JORSEN
Journal of Research in Special Educational Needs
nasen
Helping Everyone Achieve
An International Peer Reviewed Journal

Journal of Research in Special Educational Needs · Volume •• · Number •• · 2012 ••–••
doi: 10.1111/j.1471-3802.2011.01230.x

Technology for people, not disabilities: ensuring access and inclusion

Alan Foley and Beth A. Ferri
Syracuse University

Key words: Inclusive technology, assistive technology, accessibility, disability and technology.

The potential of technology to connect people and provide access to education, commerce, employment and entertainment has never been greater or more rapidly changing. Communication technologies and new media promise to 'revolutionize our lives' by breaking down barriers and expanding access for disabled people. Yet, it is also true that technology can create unexpected and under-critiqued forms of social exclusion for disabled people. In addition to exploring some of the ways that even (or especially) assistive technology can result in new forms of social exclusion, we also propose alternative ways of thinking about inclusive and accessible (as opposed to assistive) technology and provide some very practical ways that accessible technologies would promote greater access and flexibility for disabled students and adults. We contend that technology should be conceived of as a global, accessible and inclusive concept, not one that requires a qualifier based on who it is *for*.

Introduction: complicating the meaning of access

The potential of technology to connect people and provide a means of access to education, commerce, employment and entertainment has never been greater or more rapidly changing. Communication technologies and new media promise to 'revolutionize our lives' by breaking down barriers (Goggin and Newell, 2003, p. 13) and expanding access for disabled people[1] (Ellis and Kent, 2011, p. 2). Technology is often characterised as liberating – making up for social, educational and physical barriers to full participation in society. Often viewed in very utopian ways, technology promises to liberate us from the confines of embodiment and provide us with a futuristic antidote for impairment. Through technological advancements, disability would simply fade away or become a largely inconsequential difference.

A powerful undercurrent reflected in these assumptions is that assistive technologies in particular 'level' the playing field; however, we believe the relationship between technology and access is paradoxical. On the one hand, disabled people increasingly have access to educational opportunities that were not available to them in the past. As technologies become smaller, faster and cheaper, technology is also becoming easier to use and procure. Increasingly, the technology divide is less about access to technology and more about the deeper underlying meanings of 'access'. In other words, access is more than a bifurcation between 'haves' and 'have-nots'. To more fully capture the deeper meanings of access, we advocate a shift in the discourse on access away from binaries created by ability and performance towards notions of equity that qualify and contextualise technology-centred disparities within local and societal histories, values, languages and perceptions of success and disproportion.

For instance, although technology is typically associated with access and integration, technology can also isolate people, creating unique forms of social exclusion. These exclusions can be the results of formal, mechanistic processes, such as the discursive practices around assistive technology in primary and secondary school settings, where technology is matched prescriptively to student 'impairments'. Exclusion, however, can also be subtler. Technology, for instance, privileges particular ways of being, which are grounded in normative, social, cultural and economic practices, further reified in the design, manufacture, marketing and implementation of technology. In other words, technology is designed in ways that reflect taken-for-granted ideas about what constitutes normal.

These ideas about how we *should* operate are embedded within technology and are reflective of an ableist worldview – one that would view, for example, a cochlear implant as a 'desirable and necessary' technological advancement over deafness, which would be perceived from this vantage point as 'pathological and disabling' rather than as a linguistic minority identity reflective of a deaf culture perspective (Goggin and Newell, 2003, p. 11). As Davis (2005) in his book *Enforcing Normalcy* argues, although we might perceive a particular mode of communication as normal or natural, 'like all signifying practices, [it] is not natural but based on sets of assumptions about the body, about reality,

[1] Person-first terminology (i.e., person with a disability rather than disabled person) is considered preferable in many professional journals. The idea behind person-first terminology is that the disability should not circumvent the individual who has it. Increasingly disabled activists and academics argue that person-first terminology implies that disability is somehow a diminished aspect of the self, rather than an aspect of identity that is a source of pride. They reject person-first terminology, as do we in this paper.

and of course about power (p. 16). Thus, because technology is very much a part of the larger social context, such normative assumptions about how bodies are supposed to operate are deeply embedded in all aspects of technology. Moreover, these ideologies of ability and normalcy are so 'imbricated . . . in our thinking and practices', that we often fail to notice their 'patterns, authority, contradictions, and influence' (Siebers, 2008, p. 9).

Cyberspace, in particular, appears to offer the promise of free-flowing worlds where identity, embodiment and subjectivity can be fashioned and refashioned at will (Goggin and Newell, 2003). In online contexts, the postmodern individual can choose to inhabit different genders, racial backgrounds, sexualities and even species. Physical attributes, too, can be deliberately crafted in online contexts – allowing individuals to acquire disabilities and, just as easily, shed them. The postmodern cyberbody then, becomes more of a choice than a static reality. As such, technology promises exciting new worlds where bodily 'limitations can be transcended, and new freedoms found . . . [particularly for] people with disabilities, [who are seen as] special beneficiaries' of technology[2] (p. 110). Yet, despite all of these choices, the norms in on-line contexts often mirror (and even exaggerate) the norms of everyday society. Similar to standards of attractiveness or gender, racial and class hierarchies, disability, as constructed in on-line contexts, often replicates the social meanings of non-virtual worlds (Goggin and Newell, 2003). Again, it is impossible to separate technology from the larger social context.

In fact, instead of eliminating disability, technology often creates 'new dimensions of disability' (Goggin and Newell, 2003, p. 131). In electronic forums, for instance, disability disclosure shifts in unpredictable ways, as does what is considered an obvious (or visible) disability. In a virtual classroom environment a student with dyslexia might find that 'disclosure will be unavoidable', whereas a wheelchair user will have to consciously decide if he or she wants to disclose their disability to their on-line classmates or instructors (Ellis and Kent, 2011, p. 120). Although what are perceived to be obvious or visible disabilities shift in on-line contexts, the idea of norm or normalcy remains in place.

Despite calling into question the relevance of bodily appearance and difference, in practice virtual worlds continue to privilege the able body by conforming to the social realities and norms of the non-virtual world. In fact, the reproduction of the non-virtual world into the virtual world highlights the ways that normalcy and able-bodiedness operate as a compulsory system of identity that must be replicated, despite its inevitable impossibility (McRuer, 2006). In other words, through technology we 'enforce normalcy' (Davis, 2005), at the same time we fail to acknowledge normalcy as a fictional and unstable category, which is inherently unattainable.

Rather than assume that technology is always liberating to individuals with disabilities, in the remaining sections of this article we shift the typical focus on *assistive* technologies to explore what it might mean for all technology to be *inclusive* and *accessible*. We argue that in the ever more wired and socially networked world in which we live, the lack of accessibility in many electronic spaces create new forms of exclusion at the same time they are heralded as expanding opportunities for individuals to connect to an ever-expanding social world. By examining ways that technology creates unexpected and under-critiqued (Lanier, 2010) forms of social exclusion for disabled people, we also propose new ways of thinking about accessible (as opposed to assistive) technology. Rather than recreating a two-tier system, in which technology for disabled people is seen as specialised and specific, we advocate for a more inclusive view we are calling accessible technology, informed by disability-specific ontologies. We conclude the article with some of the practical ways that accessible technologies would promote greater access and flexibility for disabled students and adults. First, however, we will look at some of the ways that assistive technology creates subtle forms of exclusion.

Social meanings of (assistive) technology

Discourse on technology in relation to disability often focuses on the potential of assistive technology to replace human supports and allow greater independence. Thus, technology that is disability focused or designed for disabled people is often 'conceptualized as a form of "care" . . . administering to the biomedical/functional/normalizing needs of disabled bodies as commonly defined by service providers . . . and rehabilitative experts' (Campbell, 2009, p. 52) rather than disabled people themselves, who, more than any other group of individuals, have had a unique and long-standing 'erotic consubstantial liaison with technologies' (p. 45) – a relationship that could inform the development of technology for all potential users. As Davis (2002) writes, a disability-informed theory of dismodernism signals a corrective to the myths of both modernist and postmodernist views about the relationship between the body and technology. He writes that,

> *'The dismodern era ushers in the concept that difference is what all of us have in common. That identity is not fixed but malleable. That technology is not separate but part of the body. That dependence, not individual independence, is the rule.'* (p. 26)

Conversely, the assumed goal of assistive technology is 'anti-dependency' and assimilation (p. 53), reflecting ableist and normative values of independence and competence. Besides downplaying ways that technologies require their own maintenance and care, assistive technology perpetuates a myth of independence that has been critiqued by disability rights activists and scholars, who argue that

[2] Of course, there is a certain contradiction in relying on science or technology to resolve or ameliorate the very problems that were created or constructed by science in the first place (Sheldon, 2004). It should also be noted that utopian thinking, as evidenced by the many utopian movements and communities that sprung up in the United States during the 18th and 19th centuries, often shared elements of eugenic thinking.

perceiving disabled people as dependent obscures the myriad ways that all people are interdependent on one another and on technology.

Disabled people are using a range of online tools and technologies to subvert mainstream media's representation of disability, to counter negative stereotypes and to 'offer more complex realities of disability' (Ellis and Kent, 2011, p. 56) and new forums for activism. Through digital media, blogs, social networking, Second Life and YouTube, disabled people are finding a wider audience for counter narratives that talk back and subvert mainstream representations of disability (Ellis and Kent, 2011; Sheldon, 2004). An article in Wired magazine illustrates the ways people are using technology to challenge notions of identity (Wolman, 2008). The article describes how adults labelled as Autistic are using technology to challenge essentialising and deficit-based understandings of autism and to illustrate alternative models of intelligence and cognition. Amanda Baggs, a woman who identifies as Autistic, used YouTube to post videos, like one called 'In My Language'[3], to demonstrate more nuanced representations of people with autism to the larger community. Baggs points out the irony in the assumption that her typical engagement with the world around her, which involves ongoing tactile, kinaesthetic and auditory interaction with her environment, is often characterised as being in a 'world of her own' or 'trapped in her mind'. She counters that, 'whereas if I interact with a much more limited set of responses and only react to a limited part of my surroundings [specifically language], people claim that I am opening up to true interaction with the world' (Baggs, 2007). Uses of video, like Baggs', can be effective in challenging normative assumptions that presume that a person labelled with autism who cannot verbally communicate is not intelligent. The capacity of individuals to represent the complexity of their lives and subjectivities should raise questions about testing intelligence with tools predicated on verbal communication.

Yet, although virtual worlds offer much potential for disability-based consciousness raising and politicisation (Ellis and Kent, 2011), they also pose navigational and accessibility challenges to many users with disabilities. For instance, many online forums fail to meet accessibility guidelines (i.e., Twitter, for instance, continues to be inaccessible). Websites, as well as various forms of hardware and software, are often quite inaccessible, particularly for blind or visually impaired users. Moreover, we have barely scratched the surface in terms of thinking about web accessibility for individuals with cognitive disabilities (Braddock, Rissolo and Thompson et al., 2004).

Moreover, given that disabled people, as a result of longstanding inequality, have one of the lowest rates of education and highest rates of unemployment, as social networking sites continue to become ubiquitous in our daily lives, so too does the cost of exclusion from these contexts (Ellis and Kent, 2011), whether that exclusion is based on social, educational, economic or technological barriers. Söderström and Ytterhus (2010) note, 'In the ever more wired and socially networked world of teenagers', where the "speed of peers" digital exchanges . . . [and the] graphic nature of on-line interfaces and games' (p. 313) pose multiple challenges to access, the lack of access to these spaces create new forms of social isolation for youth with disabilities.

Despite these and other aspects of inaccessibility, the persistent and 'stubborn belief that technologies are liberating for their projected user' (Goggin and Newell, 2003, p. 41) is a very difficult idea to dislodge. In fact, so complete is the perceived power of technology that coverage of disabled athletes, for instance, often leads to questions about whether technologies create an unfair advantage to disabled athletes. These stories often pivot on the uneasy notion that technology will not simply ameliorate impairment but that the techno-body, if unrestrained, might actually surpass human capacity. In a *New York Times* article focusing on whether South African runner Oscar Pistorius[4] should be allowed to compete in the 2008 Beijing Olympics, the reporter asks:

> *'Do prosthetic legs simply level the playing field for Pistorius, compensating for his disability, or do they give him an inequitable edge via what some call techno-doping? . . . "With all due respect, we cannot accept something that provides advantages," said Elio Locatelli of Italy, the director of development for the I.A.A.F., urging Pistorius to concentrate on the Paralympics that will follow the Olympics in Beijing. "It affects the purity of sport. Next will be another device where people can fly with something on their back." '* (Longman, 2007)

Another article (Clarey, 2011) suggests that officials voiced a concern that his prosthetics will pose a danger to himself or to other runners. Thus, although technology can be seen as eliminating barriers to this athlete's full participation at the highest level of his sport, the idea that he is somehow *too good* or *too dangerous* to compete with his non-disabled peers leads the Italian official to conclude that he actually belongs in the Paralympics, not the Olympics. Moreover, disability is characterised as contaminating the 'purity' of sport by an Italian official – particularly disheartening coming from a country known for its commitment to inclusive education. Here, social barriers ensure exclusion even after physical barriers are transcended.

Technology as a cultural practice

By examining technology as a cultural practice, we highlight ways that it privileges particular ways of being, which are grounded in normative, social, cultural and economic practices, and, further reified in the design, manufacture, marketing and implementation of technology. Many of the questions we raise are not so much technological but

[3] http://www.youtube.com/watch?v=JnylM1hI2jc.

[4] Pistorius is a South African runner and a double amputee who sought to qualify for the 2008 Beijing Olympics.

political (Goggin and Newell, 2003). Thus, while it would be disingenuous to claim that there is no libratory potential in technological advancements, we cannot ignore ways that technology can and often does replicate many of the same social exclusions and normative thinking operating in the rest of society. As Ellis and Kent (2011) argue, we must address the 'trend in digital design where socially constructed features from the analog world are migrated to the digital environment' (p. 39).

An example of this tendency to migrate socially constructed features from the analog to the digital can be seen in a controversy and lawsuit surrounding the Amazon Kindle in the USA (Blumenstein, 2010). A lawsuit filed by the National Federation of the Blind (NFB) and the American Council of the Blind (ACB) against four American universities considered whether adopting the Kindle e-reader as a means of distributing electronic textbooks to its students was discriminatory. In this case, both technical design of the Kindle device (including assumptions about its use) and understandings of providing access for university students with disabilities were at stake.

As a technology, the Kindle was touted to feature text-to-speech or spoken text technology that could read textbooks aloud. This feature of the Kindle would potentially provide important access to both blind users, as well as to individuals with other print and learning disabilities. Yet, the actual user interface of the Kindle (i.e., its menus) was inaccessible to blind users. This lack of basic functionality made it impossible for blind users to purchase books from the Kindle store, to select a book to read or even to *turn on* the text-to-speech feature. In this case, as in many, technology was not the issue. Spoken text is a proven and widely used technology. The political, ideological and social understandings of technology use that shaped the Kindle's design were the very cause of its inaccessibility. Although spoken text was built in to the Kindle, it was never designed with users with disabilities in mind. Instead, the inclusion of this functionality was presumably included to provide a talking interface for mobile users (e.g., while driving). Because of this, spoken text was not implemented to support the spoken interface familiar to many assistive technology users. The inclusion of text-to-speech also fell into a grey area regarding copyright – publishers felt that text-to-speech represented a different form of presentation for which they could not control pricing or distribution. As a result, publishers were given control over whether a text could be accessed via text-to-speech or not.

The decision to use the Kindle on a university campus as a way to distribute textbooks represents an approach to technology use that continues to assume that technology use for students with disabilities will be addressed exclusively through accommodations and alternate formats. In response to the lawsuit, Stephen Kuusisto (2009) noted on his blog:

> *'American higher education still imagines that the Victorian approach to disability is acceptable–that the disabled are taken care of by people who will read to them in the dark or laboriously turn their books into tape recordings or Braille. . . . We know for instance that college administrators who imagine that accessibility is merely an inconvenience and that they can pass along the issue to others are ignoring the ADA and many state laws. But they do so with the built in assurance that the rehab model is acceptable. Someone else will retrofit inaccessible learning environments or physical facilities and assure accessibility for the blind or the wheelchair users or the deaf or what have you. Those "rehab people" will take care of that.'* (Kuusisto, para. 3)

Part of this work involves examining how individuals with disabilities are constructed and reproduced based on taken-for-granted assumptions about ability and disability. For instance, as stated earlier, the belief that technology affords greater independence and an ability to transcend the body, run counter to disability studies scholars, and activists who have insisted that interdependence and different ways of being in the world should be perceived as equally valid. Assistive technology also places a higher value on technological, rather than human supports (Sheldon, 2004), which may or may not reflect the desires or preferences of the user. The push for technological answers to inaccessibility also represents a shift from the responsibility of society to remove barriers to full participation in society, to requiring individuals with disabilities to submit to a technological 'fix' (Sheldon, 2004, p. 156). As stated earlier, assistive technology could be thought of as promoting a form of what McRuer (2006) calls 'compulsory ablebodieness', wherein individuals are compelled to rely on technology to approximate able body norms rather than push the boundaries of what is considered normal. This kind of thinking also ensures that there is technology that is designed *for* disabled people and technology designed for *presumed* non-disabled people; and more importantly, that the latter need not be accessible *because* of the former.

Beyond inaccessible websites, media and electronic forums, technology can also result in unexpected and often subtle forms of exclusion. Less visible, for instance, are the ways technology can isolate people, creating unique forms of social exclusion. Exclusion can result from schools or universities (or even employers) sidestepping the need for brick and mortar accessibility by increasingly relying on technological fixes to make up for physical inaccessibility. When a student is encouraged (or required) to take an online course rather than a course on campus, that students risks being further isolated from social opportunities available to students who take courses on campus. Exclusion can also manifest in ways that accessibility is approached as a retrofit or add on to accessibility rather than being an integral part of the roll out (Ellis and Kent, 2011). Besides being more costly, this model means that accessible options are always one step behind whatever technology is being developed for mainstream markets. For example, video games played on consoles like the Wii or XBOX require specialised modifications to be made accessible – always after the fact. Moreover, 'by accepting systemic

inaccessibility, people with disabilities are manipulated into reaffirming . . . "normality" ' (Ellis and Kent, 2011, p. 15). In other words, technology is for what Garland-Thomson (1996) calls, normates, and only through additional efforts can technology be made accessible to disabled people.

We would argue that social inclusion must be a key consideration when technology is developed. There are many examples of accessibility efforts that fail to consider social inclusion. For instance, a colleague shared a story about a student group at her public university that organised a protest when the wheelchair accessible section of a new hockey stadium was placed far from the student section, meaning that disabled students were denied access to their peers and the raucous celebration that typically ensues in that section during games. Similarly, 'handicapped' sections of theatres or stadiums are often separate and assume that non-disabled and disabled people will not attend an event together. Accessible vans that have a policy of only picking up disabled passengers make it difficult for users to go on a date with or go to a party with friends who are not disabled. Again, these oversights are instructive because they reveal much about the taken-for-granted ways of thinking about disabled people as friends, lovers and members of their communities.

From assistive to accessible technology

Rather than relying on static and outdated definitions of disability and technology or conflating disability with assistive technology, there is a need to understand disability and technology more fluidly and responsively. By offering a vision of accessible technology, as opposed to assistive technology, our aim is promote thinking about technology for *people* rather than for *disability*. In other words, we should be talking about technology as a global, accessible and inclusive concept, not one that requires a qualifier based on who it is *for*. This would mean that we would not have one kind of technology designed only for some of us and another form of technology that must be redesigned or reworked to make it accessible for the rest of us.[5]

Despite the almost universal assumption that technology is a liberating force for disabled people, technology and electronic formats are often inaccessible or only partially accessible. Accessibility, by definition, is about ensuring access to online or digital information by making specific accommodations for particular disabilities or, more specifically, to the types of technologies that individuals with disabilities would presumably use.[6] Increasingly, advanced technology systems are being deployed to facilitate and support educational experiences. These technologies can be formal instructional technologies, like Blackboard or other course management systems (e.g., Moodle). Although higher education would represent a continuum in terms of use and scope of technology, it is rare to find a university or college course without some technology component.

While these systems are becoming ubiquitous, they have been developed with little functional understanding of disability. This results in technology development that does not work for many people, including disabled people. For example, in an analysis of a number of predominant online educational tools, a study by the AFB (Kelly, 2008) found that almost one third of respondents (N = ~100) who used assistive technology to access online educational tools reported that the experience was either unreliable or inconsistent, if they were able to access or use the tool at all. Thus, although the lack of access to the Internet has become all but unthinkable, many disabled people continue to experience a host of barriers. A recent survey by the Pew Research Center's Internet and American Life Project, for instance, reported that only 'Fifty-four percent of adults living with a disability use the Internet, compared with 81% of adults' who do not identify as disabled (Fox, 2011, p. 3). This held true even when demographic variables (such as age, education level and income) were controlled.

Yet, many of the so-called accommodations that make the web more accessible for disabled users enhance its use for all users. For example, keyboard navigability increases the speed of input for any user. Captioning of content provides access in noisy environments (or places where quiet is enforced). Captioned content is also beneficial for people trying to learn a language, those who are visual learners or those who learn best when presented content through more than one mode of delivery. And, text transcripts from captioning can be indexed and archived, facilitating accurate and comprehensive archiving of information.

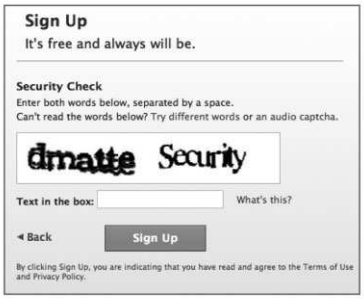
It is also true that accessibility features that are designed for one group of users can inadvertently cause problems for another group of users. A classic example is curb cuts, which are helpful for wheelchair users (as well as people using strollers or wheeled suitcases) but can create challenges for blind people who rely on curbs to help navigate. Similarly, access features for individuals who use screen readers that are heavily text based can pose difficulties for users with intellectual and print-based learning disabilities. Thus, a significant problem with Universal Design (UD) is that it suggests the possibility of *universal* access, even when products that have gone through a UD design process might not be universally accessible in practice. Moreover, the UD process rarely requires that designers engage or involve disabled people in the design process itself.

There are many concrete ways in which technology determines our interaction with it. Limitations within technology are often a reflection of the values of those who design, implement and maintain technology applications. For

[5] Our ideas here are analogous to the concept of inclusive classrooms, which are meant to be welcoming of all learners, regardless of ability or disability. Ideally, all classrooms would be inclusive classrooms – eliminating the need for a qualifier to designate which classrooms are and are not inclusive. Similarly, we are using the term, accessible technology but are actually arguing for all technology to be inclusive and accessible – at which point there would be no need for the qualifier, accessible.

[6] Again, what kinds of technology are coded as being for disabled people versus those that are seen as being for everyone else reflects normative and ableist assumptions.

Figure 1: CAPTCHA verification on the Facebook registration page



example, the decision to utilise CAPTCHA,[7] a visual verification tool used to keep spam out of sites that provide online services, makes it very difficult with someone with a visual disability (or a reading disability even) to join sites, such as Facebook, without assistance. CAPTCHA requires users to retype blurred and distorted characters to ensure an actual human is accessing the site (Figure 1).

However, this seemingly innocuous tool for 'telling humans and computers apart therefore rests on a very narrow definition of humanness', which presents a 'significant hurdle' for blind or visually impaired users who use screen readers or Lynx, which cannot decipher these characters (Ellis and Kent, 2011, p. 48).

Assistive technology routinely operates from a deficit-based, medical model orientation, resulting in an 'apartheid of "special needs" ' (Goggin and Newell, 2003, p. 136). In addition to dividing technology into assistive and presumably 'regular' or 'generic' technology, these divisions are ingrained in much deeper ways. Recreating an Internet search by Goggin and Newell (2003), for instance, is instructive in this regard. A recent Google search for the term 'blind', resulted in a Wikipedia entry and a website for a skateboard brand, followed by links to a local service provider for the blind, a New York state commission on blindness and two major associations for the blind. As a comparison, a similar search for terms like 'gay, lesbian, and transgender' or 'Latino or Latina' resulted in very different 'hits'. Here, after the ubiquitous Wikipedia link, were links to local community groups, activist and political sites, etc. The point here is that disability is still very much tied to charity and medical model discourses, even within electronic spaces. Websites focusing on managing, treating, rehabilitating, remediating or preventing disability predominate despite a burgeoning awareness of disability culture and disability studies scholarship.

Thinking about disability within the context of technology provides a useful lens for understanding issues of identity and exclusion because, as Roulstone (1998) notes, 'the way that new technology is experienced cannot be understood in a social and theoretical vacuum' (p. 7). As a result of medical model thinking, technology often carries very different social meanings depending on the assumed user of the technology. The social meanings associated with particular types of technology can play a large role in determining how readily technology will be taken up by users and may ultimately explain why many assistive technologies are rejected by youth with disabilities (Söderström and Ytterhus, 2010). For instance, technology used by non-disabled people is often associated with competence, belonging, freedom and independence. Conversely, assistive or disability-focused technologies are more likely to be associated with restriction, difference and dependency (Söderström and Ytterhus, 2010). Disability is often perceived as something that must be discretely identified and accommodated rather than embraced. Moreover, it is assumed that an assistive technology user is seeking assimilation or the approximation of normalcy.

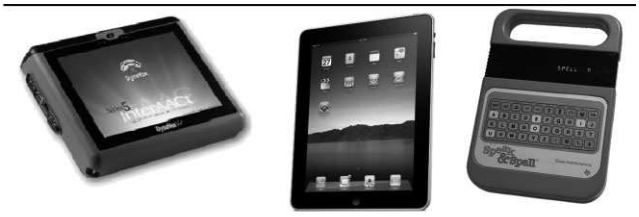
Unfortunately, by the time an accessible version is developed, mainstream technology has often been updated or otherwise changed. In other words, 'Assistive technology will always assist something that already exists' (Söderström and Ytterhus, 2010, p. 313). Despite the fact that technology rarely stands still for long, it is also true that a lot of technology starts off more accessible than later iterations. Internet Explorer, for example, had fewer accessibility features than earlier versions (Ellis and Kent, 2011). Obviously, ensuring that all technology (new as well any update) is made as accessible as possible from the start would eliminate the lag time between the two.

The retrofit model also results in outdated and inadequate technology solutions. In a typical product development environment, retrofitting materials and developing additional functionality after the fact is costly and usually ineffective. Moreover, depending on the materials being used, the cost of retrofitting can be prohibitive, leaving the user with few options. In addition to the issue of cost, the delay in accessible or appropriate course material, for instance, often disadvantages disabled students and risks subjecting them to stigma (Foley, 2007).

As stated, technology is often seen as an alternative to bricks and mortar accessibility. Distance learning, for example, offers an alternative to place-specific classes. Internet technologies provide access to a wide range of assistive technologies. Online courses are also appealing to educational institutions as sources of revenue, and faculty are increasingly encouraged to develop online courses. Because online learning environments are typically not created with the intention of serving disabled students (or faculty), any need to accommodate a disabled person is unexpected, resulting in an additional expense. A deaf student, for example, who normally takes courses on campus but decides to take a course that uses video delivered over the web, presents a financial challenge when pre-produced video must be captioned. Thus, it remains to

[7] Completely Automated Public Turing test to tell Computers and Humans Apart (http://www.captcha.net/).

Figure 2: Price and design of assistive and mass-market technologies



Dedicated AAC Device	iPad	Speak&Spell™
$6000+	$600	

be seen whether students with disabilities will be pushed into electronic learning or whether electronic learning contexts will result in greater access or new forms exclusion.

As stated, because of the very different social meanings associated with technology that is considered 'assistive', many youth end up rejecting technologies that carry this stigma. Compared to other types of technologies, assistive technology carries very different symbolic meanings as well as social costs (Söderström and Ytterhus, 2010). Thus, technologies often take on inherently contradictory sets of associations depending on whether technology is coded as 'assistive' or not. Technologies designed for use by disabled people often look like they were designed for children or carry other markers that signify disability in some way. While mass-market technologies have consistently become more 'stylish', assistive technologies frequently do not have what we might call the 'cool factor'. As identity markers, the symbolic values and identities associated with various types of technologies play a huge role in determining how readily individuals embrace them. The rate of assistive technology abandonment or discontinued use of assistive technology is reported as high as 30% in adults (Scherer, 2004). There is no comprehensive literature on assistive technology abandonment rates by children or youth with disabilities; however, anecdotal evidence suggests a high abandonment rate among these users compared to 'typical' users.

In comparison to technologies coded as 'assistive', the iPhone/iPod Touch has become a fashion accessory and the iPad is not far behind. Despite their versatility, these technologies are not marked by what we'd call the 'Speak & Spell effect' Speak&Spell™. In other words, they don't look like they were designed for a child or a person with special needs (Figure 2).

This example illustrates that assistive technology is not designed in the same way that mass-market technology is designed. Whereas, mass-market technologies are typically designed for broad (non-disabled) audiences, assistive technology is designed around assumptions about disabilities and disabled users that may or may not be accurate. For example, a dedicated augmentative or assistive communication (AAC) device, which costs over $6000, is 'toughened' ostensibly to withstand the rough use of a disabled person. An iPad costing about $600 (plus $200–$300 in specialised apps) can provide the same functionality (Figure 2). Moreover, the iPad can also be placed in a protective case that offers almost as much 'protection' as the specialised device. Yet, by investing six or seven thousand dollars in a dedicated device, assistive technology users are 'committing' to technology that has been designed with very particular ideas about who disabled users are and what they need or want in a device.

A technology's success and popularity is often related to its transparency. Thus, although an iPhone may be considered a fashion accessory, its user interface would still be considered 'transparent'. Using an iPhone requires little effort (to learn and use), which follows a famous technology design maxim that insists that 'tools should be noticed only when they break' (Norman, 1998, p. 243). Mass-market technologies are also typically designed to be 'disposable'. Because the rate of technological change is so rapid, today's technology is expected to be obsolete in a fraction of the time that it did a few years ago. Futurist and inventor Ray Kurzweil notes that a person in Kenya with a mobile phone has more access to information than the president of the United States did a decade ago. Kurzweil recalls working with a computer at MIT in the 1960s that was the size of a whole room. Today, the technology in mobile phones is 100 times smaller and 100 times more powerful than the huge computers from the 1960s (Ptolemy, 2009). A somewhat cynical reason given for the disposability of technology is that technology is big business: If technology does not become obsolete, then people will not replace it.

Eyeglasses are a good example of how a technology designed to ameliorate a problem can also become fashionable. Furthermore, conceptualisations of disability are rarely static. What is considered a disability changes in different social and historical contexts (e.g., Foucault and Gordon 1980). Pullin (2009) notes that the fact that mild visual impairment is not considered to be a disability, whereas mild hearing loss is, is a sign of the success of eyeglasses. Despite their current status as fashion accessories, glasses were classified as medical appliances in Britain in the 1930s and specifically designed not to be stylish.

The ways in which technology is being developed and disseminated are changing. Contemporary technologies often are both functional and aesthetic–fashion accessories. Both the pace of change and the tendency to focus on trends to meet niche markets results in technology being perceived as 'immune' from a broader ideology. Reflective of other types of binary thinking about difference, ability and disability are also perceived as static and mutually exclusive constructs. However, as Sheldon (2004) notes, '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' (p. 155).

Accessibility, in terms of technology, too often follows a reactive (Söderström and Ytterhus, 2010) or retrofit model,

rather than building in access from the beginning, a stated goal of approaches like Universal Design. Given the rapid changes in development and implementation, technology often outpaces accessibility standards, leaving accessibility issues to be addressed as they arise. Likewise, there is a tendency to promote disability-specific solutions, creating a two-tier system (Sheldon, 2004) that replicates the ways educational systems are divided into general and special education.

Precedent for a more accessible and inclusive conceptualisation of technology can already be seen in aspects of the technology market. Assistive technology can be designed to look as 'cool' as any other technology. Additionally, technology designed for disability does not have to be segregated to any particular market. In fact, there are many examples of the crossover appeal of technologies for disabled users,[8] making it difficult to draw a hard and fast line between what is and is not considered assistive technology. Pullin (2009) argues that disability can inform design and celebrate disability, rather than try to mask it or package it into preconceived notions of dis/ability. Skrtic (1991), too, insists that disability should be seen as offering a useful aspect of complexity that, if embraced, would lead to innovation.

Conclusion

Rather than designing technology around impairment or relying on a retrofit model, we argue that people's relationship to technology must be understood in a larger social, historical and cultural context. Moving beyond merely accommodating disabled people, accessible and inclusive technology would encompass a range of social and technical approaches to technology. In this conclusion we lay out some of these practices.

First, similar to universal design, accessible and inclusive technology would build in accessibility from the start rather than try to retrofit after the fact or make accommodations. Taking universal design one step further, by including disabled people in all aspects of the design, development, implementation and marketing of technologies, the aim would be to develop technology that is both accessible and responsive. Accessible technologies would not be seen as a replacement for, but rather a way to augment brick and mortar accessibility, thereby creating multiple points of access for all users. This approach would consider the needs of those with cognitive, sensory and physical disabilities as important sources of diversity and complexity necessary to inform the design of technology to increase accessibility and usability for all users.

Second, accessible and inclusive technology would offer the opportunity to 're-crip' technology by honouring and valuing interdependence and different, disability-specific ways of being in the world. Thus, even in designing specialised technology, an accessible and inclusive approach would aim to enhance the 'cool' factor. Accessible technology would also be grounded in the understanding that technology cannot be isolated from the social context, and the knowledge that if technology is to reduce social isolation, it must be designed with social inclusion in mind.

The time is right for technology to be re-imagined without qualifiers (i.e., assistive, inclusive or accessible). A report by the US Census Bureau reported about 18% of the US population as having some form of disability in 2002 (U.S. Census Bureau, 2006). While this figure represents a significant portion of the population, it does not take into account the fluid nature of disability (i.e., temporary or episodic disabilities). For example someone with a broken wrist may have difficulty using a mouse but still needs to be able to use technology to meet the day-to-day requirements of their job. Similarly, as we age, most of us will experience disability of some kind (around 72% US population over 80 years old has a disability). Thus, accessible and inclusive technology is about more than just 'opening doors', it is also about keeping them open. We must consider that disabled people will always be users of any and all technologies, and that it is the responsibility of designers and technology makers to consider access and not assume access will be retrofitted later.

The growth of the Internet, and the explosion of small and powerful devices like tablets and smart phones, has changed the ways people communicate, teach, work and learn, while at the same time increasing the isolation of those who do not have access to information technologies, Access is becoming a higher-stake issue – we cannot wait for an accessible patch or Band-Aid.

[8] The best example of this crossover can be see in closed and opening captioning which is now widely used in gyms, airports and other noisy environments where people might have difficulty hearing audio. Anyone who has pushed a shopping cart out of a grocery store can attest to the value of automatic doors and ramps cut into curbs. Similarly, accessible Web design creates pages that are often easier more readable, easier to navigate and faster to download.

Address for correspondence
Alan Foley,
332 Huntington Hall,
Syracuse University,
Syracuse,
NY 13244,
USA.
Email: afoley@syr.edu.

References

Baggs, A. (2007) 'In my language.' [Video]. <http://www.youtube.com/watch?v=JnylM1hI2jc> (accessed 6 January 2012).

Blumenstein, L. (2010) 'Four universities settle suit over accessibility to Kindle for the blind.' <http://www.libraryjournal.com/article/CA6716860.html> (accessed 17 August 2011).

Braddock, D., Rissolo, M. C., Thompson, M. & Bell, R. (2004) 'Emerging technologies and cognitive

disability.' *Journal of Special Education Technology*, 19 (4). <http://www.colemaninstitute.org/article_braddock_1.pdf> (accessed 7 January 2012).

Campbell, F. K. (2009) *Contours of Ableism: The Production of Disability and Abledness*. New York: Palgrave.

Clarey, C. (2011) 'At worlds, sprinter faces possible hurdle.' *New York Times*. D1. <http://www.nytimes.com/2011/08/27/sports/amputee-sprinter-to-make-history.html> (accessed 8 January 2012).

Davis, L. J. (2002) *Bending over Backwards: Disability, Dismodernism & Other Difficult Positions*. New York: New York University Press.

Davis, L. J. (2005) *Enforcing Normalcy: Disability, Deafness, and the Body*. London & New York: Verso.

Ellis, K. & Kent, M. (2011) *Disability and New Media*. New York: Routledge.

Foley, A. (2007) 'Informing instructional technologies: re-readings of policy, practice, and design.' In S. Danforth & S. Gabel (eds), *Vital Questions Facing Disability Studies in Education*, pp. 237–52. New York: Peter Lang.

Foucault, M. & Gordon, C. (1980) *Power/Knowledge: Selected Interviews and Other Writings, 1972–1977*, (1st American ed.), pp. 166–82. New York: Pantheon Books.

Fox, S. (2011) *Americans Living with Disability and Their Technology Profile*. Washington, D.C.: Pew Research Center Internet & American Life Project.

Garland-Thomson, R. (1996) *Extraordinary Bodies: Figuring Disability in American Culture and Literature*. New York: Columbia University Press.

Goggin, G. & Newell, C. (2003) *Digital Disability: The Social Construction of Disability in New Media*. Lanham, MD: Rowman & Littlefield.

Kelly, S. (2008) 'Distance learning: how accessible are online educational tools.' <http://www.afb.org/Section.asp?SectionID=3&TopicID=138&DocumentID=4492> (accessed 20 August 2011).

Kuusisto, S. (2009) 'Higher education's studied indifference to people with disabilities reflects the 'Rehab Model' ad nauseum.' <http://www.planet-of-the-blind.com/2009/07/higher-educations-studied-indifference-to-people-with-disabilities-reflects-the-rehab-model-ad-nauseum.html> (accessed 20 August 2011).

Lanier, J. (2010) *You Are Not a Gadget : A Manifesto*. (1st edn). New York: Alfred A. Knopf.

Longman, J. (2007) 'An amputee sprinter: is he disabled or too-abled?' *New York Times*. <http://www.nytimes.com/2007/05/15/sports/othersports/15runner.html?pagewanted=1> (accessed 6 January 2012).

McRuer, R. (2006) *Crip Theory: Cultural Signs of Queerness and Disability*. New York: New York University Press.

Norman, D. A. (1998) *The Invisible Computer : Why Good Products Can Fail, the Personal Computer Is So Complex, and Information Appliances Are the Solution*. Cambridge, MA: MIT Press.

Ptolemy, R. B. (2009) Transcendent Man [Film]. USA.

Pullin, G. (2009) *Design Meets Disability*. Cambridge, MA: MIT Press.

Roulstone, A. (1998) *Enabling Technology : Disabled People, Work, and New Technology*. Philadelphia, PA: Open University.

Scherer, M. J. (2004) *Connecting to LEARN: Educational and Assistive Technology for People with Disabilities*. Washington, D.C.: American Psychological Association (APA) Books.

Sheldon, A. (2004) 'Changing technology.' In J. Swain, S. French, C. Barnes & C. Thomas (eds), *Disabling Barriers: Enabling Environments*, pp. 155–60. London: Sage.

Siebers, T. (2008) *Disability Theory*. Ann Arbor, MI: University of Michigan Press.

Skrtic, T. (1991) 'The special education paradox: equity as the way to excellence.' *Harvard Educational Review*, 61 (2), pp. 148–206.

Söderström, S. & Ytterhus, B. (2010) 'The use and non-use of assistive technologies from the world of information and communication technology by visually impaired young people: a walk on the tightrope of peer inclusion.' *Disability & Society*, 25 (3), pp. 303–15.

U.S. Census Bureau (2006) 'More than 50 million Americans report some level of disability.' [Online]. U.S. Census Bureau. <http://www.census.gov/newsroom/releases/archives/aging_population/cb06-71.html> (accessed 25 August 2011).

Wolman, D. (2008) 'The truth about autism: scientists reconsider what they think they know.' *Wired*. <http://www.wired.com/medtech/health/magazine/16-03/ff_autism?currentPage=1> (accessed 10 November 2010)