This was provided to implement Sunderland's proposal of delivering technological solutions to socially excluded individuals and communities within the city (Sunderland City Council 2007). One of the key groups identified within Sunderland's socially excluded remit were disabled people (Tunstall 2008). Disability has been a major concern in terms of digital inclusion, both by Labour and the recent Tory-led government. As the Department of Work and Pensions states:

> Digital inclusion provides people with wider choice and empowerment around the major areas of their lives. By ensuring that disabled people have access to technologies … digital inclusion opens up many social, financial and entertainment benefits of the internet. Digital inclusion can also improve: employment and learning opportunities [and] access to services and information, including public services. (Department of Work and Pensions 2011)

There has been a recent move in terms of government policy and private industry in developing inclusive technology aimed at people with a range of abilities and impairments. Owing to the Equalities Act 2010, places of business, educational institutions and public spaces must be accessible for people with a range of impairments. In terms of government discourse, the ideology of inclusion has become central to technological innovation (Goggin and Newell 2003).

Definition of digital exclusion/inclusion

Digital exclusion is a lack of access to and use of information and communications technology (ICT) resources. By ICT the study refers to a range of technologies, including, but not limited to, desktop and laptop computers, Internet connections, mobile telephones, digital and interactive television, health-monitoring equipment and assistive technology for those with impairments. As with UK Online Centres (2007), the research emphasises the importance of the *availability* of ICT resources, whilst also acknowledging the significance of the various *motivations* that drive *use* and the *skills* needed for initial and continuing engagement. There is also a recognition that technology is increasingly used by individuals and agencies (particularly those delivering public services), which may well have a discernible indirect impact

upon the quality of life of those in socially excluded groups (Department for Communities and Local Government 2008).

The government's objective of greater digital inclusion is directly related to the goal of improved lives and life-chances – what is seen as a more socially inclusive society. For disabled people the use of digital technologies, particularly with reference to assistive technologies, is destined to enable new ways of engagement with local services, education and the workforce, which would have been restricted previously due to the nature of certain impairments. UK Online Centres (2007) have identified a correlation between those who are socially excluded and those who are digitally excluded. Those who remain disconnected from technology are more likely to also remain excluded from mainstream social, economic and political activities. Therefore, greater access to and use of technology is positioned as a key tool for addressing such social problems. What is at stake here is not, then, just the importance of use and access to technology, but the socio-economic benefits this may bring. From the government's perspective, digital technologies might assist disabled people to confront and overcome many of the barriers they face in order to prevail over social exclusion.

Disability studies and new technologies

As disability is one of the targeted groups where digital technologies are considered useful in removing disabling barriers, it should be noted that in the literature on disability a number of conflicting discourses have emerged in contrast to the official government stance (Roulstone 1998, 2007; Oliver, Barnes, and Thomas 2001; Goggin and Newell 2003; Harris 2010). To comprehend the relationship between technology and disability, it is important to understand how disability and technology have been interconnected within a historical context from a disability studies perspective. Watson and Woods (2005) suggest that technological advances have been the foundation of the development of disability activism and the political movement.

Watson and Woods (2005) use the wheelchair as an example to demonstrate the importance of technological development. Before the emergence of the wheelchair in 1916, people with physical impairments were very rarely seen by the public owing to a lack of mobility. Watson and Woods (2005) suggest that, in post-war society, access for disabled people, especially people in wheelchairs, became a central point in the negotiation for the disability movement. This was due to architectural features that excluded individuals with physical impairments who needed the assistance of certain technologies. This became the focal point for the disability movement in relation to disabling barriers, thus establishing a separation between disability (disabling barriers) and impairment (biology).

However, the idea that technology can somehow overcome issues of impairment, and include individuals who had been previously excluded, has been somewhat rejected from within disability studies (Oliver 1978; Roulstone 1998; 2007; Oliver, Barnes, and Thomas 2001; Goggin and Newell 2003; Harris 2010). Oliver, Barnes, and Thomas (2001) imply that it was the 'old' technologies of the industrial revolution that previously excluded people with impairments from society and are critical of why the 'new' technologies of the twenty-first century will subsequently include disabled people. Roulstone (1998, 2007) further dismisses the government's idea that disability can be entirely overcome by technological advances. He suggests that digital technologies do not change the relationship between individuals with an

impairment and society. What they have the potential to do is to assist in the reduction of disabling barriers presented in the environment, education and the workforce. Roulstone (1998, 2007) states that it is important to recognise that digital technologies can only assist in changing the social environment and are not the ultimate answer to overcoming disablement and social exclusion.

This is supported by Goggin and Newell (2003), who suggest that the promise of digital technologies to overcome issues of impairment and disability have been greatly exaggerated and have not materialised. They suggest that digital technologies, rather than create a system of inclusion, have the opposite effect and in many cases have further isolated people with a range of impairments. Goggin and Newell (2003) propose that the reason for this is that technology designers seek to 'normalise' disabled people. One of the key barriers they illustrate is that technologies are often too expensive and ineffective for most disabled people. This is illustrated by Harris (2010), who studied how effective assistive technologies are for many disabled people. He discovered that the fundamental barriers people experience when using assistive technologies were due to financial cost, poor design and poor training from providers. Harris discovered that for people who have access to assistive technologies they often go unused due to a lack of knowledge and training. Furthermore, many of these technologies are not adequately designed for disabled people (Harris 2010). In order for assistive technologies to be affective, Borg, Larsson, and Östergren (2011) imply that affordable digital technologies must be seen as a basic human right. From this perspective, access to digital technologies should be seen as a 'right of assistance' for disabled people rather than a 'commodity'.

The digital divide and disability

The consensus is that in the coming decades of technology, adoption will continue apace alongside growing expertise and continuing processes of globalisation (Harvey 1990; Bauman 1998), transforming the way individuals live, work, play and communicate (Bradley and Poppen 2003). The use of technology is not without its drawbacks and disadvantages, but for the majority who have access to ICT (in particular, computers and the Internet) there are a number of clear economic, educational, social and health-related advantages. However, those who remain excluded from the opportunities such technologies provide in a 'network society' (Castells 1996) are increasingly at risk of being left behind.

As more everyday commercial and public services, which were once conducted through face-to-face interactions, become transferred online, there is a danger that those who are not accessing such channels will become further excluded. From the government's (individual model) perspective, digital technologies have the potential to enable disabled people to overcome 'limitations' of their body in order to improve their life-chances. Unfortunately, there is also a recognition for disabled people who are not engaging in digital technologies that these individuals have the potential of becoming further excluded and experience more disabling barriers significantly reducing their life-chances (Goggin and Newell 2003; Harris 2010).

This gap that exists between those who have access to and use of ICT and those who do not has become known as the *digital divide* (National Telecommunications and Information Administration 1995). We also know that those on the wrong side of this divide are characterised by their already disadvantaged positions (UK Online Centres 2007). In particular, non-users of ICT indicate that financial situations and

social class positions heavily influence access to what Selwyn (2003) calls the 'opportunity structure' of ICT. Those who suffer deep social disadvantage are up to seven times more likely to be disengaged from the Internet than those who are more socially advantaged (Helsper 2008). Within these digitally excluded groups, it has been suggested that disabled people are overly represented within the digital divide (Harris 2010; Watling 2011). There is then a fundamental inequality in the current levels of access to ICT (Graham 2002), which favours more advantaged social groups and more affluent and connected localities (Russell and Stafford 2002). Poor levels of access to technology arguably both reflect and exacerbate these existing divisions.

Online resources, assistive technology and disability

The government suggest that there are some clear benefits of recent technological advances that can be found in terms of improving the quality of life of disabled people (Digital Inclusion Task Force 2009). These allow individuals to carry out tasks and activities that they would have otherwise been unable to do on such an independent basis. However, whilst those with such conditions may rely upon forms of assistive technology, it has been suggested that the Internet in particular remains '… inaccessible or difficult to access by people across a spectrum of impairments and this may have serious implications for the potential use of the Web for increasing social inclusion' (Adam and Kreps 2006, 217). Sheldon (2004, 158) emphasises this point by stating 'discriminatory Web design creates major barriers which prevent disabled Internet users from accessing information'.

Yet it may be suggested that it is not the Internet that is generally inaccessible for disabled people, but particular online resources which affect people with impairments in different ways (Haywood 1998). From this point of view, it is not useful to refer to disabled people as a generic group in terms of ICT design, but there should be a focus on designing assistive technologies around issues of impairment. For example, an individual with a learning impairment will experience different difficulties to someone with a hearing impairment (Gregor, Sloan, and Newell 2005). Although this might be a significant point at an individual level, as the Disability Rights Commission demonstrated in their 2003/04 review of website accessibility, there are key structural barriers that affect disabled people in general. These structural barriers include issues of affordability, a lack of knowledge and skills, ineffective assistive technologies, and poor design of online resources (Disability Rights Commission 2004, 2006). Even when disabled people have access to assistive technologies to support online use, these are often not compatible with particular web-browser design (Disability Rights Commission 2006). The Disability Rights Commission (2004) draw attention to the fact that disabled people are not generally consulted within the process of commercial and public online design. Hence, Glesson (1999) advises against an uncritical approach to technology for disabled people as this constructs a technological determinist approach to impairment. These issues are summarised by Alan Sheldon, who implies:

> Technology is not neutral. It is created by the same oppressive society that turns those with impairments into disabled people. … It is no surprise then that disabled people have a complicated relationship with technology. We are often excluded from mainstream technology, a factor said to have contributed to our current labour force exclusion. (Sheldon 2004, 155–156)

In the United States, Dobransky and Hargittai (2006) also found that disabled people are less likely to live in households with computers, are less likely to use computers and are less likely to be online. It has also been identified that those living with such conditions that are also in lower socio-economic groups are often unable to access the technology that is needed, while for others dependency and isolation is actually increased through their use of technology (Sheldon 2004). Hence, it seems that disabled people are excluded in their own homes from accessing technology due to lack of funds, lack of state provision, lack of support or lack of skills to access resources in different ways to a non-disabled population (Allen 2005; Oliver 2009). They are also excluded from more public spaces providing ICT, such as community centres, libraries and colleges for a number of reasons including physical inaccessibility, inability to travel, resources in place and provision of support – and not all these spaces are open – for example, to access post-compulsory educational space is both an achievement and an expense. Both poverty and disability then intersect to exclude from both these types of spaces (Allen 2005).

By drawing on a social model approach, not only does this article look to address the concept of the digital divide, but it examines how digital exclusion impacts on disabled people from more deprived socio-economic areas. In the finding section, the study explores disabled peoples level of usage of digital technologies and its impact in reducing disabling barriers for people living in deprived areas of Sunderland. The study sets out to explore the impact that digital/assistive technologies have had in assisting disabled people to improve their life-chances and reduce social exclusion.

Methodology

Over recent years criticisms have been made of disability studies due to a lack of quantitative research examining the effectiveness of the social model of disability (Shakespeare 2006). This study has attempted to quantitatively assess the value of the social model in relation to a correlation between ‘disability’ and the ‘digital divide’. The data in this study were obtained through a quantitative survey completed by local residents in socially excluded areas in the city of Sunderland. A questionnaire gathered basic demographic data, information concerning usage of various technologies, involvement with digital inclusion activities and the discernible impact and benefits upon living circumstances, quality of life and life-chances.

The purpose of the survey was to access the opinions, experiences and behavioural patterns of a range of residents from a range of social groups at different stages of the ‘digital spectrum’. This allowed an assessment of the reach of digital activities, and the benefits of engagement with technology. People were classified as disabled in this study through self-identification, where respondents specified their impairment(s). These ranged from mobility impairments, hearing impairments, brain injuries and learning difficulties to mental health problems. The study recognises the possibility that some respondents who have an impairment that affects their ability to use technology might not identify themselves as disabled. This is a general limitation to this study and questionnaire based surveys on disability in general.

Our definition of ‘socially excluded’ geographical areas was based upon the ‘Indices of Deprivation’ (Department for Communities and Local Government 2007) and those LSOAs in Sunderland that fall within the ‘10 per cent most deprived nationally’ category in this index. When developing a quantitative study,

the Indices of Multiple Deprivation is viewed as one of the most reliable measurements of deprivation, which includes data from domains such as income; employment; health and disability; education, skills and training; barriers to housing and services; living environments; and crime (Conrad and Capewell 2012). However, the study recognises its limitations, which include; the fact that it is not necessarily a direct measurement of poverty and exclusion but a relative scale (i.e. most through to least deprived); it can be described as over simplistic due to the complex nature of deprivation and exclusion; and the measurement is based on geographical concentration that excludes scattered deprivation and poverty. Yet in order to develop a large-scale study of disability, the Indices of Multiple Deprivation were viewed as more reliable compared with its alternatives.

Given that 61, 171 (21.8%) of the city's 280,600 population in 2007 lived in those LSOAs classified as amongst the 10% most deprived LSOAs nationally, the initial postal questionnaire aimed to be sent out to at least 6117 residents (10% of the socially excluded population). In order to access the sample frame of addresses we matched the LSOAs with corresponding post codes using the National Post Code Directory and then used the Electoral Roll (for 2009) to locate the most current registered addresses in these areas. According to this register, the number of residential addresses currently found in these areas totals 26,443. We took a 25% sample of this population, providing a total of 6610 addresses (a total in excess of the 6117 figure mentioned above and therefore a representative sample). This sample was then systematically and randomly selected by beginning with a random number and then selecting every third address within the frame (Dane 1990).

In total 811 residents responded to the questionnaire. The survey represents a response rate of 12.7% and a sampling error of below 4% at a 95% confidence level (de Vaus 1993). From the 811 respondents included in this study, 38&% (n = 300) classified themselves as having some form of impairment. A number of cross-tabulation tests were used to examine frequency distribution of cases (respondents) when examining the correlation between two or more variables. This shows the distribution of cases by their values. Two or more variable frequency distributions were analysed using a chi-square statistic (χ^2) to discover whether variables (i.e. disability×digital exclusion) are statistically independent or whether they are associated. The null hypothesis classification (p) is either independent (i.e. no relationship between variables exist) or the p classification is dependent (i.e. that a relationship exists between variables).

In the social sciences a statistical relationship exists if a χ^2 statistic is equal to or below 0.05 (<5% chance). The data from this survey were subsequently analysed and only data were used that were calculated to be of significance ($p < 0.05$). The data were analysed using SPSS in the form of single variable analysis, and where data were calculated to be of significance ($p < 0.05$), bivariate (comparing two variables) and multivariate analysis was also applied (comparing three or more variables). The key areas of concern in this analysis were ownership and use, engagement with digital inclusion initiatives and online public services, skills, learning and employment opportunities as well as benefits and drawbacks to the use of technology. This analysis was particularly interested in examining the use of technology in relation to the key social groups identified (age, gender, disability, employed/unemployed).

In relation to multivariate analysis, disability and digital technological interaction was compared with age, gender and employed/unemployed variables to investigate the intersectional nature of the disability variable in this study (D $\leftrightarrow$ A,

G, E, ↔ DT [where D=disability; A=age; G=sex, E=employment, DT=digital technology]). Based on the chi-square statistical data, the multivariate analysis was rejected and it was only the bivariate analysis that confirmed a significant dependent correlation between the disability and digital technology variables (D ↔ DT) It is this statistical relationship which might imply that the key factor in this study is how disabled people experience technology due to macro (disabling) barriers of poverty and inaccessibility, rather than restrictions because of other social factors such as gender, age and social class.

For the purpose of this article only significant data collected on disability will be used. The aim was to make a comparison between a disabled population (n = 300) and a non-disabled population living in deprived areas of Sunderland (n = 511). The non-disabled, socially excluded, population will be referred to as the 'control group' in this article. This article employs the social model of disability to the data analysis; hence 'disability' refers to disabling structural barriers and 'impairment' to biological/neurological variations.

Findings: disability and the use of digital technologies

The UK government has maintained that technology plays a crucial part in their national and local commitment to improve social inclusion and foster independence for disabled people (Digital Inclusion Task Force 2009). Based on the assumption that Sunderland has made significant investment in reducing digital exclusion within its local population, it would be probable that the data analysis would reveal that technology played a vital role within the lives of disabled people. Unfortunately, this does not seem to be the case as the data present no evidence of greater technological usage by disabled people compared with the control group (see Figure 1). When studying the data, the reverse seems apparent, as disabled people were less likely to use forms of digital technologies compared with the control group.

Hence, 42% of people with impairments (n = 127) reported never having used a mobile phone, computer or having accessed the Internet. This is compared with 28% (n = 140) of the control group, revealing a 14% difference ($p < 0.00$). As Roulstone (1998, 2007) notes, technologies have the potential in assisting people overcome some issues of impairment and reducing some barriers. In order for technology to have any impact on disabling barriers, people must first have access to it (Goggin and Newell 2003; Harris 2010; Watling 2011). These data seem to reveal that the principal barrier illustrated by respondents was not having immediate, or any, access to digital technologies.

Yet it is important to examine issues of usage in more depth, as the potential for specific technologies seems particularly relevant for some disabled people. The data revealed that 71% of disabled people had never used a laptop or personal computer compared with 48% of the control group (see Table 1). These findings were extremely surprising as they reveal that only 29% of disabled people had used a computer. The lack of technological usage is also confirmed when examining Internet use: 73% of respondents with an impairment reported having never connected to the Internet, compared with 49% of the control group.

Again this indicates that only 27% of disabled people have access to Internet services. Mobile phone usage was also extremely low for this group as 50% of disabled people reported using a mobile phone. This is compared with 61% of the

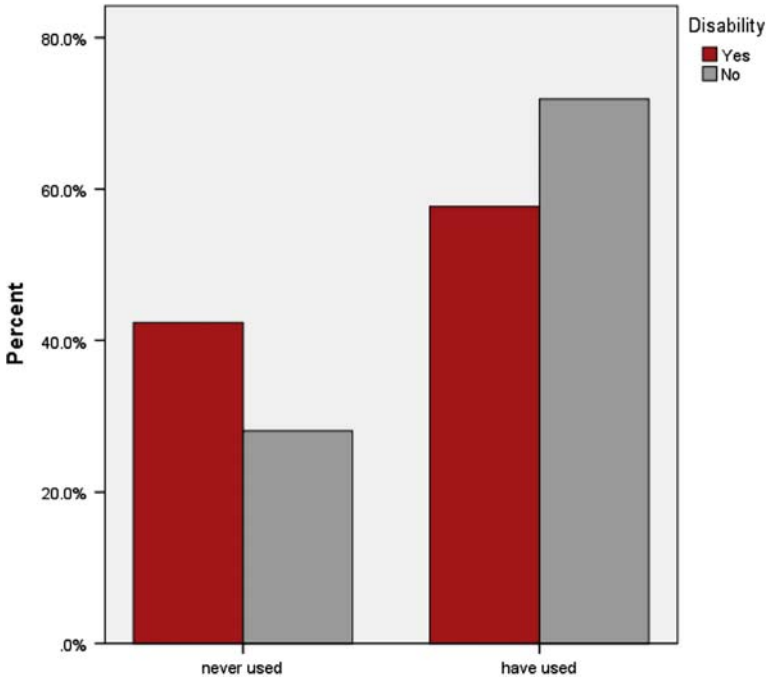

Figure 1. Usage of digital technologies, comparing disabled people with the general population.

Table 1. Reported usage of digital technologies.

Digital technology	Response	Persons with a disability (frequency)	Persons without a disability (frequency)	Persons with a disability (%)	Persons without a disability (%)
Notebook/laptop/PC	No	212	237	71	48
	Yes	88	261	29	52
Mobile phone	No	150	196	50	39
	Yes	150	302	50	61
Internet connection	No	220	242	73	49
	Yes	80	256	27	51
Digital television	No	163	231	54	46
	Yes	137	267	46	54

control group. These data findings indicate that disabled people in this study were far less likely to use digital technologies than people in the control group (see Table 1). Again this reinforces Roulstone's (1998, 2007) and Goggin and Newell's (2003) claim that the potential of digital technologies is not being achieved as disabled people are not accessing basic technologies.

When examining barriers of access to ICT, both the disabled group (58%) and the control group (71%) implied that these were due to financial constraints. The specific problem for disabled people, at 18%, was having no confidence in their skills/knowledge when using ICT ($p < 0.01$); which was not the case for the control

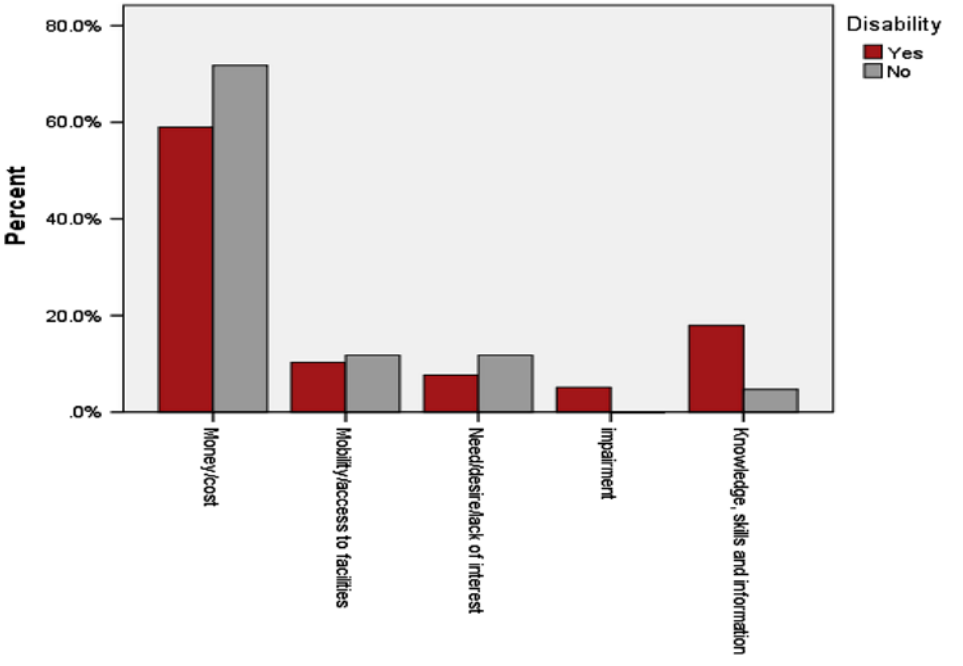

Figure 2. Barriers preventing access to technology, comparing disabled people with the general population.

group at 5% (see Figure 2). Furthermore, only 5% of the disabled group suggested that it was impairment that prevented access to digital technologies. Hence, barriers preventing disabled people from accessing technologies were primarily financial limitations, but specifically a lack of skills/knowledge of ICT. These data strengthen Harris's (2010) qualitative study suggesting that it is knowledge and cost that are barriers to engagement. It should be noted that ownership is particularly important for disabled people as access to technologies in public places (i.e. libraries) is often restricted through disabling barriers such as inaccessible buildings or PCs without the appropriate assistive software, which again restrict usage (Oliver 2009).

Disability and assistive technologies

Although the majority of respondents defined digital technologies in terms of computer/Internet and mobile phones, it should be noted that assistive technologies were also acknowledged. Although it would be expected that disabled peoples' level of engagement with technology would be higher than the control group, due to assistive technologies, this was not the case. The data analysis revealed that disabled people in this study did not engage with assistive technologies to any great extent. Very few reported using technology to assist them in medical support or to enable independent living (7% of the impaired population, $n = 23$). Within this analysis it was the Telecare service (at 17%), and the use of chair and bath lifts (at 17%) that were most commonly used (see Figure 3). Again these data suggest that this group of people are not engaging in the use of digital technologies, even ones that are specifically design for particular impairments.

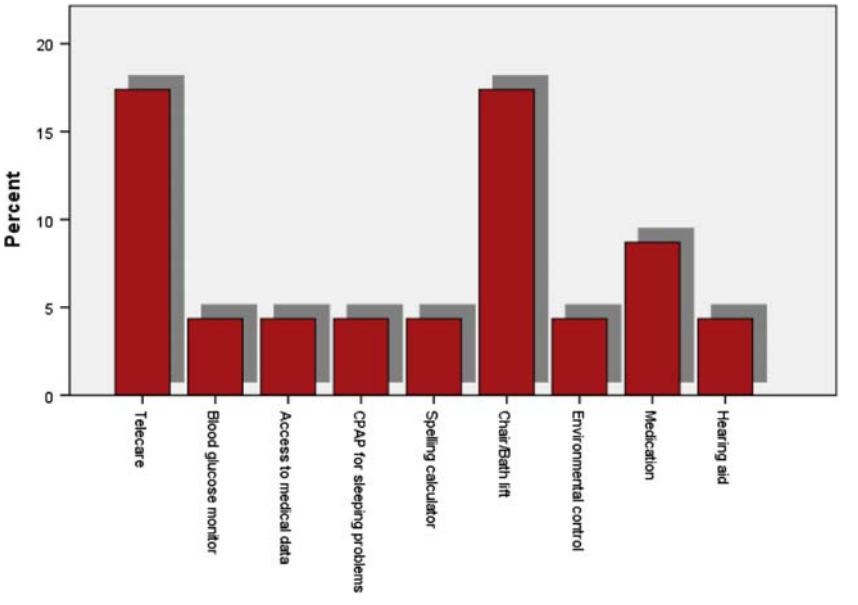

Figure 3. Assistive technologies.

Again, referring to Harris (2010) or Adam and Kreps's (2006) research, this could be due to other barriers disabled people face when accessing these forms of technologies. With an emphasis on independent living it would be expected that many disabled people will be accessing digital technologies through local government social services or National Health Service healthcare services. This does not seem to be the case in this sample, as for many people who might benefit from these technologies access seems to be denied. Hence, one of the key barriers experienced by respondents in this study is a lack of access to recent technological advances to assist people with different types of impairment.

Technology and improvements in life quality

As Goggin and Newell (2003) state, the idea that disabled people are being socially included due to technological advances seems to be a misconception. This point is illustrated within the study as 57% (n = 145) of disabled people did not consider that technology had improved the quality of their lives (see Figure 4). This was compared with 42.9% (n = 109) who agreed that some improvement had taken place ($p < 0.00$) due to recent advances in digital technology. When comparing this with the control group 64% (n = 301), agreed improvement had been made to their lives. Hence, the control group were far more likely to agree that technology had improved their quality of life.

Disability and domains of social exclusion

When this research was conducted, the UK government had targeted five domains of social exclusion (education, employment, social networking, independent living and healthcare) that they would improve with the assistance of new/digital technologies. As disabled people were defined as a digitally excluded group, there was an

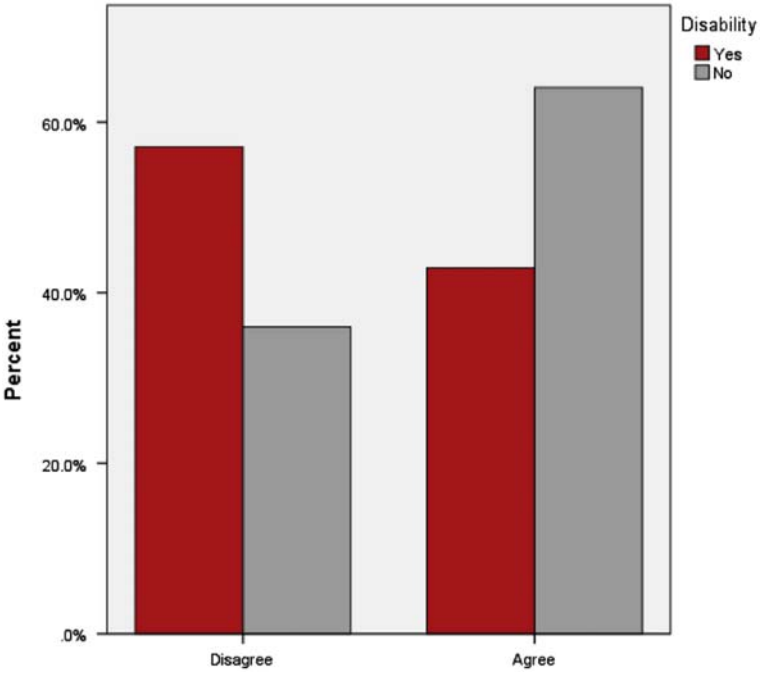

Figure 4. Long-term health condition and quality-of-life benefits from use of technology.

aim to enhance inclusion by improving access to these domains (Prime Ministers' Strategy Unit/Department for Trade and Industry 2005). The research discovered no statistical evidence to suggest that digital technologies had improved in any of these domains for disabled people in Sunderland. A significant (but negative) relationship was discovered between disability and improved healthcare ($p < 0.01$), disability and education ($p < 0.00$) and employment and disability ($p < 0.00$).[2]

When examining whether digital technologies enhanced access to healthcare, the data revealed little evidence of improvement. Only 41% ($n = 65$) of disabled people reported that technology had any impact on their general health or have made an improvement to their local healthcare services (see Figure 5). This is compared with 56% ($n = 184$) of the control group who acknowledged some benefits in their healthcare service and overall health. This is surprising given the potential benefits that some of this group could gain from greater and more effective use of assistive technologies in terms of healthcare. These findings reinforce data in Figure 3 that illustrated barriers relating to access of assistive technology for disabled people. These data are particularly concerning as disabled people could be one group who might need quick and easy access to healthcare depending on their particular impairment. Hence, this might indicate that the digital divide constructs a new layer of social barriers, where people become further excluded from their health service compared with the control group who have increased access to technology (see Table 1).

When examining the data on the relationship between technology and enhanced access to education, no evidence could be found in order to support any positive improvements for disabled people. The data revealed that 66% ($n = 95$) of disabled people did not consider that digital technologies improved educational attainment

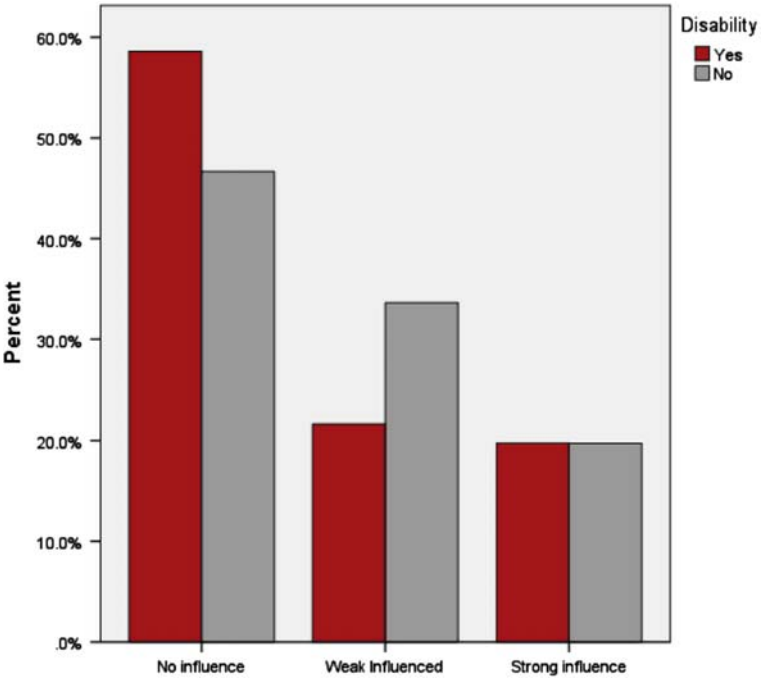

Figure 5. Social inclusion and health.

($p < 0.00$). This was reversed when examining the control group, as 64% ($n = 225$) of non-disabled respondents felt that digital technologies did in fact improve access to education. Furthermore, only 16% ($n = 23$) of disabled people reported that digital technologies had strongly influenced their educational achievements compared with 41% ($n = 144$) of the control group. As with the data analysis on healthcare, these findings illustrate that digital technologies appear to have a greater impact on the educational achievements of the non-disabled group compared with the disabled population in Sunderland (see Figure 6). Hence, the analysis seems to suggest that digital technologies do not appear to have an impact on improving access to education or the general educational experiences of disabled people in this study.

Finally, when examining the relationship between digital technologies, enriched employment opportunities and income improvement, again there were significant differences between disabled people and the control group. As we can see in Figure 7, 73% ($n = 102$) of this group reported that they felt technology had not improved their life-chances in relation to employment and income ($p < 0.00$). This was compared with 62% ($n = 223$) of the control group who felt technology had made some improvement to their employment chances. These data illustrate that although the government and local agencies in Sunderland have developed a number of initiatives in supporting disabled people back into work with the aid of digital technologies, these projects seem not to have played a significant role in improving the employability of the disabled group.

These data reveal that there has been a general failure in improving employability for people with disabilities within Sunderland using digital technologies. Again this reinforces the idea that digital technologies play only a partial role in improving access to the job market, as other disabling barriers such as social stigma,

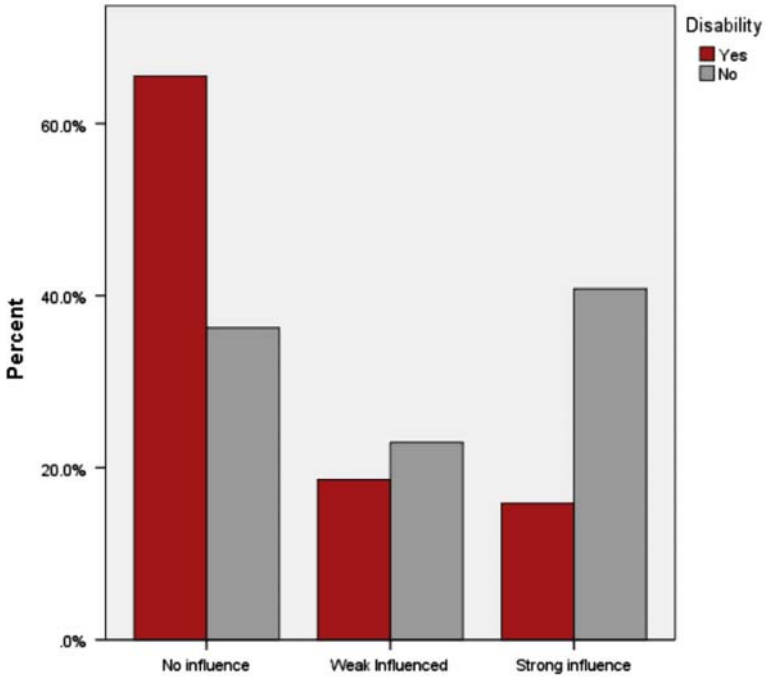

Figure 6. Social inclusion and education.

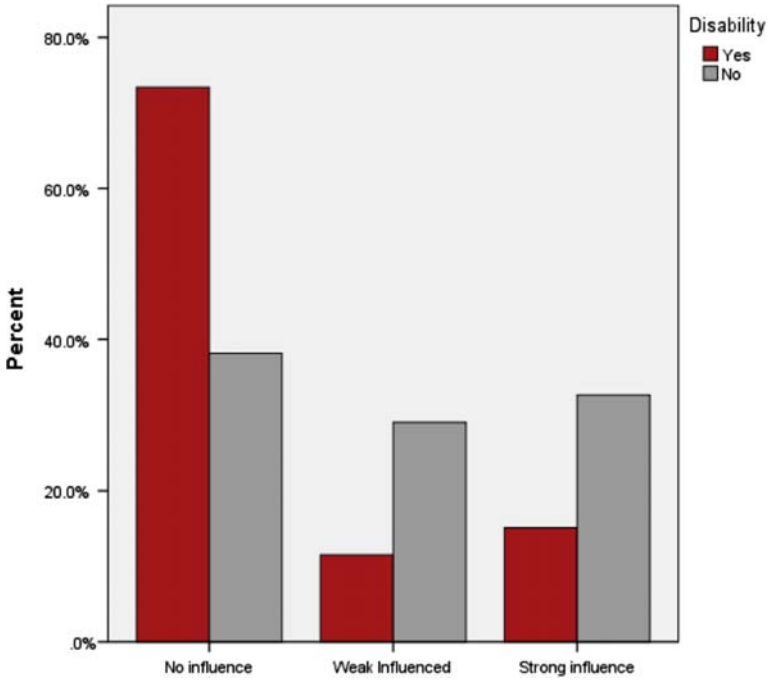

Figure 7. Social inclusion, employment and income.

environmental issues, education, and so forth, all restrict access to the workforce (Goggin and Newell 2003; Roulstone 2007; Oliver 2009). For disabled people in this study, the findings seem to reveal that these respondents are still excluded within their local communities. These data might reveal that, due to a polarised view of what disability means, digital technologies rather than improving life-chances, in reality, add an extra layer of exclusion by means of the digital divide for some disabled people (Goggin and Newell 2003).

Conclusion: barriers to digital and social inclusion

A criticism of this study, from an individual model perspective, might suggest that the ability to use ICT depends on impairment (i.e. visual, hearing, motor and cognitive, etc.). Someone with no functional vision is more likely to experience difficulties using the Internet than someone with restricted lower body movement – yet both appear under the same general category of 'disabled' in this study. From this individual model perspective, barriers to technology relate directly to impairment, and analysis should attempt to segregate respondents based on disclosed impairment in order to understand emerging patterns and barriers.

The response to this criticism is that although impairment impacts on how individuals use technology, the authors have presented evidence that there are structural barriers, such as poverty, skills/knowledge and inaccessibility, which prevent disabled people in this study from using a range of digital technologies. Hence, digital technologies are designed for people without impairments (Borg, Larsson, and Östergren 2011) and in order to make them accessible for disabled people additional technologies need to be purchased. This constructs barriers of usage as ICT design is directed towards a non-impaired consumer group, and extra financial burden falls on the disabled population.

The aim of this article is not to suggest that digital technologies cannot improve the lives of people with impairments. Digital technologies might have the power to include some groups of people with impairments; however, access must be improved to all members of society rather than to the few who can afford these digital technologies. The data have illustrated that investment by both local and national government in terms of reducing social exclusion in areas of healthcare, education and employability has not yet been successful for disabled people in Sunderland. This paper has presented (some) statistical evidence that it is poverty, a lack of ownership, restricted knowledge and inaccessible ICT that construct new forms of barriers for disabled people in this study. Furthermore, it could be suggested that barriers to digital inclusion also relate to the under use of already existing public facilities in the city due to issues of disabling technologies/public environments (Oliver 2009).

These data might indicate that disabling barriers cause aspects of digital exclusion for disabled people rather than micro issues resulting from an individual's impairment. This study has revealed that there is still a long way to go before digital technology successfully impacts on the lives of disabled people in order to reduce social exclusion. Therefore, if access to digital technologies is only for people who can afford them, then digital and assistive technologies, rather than benefit disabled people, will create a new level of social inequality reinforcing the digital divide within the United Kingdom. This study concludes by reinforcing Borg, Larsson, and Östergren's (2011) claim that access to digital technology that helps

remove barriers of exclusion for disabled people should be seen as a 'right' rather than a privilege for disabled people. Designers should be encouraged to develop inclusive ICT, and, where this is impossible, disability funding should be made available for assistive ICT support. Unfortunately, with the new Tory-led government and the focus on local cuts to services and benefits, disabled people seemed destined to a new level of exclusion for the foreseeable future.

Notes

1. The smallest area measurement of deprivation in England.
2. When examining the relationship between social networking and disability ($p < 0.07$) and independent living and disability ($p < 0.28$) it should be noted that the data analysis was not significant in our study. Hence, this study is unable to comment on improvement or failure by Sunderland to improve access to social networking and independent living with the use of digital technologies.

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