SIDPDF: Introduction

The Digital Fringe and Social Participation through Interaction Design

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Digital inclusion and its implications for social participation is emerging as a key issue for researchers, designers, educators, industry and communities, as contemporary society shifts from top-down decision-making to a more inclusive process that collaborates with a variety of demographics. Yet, this shift tends to predominantly focus on mainstream communities of highly urbanised settlements, often neglecting segments of society that lack access to resources, digital technology or telecommunications infrastructure. Likewise, people from culturally diverse and marginalised backgrounds, or who are socially excluded, such as people living with disabilities, the elderly, disadvantaged youth and women, people identifying as LGBTQIA, refugees and migrants, Indigenous people and others, are particularly vulnerable to digital under-participation, thereby

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compounding disadvantage. This special issue presents practical, innovative, and sensitive design solutions to support digital participation for older adults, children with barriers to digital access and urban and regional fringe communities. The intention is to foster digital skills within and across communities, investigate the role of proxies in digital inclusion as an enabler of social interactions, and discuss design strategies and methods for sustaining digital inclusion to eliminate the dilemma of under-participation in the future.

Introduction

Digital inclusion

The use of interactive technologies (i.e. smart phones, tablets, apps, smart watches) has become an integral part of daily reality in many areas of the globe. Growing way beyond their original technical domains, they have over time pervaded social segments as diverse as engineering, health (Waycott et al, 2014; Davis et al 2015), entertainment, matchmaking, government, urban planning (Fredericks & Foth, 2013), public art, architecture (Caldwell & Foth, 2017; Hoggenmüller, Wiethoff, Vande Moere, & Tomitsch, 2018), community engagement (Chamorro−Koc & Caldwell, 2018; Fredericks, Hespanhol, Parker, Zhou, & Tomitsch, 2017; Davis & Farmer, 2018), digital placemaking (Fredericks, Hespanhol, & Tomitsch, 2016; Hespanhol et al., 2015), smart cities (Hespanhol, 2017) and many others. Likewise, the increasing affordability of interactive technologies, coupled with more widespread digital literacy among larger social segments, has also led to their increased adoption by people from non-technical backgrounds. This results in the development of tools and platforms to support the emergence of communities of practice and more participatory exercise of citizenship.

Due to its empowering character, digital inclusion has become a de-facto basic right. Digital inclusion is critical to allow individuals and communities to connect, build networks, learn from each other, work, collaborate, play and participate in social and political life. However, digital inclusion is a complex topic, involving a variety of factors such as accessibility, affordability, usability, skills, and relevance of features to the context of a particular person (Roy Morgan Research, 2016).

The digital fringe

Evidence suggests that among those most likely to experience social exclusion are Indigenous people, people with disabilities, young people, women in disadvantaged situations, older people, unpaid caregivers, LGBTQIA people, and migrants and refugees (Peace, 2001; Silver, 1994).

Socially excluded people and their communities are particularly vulnerable to digital non-participation and under-participation, thereby compounding disadvantage (Clayton & Macdonald, 2013). For those who are connected digitally, one of the key challenges is sustained digital participation (Armenta, Serrano, Cabrera, & Conte, 2012).

Community-based digital inclusion interventions tend to fail when they 'only take into account telecommunications infrastructure and hardware, leaving social and human factors unattended' (Armenta et al., 2012, p. 347).

Not all design solutions become readily applicable or make equal sense to all segments of society. Many people, as shown above, are explicitly or accidently left out in the planning and design of digital innovation. This includes the effects of policies and design practices by many political and technological leaders who tend to target their discourse towards the core profile of the population when considering digital inclusion. Albeit large and relevant, those sectors of society who have less access to technology feel increasingly disenfranchised and powerless, facing widening gaps between digital 'haves' and 'have-nots'. We refer to those neglected or marginalised communities, collectively, as the digital fringe.

Although not included in the main discourse on digital design, individuals on the digital fringe are not oblivious to technology either, and movements towards greater inclusiveness have occasionally sprouted. Evidence of ad-hoc technological appropriation has been observed, for example, among displaced groups such as networks of support to refugees in Europe and Asia (World Food Programme, 2016), or the *Agência de Notícias das Favelas* ('Slums News Network'), connecting slum communities in Brazil[1]. Likewise, large corporations have occasionally made inroads towards greater accessibility for their products, like the example of Microsoft's recent push for more thoughtful design centred around people with disabilities (Microsoft Corporation, 2016). Yet, it is apparent that those developments are both still rare and isolated. Likewise, despite the strong recent focus among the academic research community around prospects of smart cities and smart citizens, those are usually restricted to higher density metropolitan centres, and the more visible communities of dwellers, workers and visitors to prominent public spaces. Unintentional segregation can also arise through social media and the well-known phenomenon of filter bubbles (Foth et al., 2016). In addition to forging stronger 'communities of thought', the use of social media tends to isolate even further communities lacking equal access to those platforms in the first place, worsening the matter even more. To counteract those dynamics, we propose a more concerted effort to identify shared concerns and needs, raise awareness about potential synergy in the design approach to different marginalized segments of society, and learn from stories of both success and failure in designing for those communities.

The digital fringe is, by definition, fairly broad and highly diverse in itself, being an overarching term for the wide range of demographics and communities often excluded from the mainstream discourse about digital technology adoption and innovation. Yet, these groups can be significantly different from each other. As an initial step to facilitate a framework of analysis for communities within the digital fringe, we propose their general classification into the six categories shown in Table 1. These categories are based on chief drivers for digital exclusion, as well as some potential examples which are not exhaustive, and which we discuss in the sections below.

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1 http://www.anf.org.br/ (in Portuguese)

Table 1. Types and examples of fringe communities.

Fringe community	Examples
Geographical	Communities in small cities, suburbia, regional, rural or remote areas.
Socio-economic	People in lower income neighbourhoods, teenagers in custody or in care, housebound people, homeless people, drug addicts, sex workers, people in prison, former detainees (immigration and prison).
Age-driven	Elderly people, children.
Gender-driven	Women, women in STEM (Science, Technology, Engineering and Mathematics) professions, women in politics, gender-x, LGBTQIA.
Disability-driven	People with disabilities, congenital disorders, mental illnesses, and in disability careers.
Cultural and ethnic	Indigenous people, migrant communities, refugees, minority ethnic groups, immigrants.

Preliminary analysis

As previously outlined, the digital fringe is vast and diverse. Yet, we can illustrate examples of work being developed in the field through relevant case scenarios in some of the core themes outlined above.

For instance, among the various aspects contributing to the low digital inclusion of elderly people, three are particularly relevant: (a) accessibility to digital platforms; then, partially as a consequence, (b) lack of digital literacy, and (c) social isolation. An example of a project designed to address the latter is *Speaking Exchange*[2], a multi-awarded pilot program developed in 2014 by CNA, an English language school based in Brazil. It paired local students with English-speaking elderly people living in retirement homes in the USA. It offered a context for mutual learning and addressing social isolation among the elderly by providing them someone to regularly chat to. It also gave them a purposeful and meaningful activity, the feeling of being useful and provided direct impact on their well-being. At the same time, it offered the Brazilian students with the opportunity to train their newly acquired language skills with experienced people with lots of stories to tell. A similar initiative – but addressing disadvantaged youth, particularly living in remote areas or country towns – is offered by the Australian charity The Smith Family: their *iTrack*[3] program works with schools in low socio-economic neighbourhoods to make available to students a computer with internet and dedicated chat software, and then pair each student to professionals in various fields. In

2 https://www.cna.com.br/sobre-cna/exchange *(in Portuguese)*

3 https://www.thesmithfamily.com.au/get-involved/volunteer-with-us/itrack-registration

addition to increasing digital literacy among students, the program also connects them to a professional and cultural network they might otherwise never have access to.

Another segment attracting growing attention is digital connectivity for migrant and refugee populations. According to the UNHCR (2016), 65 million people worldwide currently live as refugees, the largest number since the Second World War. Internet access is deemed as a survival tool for people stranded in unfamiliar places, struggling to secure physical safety and economic support, sustain continuous education, and to establish new social connections while retaining ties to family and culture. Yet, refugees are 50% less likely than the general population to have an internet-enabled phone, with 29% of refugee households having no phone at all (UNHCR, 2016). These statistics have prompted the emergence of various projects aimed at facilitating the digital inclusion of refugee communities, both those in transit and those already settled in host countries. For example, the *World Food Programme* has, in 2016, launched an innovative wireless internet access system to the 31,000 Syrian refugees living in Domiz refugee camp in Kurdish province of northern Iraq. It provides a social bridge that helps them to overcome their sense of isolation and to feel connected to the outside world (World Food Programme, 2016). Similarly, Kiron University, a Berlin-based social enterprise company, offers refugees a cost free blended learning model to accelerate their access to a university qualification. This model creates employment opportunities for refugees once they are settled in the country.

Further initiatives include the *ReDI School of Digital Integration*[4], also located in Berlin, which offers coding classes for refugees with the aim to provide them with valuable digital skills that they can use personally and professionally, potentially finding a job in the IT industry, a sector in Germany which lacks specialists. Despite their value, however, these initiatives often develop in a scattered and isolated manner, as a response to emergencies rather as proactive design solutions. A more concerted effort to address the shared needs posed by the circumstances of a refugee life – as well as the constraints of low budget and a challenging context – is still largely lacking. Moreover, could the insights from those projects leverage similar initiatives elsewhere – or potentially even across other domains within the digital fringe (e.g. temporary shelters for homeless or those recovering from drug addiction)?

Using media architecture as a framework, which combines people, place and technology (Foth et al., 2011) and emphasises social, ethical and aesthetic concerns over technological considerations (Hoggenmueller et al., 2018), Wouters (2016), for example, investigated the potential for media architecture to become an intercultural interface in public space for stimulating interaction between community members and refugees. His project, *Stories of Exile*, involved architectural and interaction requirements, and included the development of participatory design activities with refugees and in-the-wild evaluation of the resulting interactive projection mapping. It also provided further understanding to the new challenges that contextually embedded and socially relevant media architecture introduces regarding the roles of the content, the carrier, the environment and the researcher.

4 https://www.redi-school.org/

A third popular front includes 'one-dollar' initiatives, whereby the increasing affordability of digital techniques and platforms is employed towards producing low-cost solutions to deprived segments of society, therefore increasing accessibility to goods otherwise unavailable. For example, *OneDollarGlasses*[5] is an organisation launched in Germany in 2009 to teach people in deprived areas how to produce glasses with low-cost material and accessible technology. The initiative aims to address a significant social issue, since about 150 million people worldwide are unable to afford glasses, and thus cannot learn, work, go to school or partake in social activities. The glasses consist of a lightweight, flexible spring steel frame and prefab lenses and can be locally manufactured with simple bending machines. The material costs are low – approximately US$ 1. This was also the original motivation behind the Raspberry Pi Foundation[6]: to provide scholars and teachers with a low-cost, high-power computer, and renew excitement about computing among students – something then perceived as somewhat inaccessible to regular students, after information technologies had become efficient and user-friendly, and the activity of tinkering through hardware and software a privilege of few.

Designing participation for the digital fringe

The scenarios captured in the preliminary analysis above reveal hints of the types of participation and interactions unavailable to individuals at the digital fringe: mutual support and coaching, in a basic level, as well as basic skills, creative development, storytelling for mutual understanding, and awareness among communities who would otherwise hardly engage with each other but which, together, can promote each other's advancement in life. But how exactly can technology help? Are there specific roles technology can play in designing solutions to address those needs? What are the current trends?

Motivated by those questions, we have organised a series of academic workshops on the theme of designing digital participation with Human-Computer Interaction[7]. This particular Special Issue on Designing Participation for the Digital Fringe presents the outcomes from two of those workshops (Davis et al., 2017; Hespanhol, Davis, Fredericks, Caldwell, & Hoggenmueller, 2017), and the subsequent call for submissions on their wake.

This Special Issue is organised into an introduction section, followed by three sections dedicated to specific topics: (a) older adults; (b) children facing challenges; and (c) urban and regional fringe communities. The recurrent theme emerging from the submissions is *building self-confidence through nurturing social connections*. Individuals at the digital fringe are usually in a position of disadvantage where they tend to lack power relative to their peers in society, and are often unaware of this position. That makes them potential victims of manipulation, but more broadly their lack of

5 http://www.onedollarglasses.org/

6 https://www.raspberrypi.org/

7 https://digitalparticipationhci.wordpress.com/

awareness translates into an inability to perform tasks and engage in empowering social connections that could substantially improve the quality of their lives. This is a situation which the majority of other people would nowadays take for granted. As part of the introduction section, Article 2 by Panah, De Cotta, Farmer and Aryani provides a method to assess existing social connections with a social visualisation tool, developed in partnership with Red Cross Australia. In particular, it aims at developing more resilient communities by increasing awareness of the existing connections (or lack thereof) that people have with others, and therefore establishing pathways for social support and connectedness.

Section 1: Older Adults is composed of Articles 3 and 4 that investigate methods for achieving and enhancing digital inclusion of older adults by promoting intrinsic motivation in the process of teaching them new digital skills. Article 3, by Davis, McCosker, Bossio and Schleser describes how the researchers used mobile digital storytelling as an educational strategy, encouraging community building through the sharing of stories via social media. Likewise, Beh, Pedell and Mascitelli (Article 4) used intrinsic motivation as a driver for digital inclusion, where they designed teaching curriculum that matched the specific needs within this cohort of older adults. For example, many of the participants in their study had children living overseas and thus wished to learn more about how to communicate with them. Both Articles present the affordances of technology for effectively enabling social interactions and, consequently, a better quality of life for elderly people through the reawakening and sharing of social skills and stories.

Section 2: Children facing challenges visits the opposite end of the age spectrum, and is dedicated to the topic of children with barriers to digital inclusion. Given that children traditionally lack power in interactions with adults, there is ongoing concern for identifying their needs and designing solutions that truly benefit them. In Article 5, Korte presents a project seeking to involve adults as members of design teams with young Deaf children. In this research the adults assumed the role of supporters and proxies. As the author points out, this is a peculiar scenario, as it falls into the intersection of three of the digital fringe communities identified in Table 1: age-driven and disability-driven, of course, but also cultural and ethnic, as Deaf communities around the world identify as minority cultural groups with their own languages. In Article 6, Ireland, Farr-Wharton and Bradford provide a creative solution for this relationship between children with disabilities and technology. They investigated the possibility of integrating chat-bots into the community of children with autism. The chatbots were programmed to function as a sympathetic companion addressing children's struggles to express ideas and feelings, while helping to foster resilient behaviour. Once again, this is an excellent example of a project employing interactive technologies to facilitate broader social interactions by eliminating the power differential that is characteristic of the bully/victim relationship.

Another compounding factor for the feelings of isolation experienced by kids with disabilities, particularly autism, is living in geographically remote areas. In an attempt to address that, Schutt (Article 7) describes the pilot of a video-based technology mentoring program carried out with young Australians with high functioning autism

who are socially and geographically isolated. The program sought to enhance the social connectedness of young people with autism via online sharing of technological interests and projects. Similar to the previous two projects discussed in Section 2, this project also used technology as proxies, working very closely with the children in order to (a) gain a better understanding of their needs, and (b) build resilience and better equip them for social interactions out in the world.

Stimulating awareness of creative practices between communities living geographically or socially apart, and the potential collaborations between them, is another increasing trend in designing for digital inclusion. While isolation plays an interesting role in bringing like-minded people together and shaping local communities, it also significantly limits their capacity to exchange ideas outside their circles, to scale up and thrive. *Section 3: Urban and regional fringe communities* deals with these particular obstacles, presenting a range of ways technology has been used in meaningful research to help communities to overcome social interaction barriers of three recurrent types: geographical, socio-economic, and cultural-linguistic. Furthermore, technology is strongly adopted as both connector and enabler, mediating contacts between outcast creative communities and cultural agents in the mainstream.

In Article 8, Sarantou, Akimenko and Escudeiro discuss *Margin to Margin*, a collaboration between artist communities in four geographically isolated areas: outback South Australia, Finnish Lapland, Russian Kola Peninsula and Namibia. The project utilised technology to help participants exhibit their art in various formats, while raising awareness about their practices and promoting greater understanding about the realities faced by marginalised communities.

Similar patterns of creative isolation are often also at play within urban environments, fed by differences in social status, cultural and linguistic background, accessibility to technology and simple lack of mutual awareness about similar trades practiced by different communities. In Article 9, Bilandžić, Casadevall, Foth and Hearn highlight the issue of the potential exclusion of creative voices from the innovation discourse, particularly those not technology-centric, and then propose a way of mitigating that issue. Firstly, the authors analyse the increasing relevance of so-called ‘innovation spaces’ as shared areas to foster creative thinking, designed to accommodate informal work and social encounters by professionals with entrepreneurial mindsets. The authors frame the perceived problem of homogeneity in those innovation spaces, where typical users have little loyalty to established corporations, and are commonly known as ‘digital nomads’. Secondly, they posit the problem raised by the currently available mechanisms to find those places, which, rather than promoting diversity, actually often rely on either recommendation algorithms based on data gathered from current space users, or direct suggestions from within their already established social networks. This, in turn, ends up leading to more ‘like-minded’ people frequenting particular innovation spaces, rather than nurturing diversity and constructive idea friction. Finally, the authors propose their initial study of an application to increase awareness about existing filter bubbles, as well as ways for people to learn about spaces with diverse activities, which they named *Skunkworks Finder*.

Article 10 in Section 3, by Silva, Mora and Straubhaar addresses the lack of English-language proficiency as a barrier to social interactions between Latino migrants in the USA and their broader community. Notably, the project, *¡TechComunidad!,* sought to equip working class parents with basic internet skills, while children in those communities were actually already digitally literate from school learning. Their parents – mothers, in particular – felt they were 'the dumb ones' for lacking basic Internet skills and technology understanding. As part of the project's results, parents not only gained confidence in helping their children perform well at school, but also learned how to monitor their children's performance, increasing feelings of self-worth and participation in their family's and community's lives.

Inclusion outcomes and the roles of technology

By analysing the ways researchers made use of technology in the projects presented in this Special Issue, it is clear that technology played very specific roles in addressing the digital fringe in each case – which in turn led to different outcomes for digital inclusion. Based on that, we identify four key roles technology can play in regards to promoting social inclusion, and four corresponding outcomes, as illustrated in Figure 1.

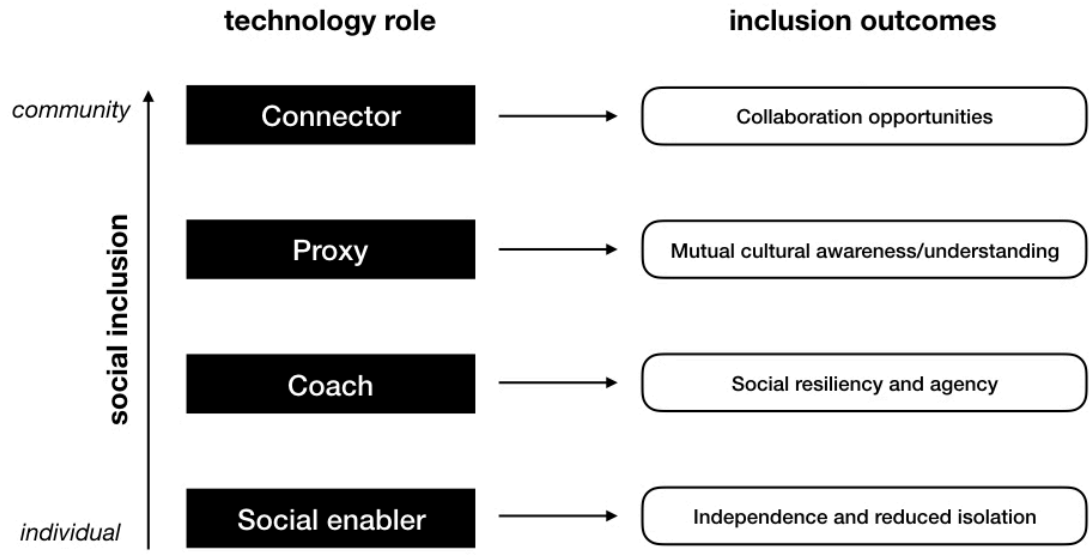

Figure 1. Technology roles and corresponding inclusion outcomes.

Notably, rather than being mutually exclusive, these roles are incremental. They address social interactions operating all the way from the 'low-level' of direct, intimate interpersonal relationships within a family or immediate neighbourhood – enabling basic social interactions – to the facilitation and mediation of interactions that nurture collective creativity, collaborations, citizenship, cultural awareness and the identification of potential new partnerships at a community level.

Table 2 illustrates the digital fringe communities (as presented in Table 1) addressed by the articles in this Special Issue, the different roles technology played in each case

(Figure 1), and the corresponding outcomes for digital inclusion within each community.

Table 2. Communities, technology roles and inclusion outcomes addressed in this volume.

Topic	Fringe communities						Technology role				Inclusion outcomes
	Geographical	Socio-economic	Age	Gender	Disability	Cultural/Ethnic	Social enabler	Coach	Proxy	Connector	
Older adults	■		■				■		■		Independence and reduced isolation Mutual cultural awareness and understanding
Children with disabilities	■		■		■			■	■		Social resiliency and agency Mutual cultural awareness and understanding
Urban and regional fringe communities	■	■	■	■		■	■		■		Independence and reduced isolation Mutual cultural awareness and understanding Collaboration opportunities

As Table 2 indicates, older adults' technology use (iPads, social media, WhatsApp) was encouraged by supporting them to leverage existing social interactions or connections with people, places, or by highlighting familiar activities undertaken in their local communities. In the case of children with disabilities technology played the role of behavioural coach, nurturing the interaction in a way that increased their self-confidence while, in the process, gathering valuable data to interpret, as a proxy, their emotions and preferences, thus informing further co-design and refinement of the solutions. In both of these scenarios, technology assists with the immediate interpersonal interactions of the lives of the individuals involved, a basic intervention to restore dignity and ensure newfound agency remains.

The design of participation aiming at urban and regional fringe communities, on the other hand, intervenes at a higher level, targeting social interactions that, once encouraged, can assist with greater cultural, creative and professional integration between different sections of society which might not have come into meaningful contact otherwise.

In addition to provide mapping between the fringe communities and the different technological roles addressed in the articles of this Special Issue, Table 2 also points out areas and 'fringe gaps' that require further research endeavours. This includes designing for people that belong to multiple fringe communities, and are therefore facing specific challenges that cannot be addressed through design strategies specifically targeting these groups individually. For instance, refugees who identify as LGBTQIA are often marginalised within their own communities, having specific reasons for leaving their existing communities. Similarly, older adults identifying as LGBTQIA often face significant disadvantage and exclusion. People with intellectual disabilities may also have complex needs such as mental health concerns, and experience significant digital

exclusion. These groups and others living on the digital fringe, are not represented in articles in this Special Issue, indeed, there is a dearth of research which addresses their experiences specifically. It is these multiple levels of disadvantage, and the increasing complexity of experiences of those living on the digital fringe, that human computer interaction researchers, designers and others should seek to learn from and address. We recognise that a 'one size fits all' approach is not appropriate when working with, or designing for these communities. Indeed, it is important that we draw upon the expertise of various practitioners, and employ sensitive and ethical design techniques (Waycott, Davis, Warr Edmonds, Taylor 2017a; Waycott et al., 2017b) and diversity in terms of existing and imagined technologies, to reflect upon the experiences of people inhabiting multiple fringe communities. The authors of this Special Issue recognise both the strides taken, and limitations to, this Special Journal focus. We view this Special Issue as a starting point in our journey.

Conclusions

The purpose of this Special Issue is to highlight the innovative efforts of researchers from distinct disciplines and interests to tackle the dilemma of digital under-participation. In particular, people who are investigating the capabilities of a variety of technologies (including apps, digital stories, and social media) to ultimately improve the experience of people living on the digital fringe.

Fostering collaboration with a variety of stakeholders can assist in addressing the generic approaches embedded in current technology design. Designing bespoke and inclusive technologies for specific fringe communities can help alleviate this global generic prejudice. Our hope is to inspire future research and professional practice that carefully considers collaboratively designing technologies that helps increase participation. This type of digital innovation is crucial in closing the gap which divides communities categorised as the digital fringe. As such, true success can be evaluated by the ability to design and embed high quality digital solutions that help to create positive systemic change for people on the digital fringe, rather than addressing issues that do not employ collaborative approaches.

As technology continues to become increasingly pervasive on a global scale, we believe that strategies to promote inclusion will be progressively more necessary. The process of inclusive design (although unique to different contexts and issues) in the case of the digital fringe, provides creative approaches to research and industry practice. The examples outlined in this Special Issue demonstrate the value of trans-disciplinary approaches, for example, collaborating with a variety of different stakeholders, and being responsive to the needs of different fringe groups. We are inspired by the dedication of the researchers who are addressing complex social problems through the use of inclusive technology that has been meaningfully and collaboratively designed.

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