Disability, Locative Media, and Complex Ubiquity

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Abstract:

The current phase of network societies has generated an intensification of pervasive, ubiquitous digital technologies and cultures of uses, with emergent, complex social functions, and politics. In this chapter, we explore a fascinating, instructive example of the actualization of such ubiquity-effects — the case of locative media technologies designed for and by people with disabilities. In the meeting of disability and locative media technology, we find an apposite, challenging example of ubiquity — its associated, emergent social practices, what their cultural implications are, and how design makes sense of this. We discuss these dynamics of complex ubiquity and disability through two case studies: way-finding locative technology, smartphones and apps; and Google Glass.

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> Disability is thus not just a health problem. It is a complex phenomenon, reflecting the interaction between features of a person's body and features of the society in which he or she lives. — World Health Organization (WHO)[1]

> Google Glass has the potential to radically impact the lives of people with disabilities. Will you partner with us in making Google Glass more accessible? — Indiegogo crowdfunding platform campaign[2]

Introduction

As this volume outlines, the current phase of network societies has generated an intensification of pervasive, ubiquitous digital technologies and cultures of uses, with emergent, complex social functions, and politics. In this chapter, we explore a fascinating, instructive example of the actualization of such ubiquity-effects — the case of locative media technologies designed for and by people with disabilities.

With their origins in developments such as global positioning satellites, cellular mobile networks, ubiquitous computing, and the socio-cultural dynamics of place-making,[3] locative media are key to the diffusion of digital technology predicated on location data.[4] Mostly overlooked in the public discussion and scholarly research on locative media such as Foursquare, Facebook Places, apps, and so on, are the many locative media technologies designed for or used by different groups of users with disabilities.

These technologies are often acclaimed for their potential to address the needs of people with disabilities, but there is little informed discussion, public debate, or critical analysis and research on their actual characteristics, potential, and implication. Notable here are the various mapping and way-finding applications, taken up by Blind users to meet a long-standing need for reliable, independent ways to navigate unfamiliar environments.

Such locative media are following in the wake of previous online and mobile technologies, including first-generation cell phones, to construct a ubiquitous environment for disabled users, wishing, in the face of various prosaic and other events in their everyday lives, to situate themselves in relation to place. More recently, wearable-computing devices such as Google Glass have been explicitly designed, marketed, and promoted as a boon for those with impairments..[5] Disability has also been a feature of the promotional discourses associated with the latest stage of autonomous vehicles — another area where Google is developing a well-publicized product, with its Driverless car.

In response to these developments, we think that important dimensions and dynamics of complex ubiquity effects are structured around power relations and lived experiences associated with impairment and disability. To explore this hypothesis, the

first part of this chapter discusses the joining of two kinds of complexity at play in these ubiquity-effects in disability-inflected locative media.

Firstly, there is the complexity of the cultural shaping of the technology, and its materialities. Disability itself has been proposed as a kind of cultural location, the specificity and dynamics of which we need to understand.[6]

Secondly, there is the complexity of disability, as it is constituted in contemporary society. In its individuation, especially, disability is never just one isolated category, but always co-dependent on a diverse range of other instantiations of class, gender, race, ethnicity, locality.[7] Disability is also historically and culturally specific.[8] In the meeting of the complexities of disability and locative media technology, we find an especially apposite, challenging example of the situation of ubiquity — what social practices emerge from it, what their cultural implications are, and how design makes sense of this. In the second part of the chapter, we discuss how these dynamics of complex ubiquity play in relation to disability through two case studies: way-finding locative media smartphones and apps; and Google Glass.

Assemblages of Locative Media

Locative media are an emergent, hybrid form of media.[9] First and foremost, locative media are characterized by a range of technologies that gather information about a device, application, or user's location, and then process this in new ways.[10] An early such technology, developed initially for military purposes, Global Positioning Technologies used satellites to pinpoint the location of a device. These GPS devices are now widely dispersed across a range of technologies and applications: transportation, including planes; cars (satellite navigation, or satnavs); handheld or portable devices for wayfinding and navigation while walking, using a wheelchair, piloting a scooter, or riding a bike; mobile phones and tablet computers. Across in many societies and wealthier groups in poorer societies, GPS now qualifies as a near ubiquitous technology that many of us now take for granted.

We have already alluded to a second major instance of locative media: the mobile phone. Rich Ling has developed a full and persuasive argument for the status of the mobile phone as a "social fact" (Émile Durkheim), a technology that, like the clock and car, is essential for belonging and participation in many societies.[11] With the communicative mobility of the mobile phone, the social and cultural innovation and use that have shaped it, and its sheer, massive diffusion (beyond seven billion subscriptions in 2014, and counting)[12] have not only meant that this technology is among the most pervasive. Rather, and significantly, with the advent of the mobile phone came a new emphasis on place and location.

Because of its portability, at least from the 1980s onwards, when the mobile phone was available in lighter, less bulky designs, the handset could be used for communication in novel places; but, also, a key theme of this new mobile communication was actually about the place and location of the user and their proximate context, and environment.[13] With camera phones especially, not to mention text messaging, users commented upon, represented, and conveyed their places of mobile presence to absent and co-present others. A new phase of such place referencing and locational predication and conjuring was entered into once mobiles had the capability to triangulate themselves using their positioning via the cellular network transmitters, switches, and nodes. Add to this, the incorporation of GPS in

mobile devices, and fully-fledged locative media was available for its domestication and appropriation in everyday life.[14] At this point, roughly circa 2005-2008, we would argue that such locative, mobile media were increasingly ubiquitous (though still far from common among many users groups, cultural settings, and societies). Moreover, this incarnation of locative media was constituted by particular kinds of complexity, not previously encountered, whether in: earlier phases of media; precursors in telephony, telecommunications, and mobile communication; or the evolution of ubiquitous computing (ubicomp)[15] or pervasive computing. We'll return to this point, and chart the more recent dynamics of complexity in newer forms of locative media. Assemblage is a vogue term in current cultural and media theory,[16] but it really fits as a shorthand description of the socio-technical complexity of locative media.[17] For our purposes here, it is interesting that disability emerges as a visible zone for design, and engagement in the formation of this assemblage of locative media in its smartphone phase, — something that it had not been earlier in the history of mobile communications.[18] As disability remains a murky topic generally, including in discussions of digital technology, culture, and media, let us briefly unpack and situate our argument about how the complexity of disability plays into the broader field of complex ubiquity effects.

The Politics of Complex Disability Effects

Thus far, we have outlined the emergence of locative media, and commenced an argument concerning its complexity. When disability meets locative media, it is important to formally note that we are encountering two major, distinct set of complexity dynamics — which of course, in actuality, are entwined. What are these two sets of complexity dynamics?

For much of the twentieth century, dominant ideas of disability were based on the medical and charity models — seeing disability as something that involved a bodily, mental, or sensory defect, or handicap, that made an individual an "invalid" (as it was once termed). As Colin Barnes notes:

> … until very recently disability was viewed almost exclusively as an individual medical problem or personal tragedy in western culture. Yet there is a wealth of anthropological and sociological evidence to suggest that societal responses to people with impairments or long- term health conditions vary considerably across time, culture and location.[19]

The negative, "deficit" approach to disability was progressively challenged, in different ways, from the 1960s onwards. Most notably, such disablism was challenged by the "social model" of disability proposed by British scholars and activists,[20] which has proven sufficiently influential to become something of an orthodoxy in recent WHO policy,[21] and in the 2006 UN Convention on the Rights of Persons with Disability.[22]

For social model theorists, disability is constituted by the social and political arrangements that are applied to, and condition the lives of, people with impairments. An impairment — vision impairment, hearing impairment, intellectual disability, Deafness, chronic conditions, bodily or genetic difference from the "norm"[23] — do not necessarily result in a person being unable to participate in society, or to need "special treatment" or segregation and exclusion. Rather, societies and their environment often needlessly disable their members, by creating barriers to access, or

not removing or modifying them, as well as relying upon narrow notions of ability.[24] This occurs in technology and its systems, as much as other kinds of environments.[25] For instance, a smartphone or tablet computer can be used by a wide range of people with disabilities, if the device, interface, applications, and so on, are designed in an appropriate way. Indeed the smartphone and tablet computer, especially Apple's iPhone and iPad are often credited with bringing about a "revolution" in accessible technology and social participation for people with disabilities.[26]

A range of scholars, commentators, and activists have noted that the existing accounts of disability — the available, still hegemonic discourses as well as new discourses based on social approaches, cultural accounts, and human rights – fall well short of grasping the peculiar, constitutive complexity of disability. Much research on disability starts from the acknowledgement of the complexity of disability and impairment. However, disability theory is in a cul-de-sac when it comes to a breakthrough in specifying the contribution that disability, in particular, makes to the complexity of social life and cultural experience generally. There are various theories that seek to provide insights into the constitutive interaction of disability with gender, race, class, ethnicity, sexuality, socio-demographics, and other categories. In sociology, one of the best-known of these is intersectionality.[27] However, there is little work available that brings together in dialogue general theories concerning complexity,[28] and theories of disability.[29]

This is not the place for an extended discussion of this topic, however we do wish to emphasize the notion that disabilities have their own complexities that are woven into the complex ubiquity effects this volume seeks to elucidate. In addition, the complex ubiquity environment, with its intensive technological systems, now plays a formative role in the contemporary experience and shaping of disability and its social relations. An obstacle to discussions here is the relative lack of attention given to disability in critical literatures on technology, especially science and technology studies (STS), something that is slowly being remedied — although there remains little research as yet on disability and ubiquitous computing, media, and digital technologies.[30] In any case, let us now turn to a discussion of early locative media to concretely establish the dynamics concerning disability and ubiquity we see at play.

Disability and Early Locative Media

For many disabled users, the advent of the mobile phone offered an important new tool to tackle many of the issues of daily life centring on communication. Because of its portability, an important attribute of the mobile phone was its ability to provide new ways to address, negotiate, construct, and conjure with location. A 2000 study noted that for one of their research subjects, "the matter of safety was a real, everyday issue because of a physical disability."[31] Other studies noted the use and potential of mobile phones for independent navigation and wayfinding.[32] As well as so-called "extrinsic" or instrumental motivations for using mobile phones, it would be very surprising if young people, or older people,[33] or indeed a range of socio-demographic categories, people with disabilities (which, of course, include all generations) did not adopt mobile phones for "intrinsic" motivations, including consumption, lifestyle, social rituals, cultural participation, gaining information and media, and so on[34] — though very little research exists on early mobile phones in the everyday lives of people with disabilities. Such everyday uses become documented by,

and legible in, the policy, scientific, and advocacy reports and research literature (cited through this chapter) on accessibility and disability with 2nd and 3rd generation mobiles phones, especially celebrated cases such as text messaging of Deaf users, hands-free facilities for users with severe dexterity and physical impairments, possibilities for Blind people and those with vision impairments with the advent of built-in screen readers for mobiles, and the expanded communicative possibilities for a wide range of people with disabilities due to the evolving affordances of mobiles.

Returning to early mobile phones, before these had location technology capability, other technologies, such as sensors, were available and used for navigation. Take for instance, the experience of Tom, a 46 year old Blind man, from Adelaide, South Australian, quoted in a 2000 study:

> Since being totally blind I feel much more traffic vulnerable, not so much getting lost or anything, just getting run over. And I have a secondary fear of actually causing injury to another pedestrian when I'm run down. So the mobility stuff [using an ultrasound sensor] is highly valued.[35]

For others, these emerging location and wayfinding sensor technologies also felt unwieldy and inappropriate. For instance, in the same study, Margie, a 24 year old Blind woman, emphasized the limitations of available locative technology — compared to the tried-and-trusted technology of a seeing-eye dog:

> A dog is far more suitable than using something like a mote sensor and a sonic pathfinder, for example, which are electronic aids that are either hand-held, or one actually sits on your head, like a head band with ear plugs and a big thing across the forehead and stuff … [I]t's socially frightening to a lot of people … Whereas, for example, to walk around with a dog is completely and utterly socially acceptable. And I think with technologies, the more obtrusive it is, the more offensive it can become to some people.[36]

As mobile phones developed to incorporate geolocalization through mobile phone networks and GPS (now standard in many phones), then to include sensors (such as in smartphones) and a wider range of interfaces (gestural, tactile and haptic, voice operated, text, and other methods), the kinds of technology development that were previously associated with a wide range of devices become focused on mobiles – precisely because the mobile phone had gained such wide user acceptance, and social taken-for-grantedness. Unlike a seeing-eye dog, the mobile phone did not in itself signify that it was a disability, or assistive technology.

Despite this potential, it took some years for mobile devices to emerge as a significant and ubiquitous locative media for users with disabilities. For instance, a 2005 paper by a key figure in accessible telecommunications and disability, John Gill, from the UK Royal National Institute, still presented a vision of location based information being mediated by a third party provider of information — rather than being delivered by mobile hardware, software, and databases, as we would expect now:

> In the event of service disruption [to public transportation], the disabled traveller needs information in an appropriate form about suitable alternative methods of reaching their destination … Mobile phones equipped with

> cameras can also be used to send visual and location information to a service centre where an operator can then guide the user to their desired destination.[37]

Nonetheless, increasingly users expected mobile phones to offer the affordances of location-based technology. For instance, GPS navigation was on the high priority request list for users with vision impairment surveyed in a 2008 Japanese survey.[38] Or, for example, a 2008 paper presented a proof of concept for a standard mobile phone with built-in camera that used algorithms to ensure a Blind or visually impaired pedestrian was guided to safely use a road crossing.[39]

Emerging locative mobile media technology was also fashioned, and marshalled, for purposes of civic action and political activism concerning disability and accessibility. The best known case here is the decade-long art project *Megafone.net*, undertaken by the Barcelona-based artist Antoni Abad, in collaboration with marginalized communities around the world, from 2004-2014. The hallmark of *Megafone.net* is its pioneering use of mobile phones as a platform to give voice to these particular communities and their experience:

> Using mobile phones they create audio recordings, videos, text and images that are immediately published on the Web. Participants transform these devices into digital megaphones, amplifying the voices of individuals and groups who are often overlooked or misrepresented in the mainstream media.[40]

In doing so, Abad pioneered the distribution and sharing of camera phones, and data, via mobile phones, before technological systems really supported doing this with the ease we now expect.[41] In particular, Abad has worked with four disability communities: people with "limited mobility" in Barcelona (2006-2013), Geneva (2008), and Montréal (2012-2013); and Blind people and people with visual impairments in Catalunya in the project *Punt de Vista Cec 2010*. A signature project was *GENÈVE*accessible 2008*, where wheelchairs users photographed obstacles in the Swiss city with GPS-equipped portable phones, and uploaded the images and data to the Internet to produce a map of the city's accessibility.[42] The *GENÈVE*accessible* project attracted widespread international attention, not only for its disability accessibility achievement — but as one of the first such projects in user-generated, "crowd-sourced" data to provide evidence and momentum for social and institutional transformation. This kind of data-intensive participatory urbanism has now become relatively commonplace.[43] For instance, IBM Sidewalks is another mobile application that has been designed to augment services such as Google Maps and Openstreetmap with disability specific information. This app relies on collaborative data collection. Citizens use the app to record and report accessibility issues around the city, labelling them as either regular, bad or terrible. The information can then be used by city administrators to correct the problem or alert others to its existence. Where accessibility issues may be obscured by pre-existing street camera views of the city, this app relies on crowdsourcing information and the participation of users switched into ubiquitous computing.[44]

Important as such design and technology experiments and developments were, the breakthrough in locative media diffusion, and thus claim to ubiquity, came with the Apple and Google smartphone technology, operating systems, and apps ecosystems. For reasons of space here, as well as its illustrative nature, we will focus

principally on Apple's iPhone. Apple had initially launched its iPhone, with a relatively inaccessible operating systems — and received severe criticism as well as legal action from the US disability movement, in particular. In 2009 Apple redesigned the iPhone for accessibility, receiving plaudits in the process. As Hollier explains "prior to the iPhone 3GS, it was largely believed that touchscreens and accessibility were mutually exclusive". [45] People with disability immediately saw the potential for accessibility information to become more widely available through crowd sourcing and locative media:

> I really hate it when we go into a restaurant and, after we've gotten settled in, I discover that I am going to need to negotiate stairs if I want to go to the restroom. Stairs are my nemesis at the moment and I would really like to know, before we go somewhere, that I won't be confronted by them. … an iPhone app [could be created] specifically for this kind of information. Like Yelp and its ilk, it would be powered by the social network, with people adding information about places that are wheelchair/cane friendly.[46]

It is no exaggeration to say that beginning with the iPhone, the disability community began seeing the potential for ubiquitous computing. Two key priorities emerge through the insights quoted above and the broader motivations of the associated research: accessibility maps and accessible maps. Firstly, the provision of accessibility maps which offer information about inaccessible environments such as damaged footpaths or other physical obstructions are identified as vital to the inclusion of people with disability in public space. Secondly, the available research identifies that much locative media is visually oriented and therefore inaccessible to people who are blind or vision impaired. There are moves also, therefore, to make these maps accessible.

A related development to locative media around wayfinding and navigation occurred in the web and Internet field — notably, in the World Wide Web Consortium (W3C) standards setting processes in 2013 where accessibility maps and accessible maps were discussed by the W4A (Web For All – the accessibility arm of the W3C; http://www.w4a). In line with the WHO definition of disability introduced in this chapter's epigraph, the W4A seeks to address the complex interaction between a person's body and the features of the society in which he or she lives. The growth and intensification of pervasive, ubiquitous digital technologies and associated cultures of use in the context of locative and wayfinding opportunities is therefore of particular interest to this standards setting group.

Consider, for instance, that people with disability are engaging in a constantly evolving technological system, sometimes while simultaneously experiencing degenerative (or changing) impairments. In her book *Claiming Disability*, disability scholar Simi Linton often writes of disability as "complex", as a complex "marker of identity," as well as the "web of social ideals, institutional structures, and government policies". An unfamiliar environment, or unexpected change in that environment (whether a broken footpath or lack of internet connectivity) is an example of the way people with disabilities must constantly reappraise their identities and what they can do depending on situations, technologies, and social expectations.. Ubiquitous locative media offers a new response to this fluidity of the lifeworld — potentially offering people with disabilities a form of prosthesis, an opportunity to re-define their

stance. Locative media, like guidedogs and canes, helps users navigate an unfamiliar environment, as it intersects with the complexity of contemporary life and identify.

Broadly speaking, the importance of information technology to people's experience of disability has been approached from two distinct traditions. The first approach has emphasized the need for specialized, often expensive technology. The second (most recent) tradition has urged the need for disability technology to be designed as part of mainstream technological systems — with the key benefit of cheaper adoption and adaptation. For instance, David Calder, a representative of the first tradition, argues that navigation devices for people who are blind or visually impaired must be developed specifically for this group to avoid problems with individual configuration.[47] By contrast, Scott Hollier, a leading proponent of the second approach, focuses on creating accessible apps for users with vision impairment by employing the mainstream features of smartphones and tablets:

> The majority of people want access to the same market-leading devices that the rest of the population use. They want to choose from the same library of apps and participate in the same activities online.48

Clearly, there are important interactions between the two traditions, as well as long-standing debates. What is notable is that the growing ubiquity of contemporary locative media is premised on mass market — but with a twist, allowing mass customization, through apps. What is especially interesting is how the contemporary experience of locative media for users with disability is leading to a re-imagining of their affordances and possibilities.

For instance, there are a range of critique of how software design encodes particular kinds of perspectives and experiences, and excludes others. For instance, in her suggestive investigation of making locative media available "to all", Tierney argues that people who use public transport are often excluded from the benefits of locative media because they belong to socially disadvantaged groups such as the unemployed. Tierney argues that maps function as a representational system conceived from the point of view of a particular social group.[49] Although she does not specifically mention disabled users, this kind of argument could be construed from a disability perspective. An obvious argument would draw attention to the visual bias in most maps, including locative media wayfinding apps — and the implications for the way that city is typically imagined, and mapped, in a visual mode and register. Such a narrow envisioning of space and maps is challenged by a range of approaches — not least those which note the importance of all senses to how our orientation in space, place, and time, especially sound and touch, but also smell (for instance, the emerging fields of sound studies, and sensory studies). In locative media, technology developers are grappling with these issues, to make cities better mappable, locable, and navigable by devices and their users. For instance, in 2014, Western Australian developer Voon-Li Chung released an android app to provide greater accessibility to people with vision impairment navigating the City of Perth public transport system.[50]
Such smartphone and tablet apps are increasingly being developed to replace guide dog or third person assistance in navigating public space. People who are blind or vision impaired are either unable to or experience significant difficulties accessing spatial information on the web such as maps because these applications are visually orientated. Innovations in locative media for users who are blind or vision impaired have shown that haptic technologies which offer non-visual means of access such as

touch sense, vibration, force feedback mouse and auditory channels can help to mitigate this.[51] Key to these innovations is the smartphone and tablet disability revolution we alluded to earlier. Smartphones and tablets are already designed to improve the visualization of web maps through features such as high definition displays, and touch screens. Given that they offer the opportunity for multimodal interactive capabilities including high definition displays and high quality touch screens, haptic technologies can theoretically be more easily introduced. However, the irony is that some, like the *StopAnnounce* app mentioned earlier, while representing important breakthroughs in accessibility restrict users to certain predefined areas of locative media possibility. Consider, instead, a recent development — Open Touch/Sound Maps — an android application that uses sonification, text to speech and vibration feedback to allow users a nonvisual way of accessing the publicly available OpenStreetMap using a mainstream, mobile device and the search functionality of Google Maps. Where previous innovations restrict users to "exploration of predefined map areas" Kaklanis et al. argue this kind of technology allows for more ubiquitous capabilities.[52] Their app uses the GPS feature common in mobile phones to retrieve pertinent information and then present it using non-visual haptic measures including different frequency sounds, and touch screen technology.

To summarize our argument, thus far, we have discussed the way in which the development of locative media has offered new tools and possibilities for dealing with the complexity of disability in everyday life. As we have outlined, experiments in using locative media to respond to disability experience have been greatly strengthened, focussed, and further catalyzed by the widespread distribution, consumption, and acceptance of the smartphone and tablet as technological systems — but also platforms for socio-technical innovation. A consequence of this ubiquity-effects of such locative media has been that the dominant sensory modes of encountering, representing, navigating, and negotiating everyday life have been contested, with new calls to acknowledge and design technology for the auditory, haptic, and other embodied aspects of contemporary life and environments.

Such a discussion can provide a context for our final case study in this chapter: Google Glass. Like the iPhone, Google Glass has been slowly launched — but already attracted intense interest. As a wearable device, and one of the oldest prostheses, a pair of eyeglasses, Glass represents a new social imaginary of ubiquitous media — in which disability is an explicit, leading aspect.

Google Glass

Google glass is a ubiquitous computing device in a pair of glasses that operates like a hands free smartphone. Users can run apps, make voice or video calls, take photos and play music. The head mounted wearable device was first introduced in April 2012, and popularized in a series of Google videos easily accessed on YouTube. An early demonstration video accompanying Google's product information features a hipster New Yorker navigating the city with the aid of his glasses, scheduling his social life via voice while on the go and receiving weather and transport updates through sight prompts. [53] In its marketing inception, the technology was interpreted as beating Apple's mobile voice technology Siri at its own game and promising new directions in augmented reality. *Time* magazine included Google Glass in its list of the best

inventions of 2012. While the Glass project is not the first example of this type of technology, it has received considerable media attention, in part due to the extensive field testing that has taken place since 2012. This careful approach to the innovation, user acceptance, and marketing is a notable feature of Glass. (Perhaps an approach informed by the design and marketing strategies Apple adopted in the remarkable success of the iPod, iPhone, and iPad.) Users applied to be part of the Glass Explorer program by responding to the twitter hashtag #ifihadglass.

Google has explicitly and prominently expressed its hopes that Glass would be beneficial for people with disabilities. For instance, Thad Starner, part of the Glass development team, describes Google Glass as reducing the time between intention and action, a mission he sees as directly benefitting people with disability.[54] Google has encouraged developers to work with users with disability, to develop potential applications. It has also approached commentators, researchers, and experts with an interest in technology and disability to gain feedback and promote positive portrayal of Google for its efforts.[55] Such efforts have yielded fruit, with significant media reporting on aspects of disability and diversity, and also connecting Glass with other devices and platforms:

> Researchers at Georgia Tech, working with Google, have discovered that a smartphone app that teaches parents to use sign language with their deaf children is used more often when integrated with the headset. Other researchers have used similar technology to help visually impaired users to crowdsource everything from whether an outfit matches to whether a child's rash needs a doctor's attention. With Glass, they can take a picture of their outfit, for example, then post it to an Internet forum for feedback.[56]

Elsewhere, prototypes apps developed with Google by Australian telco Telstra, for instance, offer new possibilities for Blind users to gain information about their everyday environment. This is reported under the title "Google Glass and Telstra Come to the Help of the Disabled":

> "OK Glass, what's this?" With four short words, 31-year-old Kelly Schulz, 97 per cent blind since birth, is given a glimpse of what's in front of her. Google's head-mounted computer snaps a photo and a reads a description into her right ear. "It is a male bathroom", a computerised voice tells her. Other times, "it is a $20 note", "a bottle of skim milk", or "a can of BBQ baked beans". Schulz trialled a prototype app on Glass for a day, and though she stresses that the best piece of technology has four legs, a wet nose and responds to the name Gallia, she says Glass has massive potential.[57]

In many ways, then, it has been very worthwhile for Google to make Glass available for users with disabilities and developers — using technology and software innovation ecologies to promote experimentation. Google also has a team in its Californian headquarters, who work in a more structured, systematic way on the accessibility of Glass.[58] How this dialectic between user and development experimentation, on the one hand, and Google's development of its product fundamentals, on the other hand, ultimately plays out is difficult to discern, at the time of writing. What is evident already, however, is a range of views among users, that at the least raise significant concerns.

One user who joined the Glass Explorer program was Lisa A. Goldstein, a journalist with profound deafness. Goldstein ultimately withdrew, writing one of the most scathing critiques of the technology describing it as "not for the hearing impaired".[59] Her review for technology website Mashable chronicles her concerns the technology would not be hearing aid accessible or able to understand a Deaf accent. She outlines the potential for communication issues on both sides given that 'When Glass speaks, there's no captioning of what it says'. By comparison, the technology has been positively reviewed by people with a range of other impairments, notably vision loss and spinal injury.

Four key themes emerge in the available disability reviews of Google Glass; firstly an increase in personal independence, or not having to rely on another person to do things such as take a picture or answer a text; secondly, the potential to participate in a more active social life, from attending bars to improved interactions in public space when people are afraid their discriminatory behaviors are being filmed; thirdly, the importance of access to a mainstream technology and finally, the opportunity to gain information in real time, whether through crowdsourcing or available databases.

Tammie Van Sant, who is paralyzed from the neck down, was also part of the Explorer program. She describes an increase in independence since using Google Glass:

> Google Glass has given me a whole new world … For 18 years, I wasn't able to take pictures whenever I wanted. I can't even describe how amazing that is. I can answer the phone and actually hear the person on the other end and they can hear me. When I get a text, I can read what the text says on the little prism and answer it.[60]

Where Goldstein was critical of Google for not taking her concerns seriously and forcing her to communicate via telephone, a clearly inaccessible medium for someone with a hearing impairment, others, such as Greg Priest-Dorman, an advisor to the project have commended the mainstream market approach. He explains that previous wearable devices were developed by medical companies or amateur hobbyists who viewed technology as disability specific without taking into consideration the preferences of the wider consumer market. Priest-Dorman focuses on the potential wearable devices hold for the self-reliance of people with disability.

> We don't need them to live — they're not breathing machines. … But it's also an amazing feeling when you don't need to be dependent on someone.[61]

Priest-Dorman's observations are a significant social comment on the social position of people with disability. Whereas disability is often thought of as a medical problem to be overcome or cured, Greg Priest-Dorman reveals the importance of devising inclusive technology as well as medical — to underpin participation in everyday life. AbilityNet's Head of Digital Inclusion, Robin Christopherson extends these ideas in his review of Glass. Like Priest-Dorman he comments on the way people with disability find ordinary, everyday activities more difficult than people without any kind of impairment:

> Technology can really help overcome those difficulties – and the more mobile, aware and intelligent that tech is the better … OK, so Google Glass only has one eye — but one eye's better than none believe me![62]

In a way the previous section also points to another type of complexity. To summarize, while still in development, Google Glass represents a fascinating yet conflicted development in disability and locative media. It has great potential, as testified by various users and developers quoted here. Yet, Glass is also presented in strikingly stereotypical ways, as yet another in a long line of technologies to bring us salvation from disability and impairment. It is unclear to us to what extent Google, with its evident good will in advancing accessibility and engaging with communities and users around disability, is tackling this burden of disability stereotypes and the implications for design and inclusion that follows. Here we would suggest it is much more useful to see Glass as a part of an evolution in ubiquitious technologies and their complex, culturally shaped co-ordinates. To place Glass in the socio-technical context of development of digital technology, via an account of locative media; but especially to see Glass through the lens of a critical disability approach to locative media is an important move in understanding the grounds and trajectories of such technology.

Conclusion

In this chapter, we have approached the question of complexity ubiquity-effects through an account of the intermingled evolution of disability and locative media technology. This discussion adds a number of important things to our understanding.

Firstly, it is clear that locative media develops in fits and starts, especially when it comes to disability and accessibility. The potential of technologies that use locative information is evident for some years before systems articulate with each other, and produce efficient, near ubiquitous and relatively easy-to-use affordances and applications. This occurs with the advent of smartphones and apps, yet even here there were many challenges and problems — something obscured in the celebration of the great strides in accessibility afforded by the iPhone and iPad.

Secondly, there is a recurrent tendency, in successive generations of digital technology to represent disability as something soon to be overcome by technical innovation. Yet, even at the most basic level of impairment type, and technical feature and capability, locative media is a work in progress — and ubiquity is an achievement not yet realized. So while Google Glass — and its generation of wearable, networked computers and sensors — are impressive in their possibility, there is little acknowledgement still that the much vaunted *complexity* of these devices needed to be articulated with the matching *complexity* of the dynamic, evolving nature of disability in the social worlds and material environments in which the technology unfolds.

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