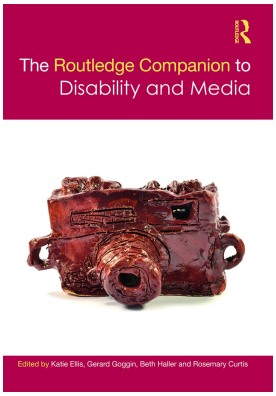

The Routledge Companion to Disability and Media

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Making the Web More Interactive and Accessible for Blind People

Publication details
https://www.routledgehandbooks.com/doi/10.4324/9781315716008-24
Jonathan Lazar, Brian Wentz
Published online on: 20 Nov 2019

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MAKING THE WEB MORE INTERACTIVE AND ACCESSIBLE FOR BLIND PEOPLE

Jonathan Lazar and Brian Wentz

Introduction

It is estimated that 15 percent of the world population (over 1 billion people) have some form of disability.[1] With regards to vision, 188.5 million people globally are estimated to have mild vision impairment, 216.6 million to have moderate to severe vision impairment, and 36 million people are estimated to be blind.[2] Within the United States, the adult disability community numbers 61.4 million, with vision impairment representing approximately 4.6 percent of adults with disabilities.[3]

Accessibility refers to the technical ability required for an individual with a disability to access technology. Many researchers and users would also point out that truly equal access doesn't only mean technical access, it also means equivalent ease of use (usability). So, a task that would take visual people 3 minutes to complete, shouldn't take blind people 30 minutes to complete. Even if it is technically accessible, the access should also be equivalent. Many people with disabilities use assistive technologies (alternate forms of input and output), to access websites, applications, operating systems and other media, which must be built to be flexible enough to work with the various assistive technologies. Many of the accessibility improvements that increase access for blind users extend to other disabilities as well. However, the focus of this chapter is on accessibility for blind individuals. A majority of blind users utilize a screen reader to access the Web, which takes the content that appears on the computer screen, and provides computer-synthesized speech output, typically in a linear manner that is based on the HTML design of the website. Some blind users also utilize refreshable Braille, but since Braille literacy is low and refreshable Braille displays are expensive, this option is used less often than screen readers. Technical guidelines for accessibility (for example, the Web Content Accessibility Guidelines) are now well established, and there are a variety of informational resources on accessible design that are available to web developers, which clearly explain how to make websites accessible to people with disabilities.

Screen readers (software that reads the visual content of a software interface or web page audibly to a user) are a primary type of assistive technology utilized by users who are blind or have low vision. However, a long-standing challenge and sometimes barrier to this same assistive technology is the financial cost involved with purchasing and maintaining the support or updates to

that technology. For example, a blind user wishing to use one of the most common screen-reader applications (JAWS) needed to invest approximately USD 900–1,100 in that technology on top of the purchase price of a laptop or desktop computer with which to use it. Apple changed the dynamics of this quandary with the introduction of its screen reader (VoiceOver) in 2005, which comes pre-installed on all Apple desktops, laptops, tablets and mobile devices, at no extra cost. Android mobile devices (4.3 and newer platform) have followed suit with an embedded screen reader as well (Talkback). Microsoft has partnered with Ai Squared to provide the Window-Eyes screen reader free of charge to users of its Office 2010 and newer software, however that requires a purchase of Microsoft Office. It has been hinted that the cost for JAWS to home users will drop, but there is not yet evidence of that. Other products, including the open-source, free NVDA screen reader from NV Access are now providing other no-cost options to blind users. However, screen readers are only useful if they interact with websites, software applications, operating systems and media that are designed to be accessible. A screen reader by itself is not useful without the digital content and apps that users want to access.

Background on Information Technology Accessibility

Laws and regulatory standards that mandate technology accessibility for governments can vary significantly worldwide. However, the laws and regulatory standards across countries generally have one thing in common: the core technical standards. The core technical standard used across the world is the Web Content Accessibility Guidelines (WCAG) 2.0, which are published by the World Wide Web Consortium (W3C) as part of the Web Accessibility Initiative (WAI). The WCAG content areas (perceivable, operable, understandable and robust) each contain more detailed standards with three levels of compliance that are designed to provide an increased level of accessibility.[4] Using a set of standards called WCAG2ICT, the WCAG standards can also be applied to non-web technologies, such as applications, operating systems, mobile devices and other media. While other technical standards exist from WAI for specific areas, for example for browsers (User Agent Accessibility Guidelines) and web developer tools (Authoring Tool Accessibility Guidelines), none are as widely used or accepted around the world as the WCAG.[5]

Statutory laws in countries around the world generally fall into one of two categories of coverage: either they require only that web and other digital content provided by the government be accessible, or they require that companies and other entities that are considered "public accommodations" make their digital content accessible as well. For instance, in the United States, Section 508 of the Rehabilitation Act of 1973 currently serves as the primary guideline for technology developed, procured, maintained or used by the US federal government, and it has been enforceable since 2001. It outlines the accessibility standards for government websites and technology, and the final rule was issued in January 2017 for the new version, based on the Web Content Accessibility Guidelines 2.0.[6]

For public accommodations (such as stores, hotels and movie theaters) that are covered under the Americans with Disabilities Act (ADA), the US Department of Justice (DOJ) has said for nearly 20 years that these entities must provide accessible websites for people with disabilities.[7] Under the ADA employers must also provide "reasonable accommodation" to employees with disabilities, which includes access to computer systems and other technology.[8] In 2010, the DOJ began a process to develop detailed regulatory requirements for websites of private companies that are considered public accommodations under the ADA and therefore must be accessible for people with disabilities, but as of December 26, 2017 the DOJ withdrew from the process saying they would evaluate whether "promulgating regulations about the accessibility of Web information and services is necessary and appropriate."[9] On September 25, 2018, in a letter responding to questions from Congress, the DOJ reiterated that the ADA requires the accessibility of

websites of public accommodations. The DOJ letter also noted that this has been their consistent policy for over 20 years, and "the absence of a specific regulation does not serve as a basis for noncompliance with a statute's requirements."[10] On January 15, 2019, the US Ninth Circuit Court of Appeals reversed a lower court ruling, establishing yet again that the Americans with Disabilities Act addresses websites of public accommodations, even in the absence of specific technical guidance or regulations on what interface accessibility standards to use.[11] The Twenty-First Century Communications and Video Accessibility Act of 2010 further attempts to legally require access to Internet communication devices and video for people with disabilities.[12]

In the United Kingdom, the Equality Act 2010 applies to both the public and private sector. It was enacted to strengthen the previous Disability Discrimination Act, and is proactive, in that an organization can no longer wait until a person with a disability attempts to use a service to comply with the law, but there must be a proactive attempt to determine in advance and on a regular basis what should be done to provide accessibility.[13] For websites, the current law allows conformance to either WCAG 1.0 or WCAG 2.0. Other countries, such as Australia, also utilize the WCAG; there is a mandatory requirement that all Australian government websites must meet WCAG 2.0 level AA.[14]

It is important to note that in common law countries (including the United States, United Kingdom, Australia, Canada, New Zealand and others), court rulings establish judicial precedents that create enforceable law. So, in common law countries, cases such as the *National Federation of the Blind v. Target* (2006 in the United States), *Maguire v. Sydney Organising Committee for the Olympic Games* (2000 in Australia) and *Jodhan v. Canada* (2011 in Canada),[15] impact the legal requirements for digital media accessibility. In civil law countries (also known as codified law), such as France, Germany and Italy, the case law is considered non-equivalent and non-binding compared to the statutory law and codification of law, so court cases in civil law countries have much less of an impact on legal requirements for digital accessibility.

There are multiple initiatives around the world to improve accessibility to digital media. A well-known human rights treaty, the UN Convention on the Rights of Persons with Disabilities (CRPD), has two articles, 9 and 21, which relate specifically to digital accessibility. Article 9 specifies equal access to "information and communications technologies and systems" and Article 21 specifies both "providing information intended for the general public to persons with disabilities in accessible formats and technologies" and "encouraging the mass media, including providers of information through the Internet, to make their services accessible to persons with disabilities."[16] The CRPD has especially had an impact on the rights of children with disabilities.[17] Within the developed world, initiatives such as the European Union Mandate 376 attempt to require technology procurements by governments in the European Union (EU) to be accessible,[18] and individual countries in the EU have also enacted specific local legislation related to accessibility. Within the developing world, there are efforts, by both governments and disabled persons organizations (DPOs) to address digital accessibility during the formation of technological infrastructures, before inaccessible (and needless barriers) are put into place.[19] These efforts have born some fruit, including the "Accessible India" campaign and progress in making banking and libraries more accessible for blind people in India.[20]

Areas of Web Media Where Inaccessibility Has an Exclusionary Impact

People who are blind or low vision need to have a key set of media competencies.[21] These include the ability to read braille and utilize assistive technologies, such as screen readers. However, having the appropriate media competencies isn't enough to succeed in the use of information and communications technology. Websites, intranets, operating systems, media and applications need to be flexible enough to work properly with assistive technologies such as screen readers and refreshable

braille displays. When web-based media is inaccessible for blind users, it can lead to multiple forms of exclusion and discrimination. These are real impacts, and we describe them in the context of commerce, employment, education, communication and entertainment.

Commerce

Many commerce transactions are now facilitated through the Web. This includes all types of commerce, including sites where products are sold by businesses (typical e-commerce), products are sold from consumer to consumer (for example, eBay and Etsy), sharing and crowdsourcing sites (for example, Mechanical Turk and Craigslist) and other sites and apps that power businesses such as the apps for Uber and Lyft. When websites are inaccessible for blind users, it removes blind people from opportunities to participate in commerce. It also leads to fewer overall choices for products and services, and it can lead to fewer opportunities for economic self-sufficiency.

Inaccessible websites often result in forms of pricing discrimination for blind users. When inaccessible e-commerce sites have "web-only" sales that are not available in the brick-and-mortar stores, there is the potential for pricing discrimination. Transportation websites have been especially problematic. For instance, when airline websites are inaccessible, airlines may suggest that blind users instead call the airline call centers. However, airlines typically offer their lowest fares on their websites and may quote blind users higher fares over the phone, even when that is against the law. For instance, in a series of research studies, Lazar et al.[22] documented that when websites are inaccessible, airlines often charge blind users higher prices, as much as a third of the time. For similar reasons, the US Department of Justice announced a legal settlement in May 2011 with Megabus, which previously was only offering their lowest one dollar fares on their inaccessible website, and was not offering those fares on the phone.[23]

Ironically, the legal and social rationale for accessible commerce transactions on the Web is not the only reason for promoting accessibility in this venue. Rich Donovan's research estimates a global figure of 1.3 billion people with disabilities with USD 1.2 trillion in disposable income. This increases to USD 8 trillion when the USD 6.9 trillion of disposable income of their friends and family is included.[24] A US-wide study using 2014 American Community Survey (ACS) data estimated:

> The total after-tax disposable income for working-age people with disabilities is about [USD] 490 billion which is similar to that of other significant market segments, such as African Americans ([USD] 501 billion) and Hispanics ([USD] 582 billion); discretionary income for working-age people with disabilities is about [USD] 21 billion, which is greater than that of the African-American and Hispanic market segments combined.[25]

Employment

According to data from the United Nations, countries forego up to 7 percent of their GDP because of the exclusion of people with disabilities from the workforce.[26]

There is a high level of unemployment among people with disabilities, so the job hiring and application process is very important in terms of accessibility. The US employment rate for people without disabilities is approximately 65.7 percent, while it is approximately 18.7 percent for people with disabilities.[27] The employment rates for people with disabilities in other countries are also low—for example, in the United Kingdom the rate is estimated at 33 percent[28] and at about 38 percent in Canada.[29] Inaccessible web media relates to unemployment in two ways: the hiring process and the actual employment.

Most employers now post job advertisements and applications on the Web.[30] Job postings may be on a company's own website, and the application process may use a software platform,

such as the one provided by Taleo. Other companies and organizations may simply utilize a well-known website, such as monster.com, or indeed.com, for managing the hiring process. It has been well documented that many online employment applications are inaccessible,[31] and this leads to many potential problems. If a blind user cannot even apply for a job online due to an inaccessible job application, then it already separates out the blind person and employers may perceive them to be incapable, because they cannot even apply for the job without an accommodation. It is important to note that disability rights laws, such as the Americans with Disabilities Act in the United States, do not allow employers to ask about disability status during a job application process, so it is legally problematic that an inaccessible job application website can force blind individuals to reveal their blindness.

Once people are hired and employed, inaccessible websites can pose another barrier in the employment itself. Imagine a situation where an employee is blind, and has been an employee for a long time, doing an excellent job. Then, a new software package is implemented and it is inaccessible, so the employee is no longer able to do their job and is either cut from their employment or assigned to a less desirable job. The disability clearly isn't stopping the employee from doing their job—the software or application is stopping the employee. This isn't a hypothetical example; this is an actual case from the US Federal Court System.[32] Often, in employment of people with disabilities, the attention is placed on the hiring process, however, once employed, inaccessible websites and applications can be barriers to continued employment. The term "reasonable accommodation" is often used to determine what types of modifications are appropriate in workplace technology.[33] However, the previous example shows that the accommodations are often not needed due to the disability, but are caused by the procurement and/or use of inaccessible technologies. Further, according to a survey of US employers, a high percentage (59 percent) of workplace accommodations cost nothing to make, while the rest have a typical cost of USD 500.[34]

Education

Some of the barriers to employment are related to the application process, inaccessible technology or simply discrimination. However, educational preparation plays a significant role and it is known that 16.4 percent of people with disabilities aged 25 and older have a bachelor's degree or higher, compared to 34.6 percent of people without disabilities.[35] The domain of education is one that holds tremendous potential and promise for learners with disabilities; however, it has also frequently been at the forefront of conflict between access and discrimination. The use of online technology as a companion for face-to-face education, or a distance education venue of its own, provides the technical potential of more equitable educational opportunities than might be available in a traditional, face-to-face environment. The evolution of e-book and e-reader technology also presents a vital opportunity for faster, more flexible and more equitable access to textbooks and other learning resources. Again, however, both of these technologies that are inherently accessible have been awash in serial instances of exclusion for people with disabilities.

Most of the research literature, case studies and legal enforcement related to IT accessibility in education, have occurred in the area of higher education. Very little has appeared in the area of primary and secondary (K–12) education. There has only been one legal case in the United States, addressing the issue of accessible IT in the K–12 environment, *Nightingale vs. Seattle Public Schools*. A blind parent of children in the Seattle Public Schools sued the school district because she was unable to access the resources to monitor her children's progress. While the website was originally accessible, changes made to the website in 2012 rendered it inaccessible for her to access information about her children. The Seattle Public Schools entered into a consent decree in September 2015 before the case went to trial.[36] While US federal laws often are clear about

the requirements for accessible digital media in the K–12 environments, the state-level educational technology plans and accessibility statutes often are vague about the requirements for accessibility and how they should be met within the K–12 environment.[37] The lack of progress in the area of primary and secondary education is surprising, given that children and young adults with disabilities are often the early adopters, utilizing technology earlier than many of their peers.[38]

In the United States, federal legislation requires that college and university programs and services must be accessible to qualified individuals, in particular when federal aid and financial resources are in any way used by the college or university. For example, Section 504 of the Rehabilitation Act of 1973 mandates inclusion for people with disabilities by institutions that receive federal funds. In addition, the Americans with Disabilities Act (ADA) of 1990 extends to public programs and services, regardless of whether or not these programs and services are federally funded. The friction between the use of emerging technology in education, and legislative policy and legal rulings that demand inclusion and accessibility, is technically unnecessary, however it is a current reality. The 2010 US Department of Justice settlement regarding the ADA and e-readers at Arizona State University highlighted this reality, noting that "it is a core priority of the Civil Rights Division to strengthen and expand the educational opportunities for individuals with disabilities."[39]

A positive area of change has been that of the primary websites for universities, some of which have made significant strides in their accessibility over the past ten years[40] and some that have been encouraged through litigation to make similar strides.[41] This is, of course, an ongoing challenge, illustrated by the recent litigation filed against 50 universities in the United States.[42] The challenge with universities and other educational institutions and providers is that a primary website is only one of a plethora of web-based resources that comprise the average educational experience, both face-to-face and during online learning/instruction. Third-party web-based resources, including learning management systems, textbook companion resources, virtual lab resources, scheduling systems, library resources and mobile apps, are all used in various aspects of education. Unfortunately, research continues to illustrate examples of these ancillary components being far from accessible for students with disabilities.[43] Studies have further illustrated that the social media tools, which are often used for online courses to provide a missing aspect of context present in face-to-face courses, also have accessibility problems.[44]

Some of those resources, including a dominant learning management system provider (Blackboard), have made progress towards being accessible.[45] A practical benefit from this technology, when accessible, is that online resources can increase inclusion for students who are unable to attend class as well as for students with other print impairments.[46] Other universities have created inclusive or accessible technology initiatives across their campuses and highlight resources on their websites that are focused on accessibility or how to make course content accessible. Out of this discussion follows a separate issue from the technology itself—the design of courses within educational institutions. It has been documented that many online courses simply are not designed in an accessible manner, regardless of the technology.[47] With the increasing use and participation in online education within educational institutions,[48] there must be a renewed focus on ensuring that all aspects of learning are accessible, so that the increasing availability of educational degrees, training and learning opportunities are inclusive throughout the current and emerging educational arena. A renewed focus on inclusive design, government mandates regarding technology accessibility and emerging technology (such as WAI-ARIA discussed later), all hold the promise of a more inclusive future for education.

Communication and Social Media

The usage of social networking websites such as Facebook, Twitter and LinkedIn holds ongoing importance in communication, collaboration and professional networking. Social networking

applications can be used for communicating, collaborating and strengthening professional relationships. Even when not used for professional purposes, social networking is an important part of socialization. When social networking sites are inaccessible to blind users, this can cut them out of not only professional communication, but also social communication. More then 15 years ago, researchers such as Preece were documenting how people with chronic health issues and disabilities could turn to online communities, which were earlier forms of what we now refer to as social media.[49] However, you can only turn to these social networks online if they are accessible. Previous research has documented problems with the accessibility of social networking sites. For instance, when a social media website had accessibility problems, the company suggested that screen-reader users who were blind, should instead utilize the mobile version of their site, which was more accessible, but had much more limited functionality.[50] A 2013 survey documented high rates of social networking usage by blind users, potentially higher than the general population of users, with Facebook and Twitter being the most popular.[51] While Twitter was once considered to be the most popular social networking service among blind users (due to its focus on text), as it is increasingly used primarily for images, it's no longer as popular among blind users.[52]

It is essential that other common forms of communication (both in the workplace and for personal use) are accessible for people with disabilities. Social media plays a dominant role in personal and some workplace communication, however email has continued for decades to maintain a critical role for workplace communication and many other types of communication that require a more formal communications venue. There are certainly still personal computer software applications such as Microsoft Outlook that are used for email purposes, but most email users rely on mobile phone applications and web-based email solutions for their email communications purposes. It is estimated that traditional desktop email applications now only account for less than a quarter of all email usage, with email via mobile devices now accounting for more than half of all emails that are accessed.[53] This trend should emphasize the importance of web-based and mobile email accessibility. Prior research indicates an ongoing need for email accessibility,[54] and this is particularly essential given the rapid pace of updates and revisions on mobile apps and web-based applications.

Entertainment

Often, entertainment is considered to be less important than the areas discussed earlier in this chapter, such as commerce, employment and education, which are keys to economic success and independence. However, to think that entertainment is less important for someone with a disability is wrong for at least two reasons (and probably many more).

First, entertainment is often a core component of socialization. When people get together, they watch movies, play video games, use digital-based exercise applications (for example Wii tennis and bowling) and engage in these and other digital media-based activities. To not allow blind people to have access to these forms of entertainment is to exclude blind people from socialization activities. Furthermore, in later sections, we will discuss how many of these forms of entertainment can be accessible for blind people.

Second, entertainment-style digital media is now often used in the areas of education and employment.[55] Games, simulation and entertainment are used to teach basic skills in math and science, sometimes known as *serious games*.[56] However, educational games have often been reported to have very low accessibility, especially for blind students.[57] Digital simulations are utilized in the job application process, to determine skill level and for evaluation of potential job candidates. Once someone is employed, simulations and virtual reality can be utilized for training on specific skills. When someone is excluded from the ability to use digital media such as gaming and simulations, it really can have an impact on employment and education.

There are many approaches to make entertainment and digital media accessible for blind users. Often, when people say that, "it can't be done," it is because they are not aware of the already-existing solutions. For instance, in the area of gaming, there are many existing research studies, documenting how to make common video games accessible for blind users, including modified versions of well-known entertainment and games such as Guitar Hero, Rock Band, Wii Bowling and Dance Dance Revolution.[58] More recently, Microsoft has promoted its new adaptive gaming controller, illustrating a growing awareness of the need to become inclusive in gaming design. Video games and similar digital entertainment *can* also be made accessible for blind users.

In terms of movies, video description of movies and television can be helpful in ensuring equal access to digital media for blind users. The Federal Communications Commission provides a very basic definition of video description: "Video description is audio-narrated descriptions of a television program's key visual elements. These descriptions are inserted into natural pauses in the program's dialogue. Video description makes television programming more accessible to individuals who are blind or visually impaired."[59]

Video description is a newer technological solution, in comparison to captioning for the Deaf and hard of hearing, which has existed for decades. However, both video description and captioning services are easily available from multiple companies. As an example of how captioning is well established, while video description is not yet as well established, in the United States, the legal requirements for video description are that television stations in major markets must have 50 hours per calendar quarter, of programming with video description.[60] Compare those minimal requirements for video description, with requirements that nearly all programming from broadcast stations and cable operators must have captioning for the Deaf and hard of hearing.[61]

Unfortunately, the legal protections for video gaming are even more absent. In the only legal case in the United States examining whether people with disabilities have a legal right to video games,[62] a court ruled that video games do not count as a public accommodation under the Americans with Disabilities Act.[63]

Emerging Technology That Could Have a Positive Impact

HTML5 is the latest version of HTML ratified by the W3C (in 2014), and it has seen rapid adoption in the last few years. HTML5 attempts to bring better accessibility to the HTML markup language through improvements such as a more navigable and clear document structure and better form access. Inadequate form labeling and accessibility have long been a common challenge for users who are blind. Accessible video interaction without a third-party plug-in is one of the clear gains in accessibility as a result of HTML5.[64] As a response to the type of dynamic web content and interface controls that are currently employed by many websites, the W3C through its Web Accessibility Initiative, released a new set of technical standards and attributes called WAI-ARIA (Web Accessibility Initiative—Accessible Rich Internet Applications). These standards work along with newer standards such as HTML5 to increase the accessibility of websites and applications through markup that applies specifically to assistive technologies such as screen readers. All modern browsers typically support the most common features of both HTML5 and WAI-ARIA. WAI-ARIA adds features such as landmark navigation, improved support for JavaScript and AJAX widgets, enhancements to web-based forms and access to "live regions." One of the accessibility challenges presented by dynamic, "Web 2.0" content, is the type of content updates that are automatically received on web pages and web-based applications. Examples include email messages received while working on a page, stock updates received and emergency notifications received or updated. Live regions were included with WAI-ARIA to address dynamically updated technology for assistive technology.

As desktop, laptop and mobile technologies have introduced new types of interaction and user interfaces, one of the most notable changes has been the transition to touch-based and gesture-driven computing. An obvious concern with this transition was the potential loss of significant accessibility gains on prior input devices, by moving towards a type of input that would traditionally be categorized as visual. While there have been some challenges that can probably be attributed to designers and manufacturers (for example, Amazon and Google), through early innovation from companies such as Apple, the touch-based computing era has not only improved in its own accessibility but also in the broader dimension of an accessible user experience that it has been able to now offer many users with disabilities. Most early mobile devices (smartphones) were not very accessible, particularly for those who are blind or low vision and the few accessible models were offered at considerable cost to the user. Advocacy and attention to more inclusive design have now resulted in a variety of mobile devices that can be used by those who are blind or low vision, at a much lower cost. For example, as noted previously, both Apple and Android mobile devices today have embedded screen-reader and accessibility features. Touch-based interfaces that work with a screen reader now allow those users to experience more than a simple linear dimension of interface content. This, combined with the significant strides that have been made in speech to text applications, creates a growing world of mobile technology that holds a promise of increasing accessibility.

Conclusion

Digital media is in many ways representative of the ever-evolving social changes that impact our society. The increasing variety of digital forms of media provide new and fascinating opportunities for communication, work, education and recreation. Unfortunately, it is well documented that many of these exciting advances in media either exclude or provide limited access to individuals with disabilities, especially blind users. Sometimes many years go by before a media product begins to become accessible for people with disabilities. While it might be assumed that the nature of technology is to blame, many studies have illustrated that it is rarely the technology but rather the hasty design or poor implementation of that technology which creates this disparity. Product developments such as the embedded screen reader on newer mobile phones, highlight the underlying promise and potential that can easily exist through inclusive design and implementation.

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