

eQuality: Web Accessibility by People With Cognitive Disabilities

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Abstract

eQuality: The Struggle for Web Accessibility by Persons With Cognitive Disabilities (Blanck, 2014a) examines the right under the Americans with Disabilities Act to web access for people with cognitive disabilities (intellectual and developmental disabilities, autism, traumatic brain injury, and other conditions). This article continues that line of study examining the full and equal enjoyment (accessibility and usability) of web content by people with cognitive disabilities. I consider definitions, legal challenges, and rights that are discussed more fully in *eQuality*, and I reflect on new disability law and policy developments in the United States (e.g., Section 508 refresh and web equality case law) and internationally (e.g., developments in CRPD Articles 9 and 12, and European standardization efforts) since *eQuality* was published.

Key Words: *accessibility; web equality; cognitive disabilities; international web standards*

This article and the book it is based on, *eQuality: The Struggle for Web Accessibility by Persons With Cognitive Disabilities* (Blanck, 2014a), were spurred several years ago by Dr. David Braddock, Executive Director of the Coleman Institute for Cognitive Disabilities, who asked me to examine “The right under the Americans with Disabilities Act to web access for people with cognitive disabilities.” Given the ubiquity of online activity in the United States and most of the world, as well as the shifting of nearly all daily interactions and activities to the Internet, the right under law to web equality may seem obvious. However, establishing the rights of individuals with disabilities, and particularly individuals with cognitive disabilities (intellectual and developmental disabilities, autism, traumatic brain injury, and other conditions) has seldom come without legal and political struggle, which also is necessary to achieve a broader shift in attitudes and practice (Blanck & Marti, 1997).

This article explores how web content equality grounded in law and policy is necessary for people with cognitive and other disabilities to fully partake and flourish in the information age (Blanck & Martinis, 2015; Putnam, 2014). To that

end, this article overviews the struggle for web equality for people with cognitive disabilities.

Defining Web eQuality

Full and equal access to the Internet’s World Wide Web (web) is an enabler of other basic human and civil rights (Wicker & Santoso, 2013). The web supports the freedoms of speech, association, and civic engagement (Illich, 2015). Yet, though it is fundamental to exercising one’s rights of citizenship (Ferri, 2014; Giannoumis & Kline, 2015; Halvorsen & Hvinden, 2013), access to the tools of the Internet alone is not sufficient to guarantee web equality. Overly complex interfaces, lack of information alternatives (e.g., symbols along with text, captions instead of audio), and the inability to transform content presentation all prevent effective use of the tool that is the Internet’s web. *Access alone is not web content equality.*

I have described web *eQuality* as the opportunity for *full and equal enjoyment* of web content across all its technologies and interfaces:

Full and equal enjoyment of the web is to have the meaningful and reasonably compa-

able opportunity to enjoy—access and use—web content, and to not be excluded from that prospect on the basis of cognitive and other disabilities, either by individuals, organizations, or through the design of web technology. (Blanck, 2014a, p. 245)

This proposition for web equality, including the opportunity for equal and active citizenship, is “the right to share in the full social heritage,” as embodied in civic, educational, economic, and social information available to citizens (Marshall, 1950, pp. 150, 154). The elements of active citizenship include the opportunity to participate in the democratic endeavor and to be heard as a part of that community. In this sense, web content equality is both a fundamental right and an enabler of other human and economic liberties. Web technology has the unique potential to reduce the attitudinal, behavioral, and structural barriers encountered by individuals with a range of cognitive, physical, and sensory capabilities (Blanck, 2014b).

I take a civil and human rights approach to disability and, therefore, frame web equality within the norms and legal obligations of the Americans with Disabilities Act (ADA) and the U.N. Convention of the Rights of Persons with Disabilities (CRPD). The power of the web is in its potential to mitigate barriers to knowledge that drive and inform human cognition, speech and ideas. The web increases the opportunity for individuals and collectives to share knowledge, although structural barriers such as poverty and a lack of access to technology continue to stand in the way of full access to the information society.

At present, to approach web equality, people with a range of disabilities require modifications and accommodations in service design when reasonable and feasible to do so. These accommodations alone do not, and cannot, guarantee that in all circumstances people with disabilities will have the same outcomes from their activities on the web. In this sense, *web equality does not necessarily equate with content impartiality*, because there may be judgment at some point before the end user to determine what information will be offered and how. Although it is expected that content transformations and substitution of equivalent information would be directed by the end user, there is still a filtering process that may raise concerns about how web content is selected.

Would certain alternate content be favored over another and, if so, why?

With such caveats, I use the term *eQuality* to emphasize two essential ideals. The first is the conception of equality and justice under law. Thus, in the ADA there may be found a justiciable right to web equality for people with cognitive and other disabilities. The second is the conception of “*electronic quality*,” which is to signify that the meaningful and objective opportunity for the comparable use of web content by people with disabilities is possible, with particular reference to people with cognitive and print disabilities. The right to enjoy digital knowledge and social interaction is encompassed by the freedom from discrimination as a consequence of disability, and is established by the ADA and recognized in the CRPD.

Rights of People With Cognitive Disabilities

In the United States, the ADA has been in effect for 25 years, and there has been a concordant growth in the strength of the disability rights movement worldwide (Blanck, this issue). Nevertheless, web equality for people with cognitive disabilities has received limited attention, and when examined has faced resistance and pushback. Under the ADA, the right to web equality, as for other rights assuring nondiscriminatory access to society, is considered on an individualized basis in circumstances involving the human and computer interaction. People with cognitive and other disabilities who choose to engage with the web must have the prospect for reasonably equivalent and comparable use of its electronic content, and not simply separate access to it, as do others without disabilities in the same situation (Pariser, 2011).

Nondiscrimination in the full and equal enjoyment of web content offered by commercial entities is addressed by the ADA’s third chapter (Title III), which covers services offered by “public accommodations,” including those of online service providers. Freedom from discrimination because of disability in the use of the online activities of public accommodations (and of state and local governments under ADA Title II), and the corresponding obligation to make modifications within reason to ensure that services offered are equally enjoyable, are among the central means

by which people with disabilities meaningfully participate in the digital information society.

The ADA's preamble establishes its mandate as to ensure equal opportunity, inclusion, choice in independent living, and opportunity for economic self-sufficiency (ADA & ADAAA, 2008). The web is a major driver of these principles, and particularly for people with cognitive disabilities (Imrie, 2012; Schur, Kruse, & Blanck, 2013). For this reason, the lack of equal opportunity to participate on the web, whereby separate access to web content becomes the default means for interaction, is *inherently not equal* for people with cognitive and other disabilities who aim to enjoy such services (Giannoumis, 2014).

The World Wide Web Consortium (W3C) defines equivalent web content as that which is an “acceptable substitute,” adaptation, and alternative that “fulfills essentially the same function or purpose as the original content upon presentation” (W3C, 2005). Alternative content removes reliance on any one mode and cognitive mechanisms for comprehension: for instance; text can be heard instead of seen, audio can be read instead of heard, images are described instead of seen, and so on. This seemingly complex suspension of modal reliance often is achieved simply in web content as well as in other digital content. An illustration of a common adaptation is transformations in presentation, such as text enlargements and higher contrasts.

Practically speaking, the enjoyment of web content must be considered in context. This is why laws like the ADA approach such fact-based determinations on a case-by-case basis, and not in terms of prescriptive compliance with web content technical standards and performance criteria. This also is the reason that U.S. courts tend to view web equality in accord with general notions of the fair and equivalent *opportunity* to participate regardless of disability (Marshall, 1950). The concept of web equality then embodies the comparable choice to participate online, with or without appropriate supports and adjustments, and without discrimination on the basis of disability.

Given historical and present attitudinal discrimination, web equality is a means to ensure that disability is respected as an element of human diversity. The ADA accords people with disabilities individual and collective rights to web equality, regardless of obvious or hidden individual characteristics that may subject them to

artificial, invidious, and paternalistic forms of prejudice and discrimination. CRPD Article 9 (2007) likewise conceives of web accessibility as the opportunity to have equivalent access to and use of web content, and for individuals not to be excluded unreasonably from that prospect because of disability.

Global Context

The human rights of people with disabilities set out in the CRPD are recognized by more than 150 nations that have ratified the treaty (CRPD, 2007). The CRPD reflects a commitment by member states to value active participation and citizenship by people with disabilities (Bickenbach, 2009). Article 1 of the CRPD states as its purpose “to promote, protect and ensure the *full and equal enjoyment* of all human rights and fundamental freedoms by all people with disabilities, and to promote respect for their inherent dignity” (emphasis added). People with disabilities are people with long-term physical, sensory, mental, and cognitive impairments who face societal barriers that “hinder their *full and effective participation in society* on an equal basis with others” without such conditions (emphasis added).

Among its protections, the CRPD (Article 9, Accessibility) establishes obligations for States Parties to ensure comparable access to communications technology. Borg, Larsson, and Östergren (2011) argue that the CRPD declares for people with disabilities the right to technology equality “to ensure their *full and equal enjoyment* of all human rights and fundamental freedoms” (p. 165). Although the United States has yet to ratify the CRPD, the ADA directs that in a free society, people with disabilities have the equal right to use online materials to learn, work, play, communicate, shop, and participate fully in their communities (Halvorsen, 2010).

Web Ubiquity

Almost one-half (42%) of the world's 7 billion people use the web (Internet World Stats, 2014). During the previous 15 years, web usage has increased globally at a tremendous rate. Web usage is expected to accelerate for people who previously have faced barriers to it, including people with cognitive disabilities and those who are aging (or who acquire cognitive disabilities with age), people living in poverty, and others who face

economic and political restrictions to web access. More people use mobile and tablet devices to access the web than desktop PCs, and to a greater extent these users have lower incomes (Blodget, 2014). In 2014, there were more than 1 billion smartphones and tablets bought worldwide, and this number is set to double by the end of 2015 (Lomas, 2012; Yang, 2012).

Web Content

What is web content? As a general matter, web content is online digital information derived from human and machine operations and transferred to users by various means. Nonetheless, the definition of web content is far from clear for purposes of legal analysis (European Commission, 2012). Social networking websites often distinguish among web content, online data, and metadata (“data that explains or describes other data”) (Blanck, 2014a). Generally, each are forms of knowledge-based digital information that allow for online participation and the sharing of electronic text, images, and other modes of communication, and expressed in computer code, data, and semantic information in machine readable formats. The W3C’s Web Content Accessibility Guidelines (WGAG, presently in version 2.0) similarly conceives of web content as the “information and sensory experience to be communicated to the user by means of a user agent (e.g., a browser), including code or markup that defines the content’s structure, presentation, and interactions” (W3C, 2005).

User-based content. The web’s architecture enables online service providers to organize and maintain digital information about users in computer code. One common form of such metadata collection is “cookies,” which are tracking devices that create personal summaries of user data (Baker, Bricout, Moon, Coughlan, & Pater, 2012). Other metadata content derives from the use of the web and its applications, such as information about electronic book (eBook) usage and purchases made using a browser service.

Location-based web content and services may be offered using meta-data, such as information retrieved from a device’s global positioning system (GPS) and internet service provider (ISP). This information may be used by the web service to provide a user with information such as advertisements tailored to user preferences and choices in situ. “Click data” from the user’s interaction with an advertisement, for instance, is assessed by

advertisers to determine an ad’s effectiveness and resultant closure of e-sales.

Websites often create other data from user information, for instance, using GPS and sensors that collect location information and provide contextual real-time information and content feedback to the user. Many ecommerce organizations sell this content to external third-party enterprises for marketing and other purposes. This web content is dynamic, in part because it is user generated and collected via multiple sensors and offered in multiple formats from text, photos, movies, and audio. User-based content exemplifies the extraordinary capacity of online service providers to provide personalized and customized experiences to individual visitors and to respond to the needs and preferences of the individual.

Semantic content. The web’s inventor, Tim Berners-Lee, and his colleagues, conceived of the web as a responsive (experiential) and machine-assisted “Semantic Web.” The Semantic Web is a term that refers to a common structure for understanding and processing web content with the assistance of computer algorithms (rules for computer processing) (Feigenbaum, Herman, Hongsermeier, Neumann, & Stephens, 2007; W3C, 2005). The conception of a Semantic Web draws on advances in natural language processing (NLP: computers drawing meaning from human language) and the ability of machines to recognize human speech and convert it to electronic text.

Generally speaking, the Semantic Web is a conceptual, machine-based framework that enhances access to and use of web content by diverse users. It does this by aiding in the understanding, organization, and interpretation of digital information. Intelligent web design conceived presently has not and may never replicate the intricate state of human knowledge processing and interaction; however, it has the promise to make web content accessible and usable (in its broadest form, universally usable) by people with cognitive and other disabilities. The Semantic Web, along with other innovations, is poised to support the opportunity for web enjoyment to be individualized and contextualized in consideration of a user’s preferences, skills, motivation, use of assistive technology (AT), and myriad applications across desktop and mobile platforms, operating systems, and devices.

The capacity for semantic and user-based content to form *both* universal and individualized

web content for people with cognitive disabilities is supported and increasingly delivered through Cloud Computing (Chourasia, Nordstrom, & Vanderheiden, 2014). The Cloud allows web users ubiquitous access as they move through contexts and settings in their day and interact with web-enabled and interconnected devices. Through access to software stored in the Cloud, users are not tied to one access configuration, location, device, or form of AT. Cloud computing enables a user to use AT and invoke preferences on any enabled device. No longer is the person bound to the device that has AT or preferences installed; instead, they may enjoy the freedom of web content equality in an information technology ecosystem that undergoes continuous and dynamic change (e.g., updating of content), and which leverages the exponential power of computer data mining, search capacity, and semantic content generation and interpretation.

With developments in law and technological capacity well underway, the mandate to embrace web equality is being advanced by efforts of advocates and individuals who ask that their right to web equality be established and upheld.

Stories of Advocacy

Progress towards web equality has been born out of the lived stories of individuals with disabilities seeking their right to participate fully in daily life (Blanck, 2008, 2014a). The experiences of disability advocates are useful for discussing web equality because, as Wilson (2012) has commented, they are models for our world experience.

Bruce, Melissa, and James are blind and, along with the National Federation of the Blind (NFB), brought one of the first successful ADA class action lawsuits to ensure their right to equally enjoy the website of Target Stores; they wanted to shop online at Target.com, but it was not compatible with their screen reader software (see Blanck, 2014a, for stories herein).

Jennifer and Edward are deaf, and along with the Greater Los Angeles Agency on Deafness (GLAD), challenged CNN to caption CNN.com that they may have the opportunity to learn of the world's news as did millions of others. CNN responded that if it was forced to caption CNN.com's video clips it would violate the company's right to freedom of speech.

Lee, a deaf person, along with others from the National Association of the Deaf (NAD), confronted Netflix to caption its online stream-

ing media programming. Alan, another NAD member who is deaf, along with his wife who is deaf, have two hearing teenage sons who had asked their parents to subscribe to Netflix; they refused because without the possibility to convert sound to text, they were not able to not monitor their children's shows and watch programming as a family. Donald, who is deaf, challenged Netflix's practices, saying that the company's failure to caption imposed a "deaf tax," because its DVD-by-mail plans, which provided him access to the video programming, were sold at a premium as compared to Netflix's online streaming subscription.

Courtney could not take classes requiring library research, and Blair could not read recommended texts to complete his physics classes. This was because they are blind and they did not have equivalent access to the contents of their university libraries. Kerry claimed that ITT Educational Services did not accommodate his visual disability during the online hiring process. ITT had required Kerry to complete an online job assessment within time constraints. His use of screen reader software did not enable him to process the questions in the required time frame, and he requested a reasonable extension of time. ITT refused the request and noted that, in any event, Kerry would face other online barriers during the new-employee orientation process. Kerry, along with the Equal Employment Opportunity Commission (EEOC), filed a charge of employment discrimination under the ADA.

Karen has bipolar disorder and lost her battle to maintain her cancer survivor's online social network on Facebook. The court sympathized with Karen's situation, her lackluster experience with Facebook's customer services, and losing connection to her online life. Alexander claimed his cognitive and visual impairments were not effectively accommodated in Sony's online gaming systems and this prevented him from enjoying them equally with others. Sony contended that it was not required to make its products "easier" in order to be played by people with disabilities. Likewise, Todd alleged that Google, YouTube, and Myspace discriminated against him because of his reading disability by denying him the equal enjoyment of their online theaters.

These are a handful of advocacy stories discussed in *eQuality*; together, these stories form the fabric of the disability rights movement (Blanck, 2004, 2005). They are about people

who sought the right to enjoy all that society has to offer, not as an “advantage” over or to “burden” others, but to participate equally as individuals (Stein, Waterstone, & Wilkins, 2010; Waterstone & Stein, 2008).

But there is much more to these lived stories; it is, as leading disability scholar Mark Weber (2007, pp. 23–24) has commented, that people with disabilities, and especially people with cognitive disabilities, are not only among the most stigmatized individuals, but also they face barriers to social acceptance in a world that forces them to be “invisible.” Prior to the ADA’s passage, the U.S. Supreme Court understood that such discrimination is “most often the product, not of invidious animus, but rather of thoughtlessness and indifference—of benign neglect,” and it “is primarily the result of apathetic attitudes rather than affirmative animus.” (*Alexander v. Choate*, 1985, pp. 293–296). When people with cognitive disabilities are forced to remain invisible, they are not given the opportunity to participate. Web equality fosters an individual’s right to be an active participant in society.

Cognitive Disabilities and the Web

Besides attitudinal discrimination and technological barriers, there are structural reasons why people with cognitive disabilities face exclusion from the web. Poverty and lack of inclusive education, inadequate job training, and negative expectations limit the opportunity to access computer technology and services provided online. There are associated barriers facing those across the spectrum of disability in transportation, healthcare, social and recreational activities, and housing.

The particular examination of cognitive disability and web equality involves consideration of arguably the largest meta-group of people with disabilities (Blanck, 2014a). Admittedly, within cognitive disabilities there are individual disparities in access to and use of online services. Nonetheless, there is a general lack of commitment to web equality for cognitive disability despite the fact that technological advances for people with cognitive disabilities complement and extend access strategies for people with visual, hearing, dexterity, and other conditions (Ellcessor, 2012, p. 342). Many presupposed barriers to web equality not only are surmountable, but also are

capable of resolution for individuals with diverse text- and print-related, intellectual, developmental, and neurological impairments.

Web content is produced by developers using HTML5 and Cascading Style Sheets 3 (CSS3) to present and format the information. Digital content is available on browsers used on desktop computers and mobile devices capable of multimedia presentation. For web content to operate with a user agent (e.g., browsers, AT screen reader software), it must be machine-readable (W3C, 2005). Computer code allows AT software to convert content to speech for screen reading functions and audio information to text for captioning.

People with cognitive disabilities benefit from these same mechanical and verbatim translations. As for blind people who use screen readers and deaf people who use captioning to access web content, people with cognitive disabilities profit from conversions that format text to audio and the reverse, as well as from the opportunity to use content presented in multiple communication modalities and to alter the viewing format of the information presented. This is the case where text alternatives for audio information are presented as captions and include important nondialogue audio information such as sound effects (W3C, 2005).

Challenges

Sometimes, however, people with cognitive disabilities face additional challenges in the use of web content as expressed purely in text alternatives. A user’s reading level affects comprehension and understandability, and the processing of text. People with cognitive impairments who may have hearing impairments often have lower levels of linguistic capabilities especially if a gestural language such as American Sign Language (ASL) is their first language. Some people may require ASL, or other sign languages not based in English grammar to aid in web content usability and comprehensibility (W3C, 2005). Consequently, within the domain of content transformation and modification, there is a need to consider an array of characteristics.

Cognitive Load

The process and rate involved with the delivery and transformation of electronic text generally determines the “cognitive load” that the informa-

tion presents to an individual and that person's capacity to meaningfully acquire the information. Cognitive load is affected by how online tasks (websites) are designed and presented, as well as by individual characteristics (Sweller, Chandler, Tierney, & Cooper, 1990).

Generally, for people with and without disabilities, the proliferation of online devices, services, and multitasking has made cognitive load a crucial functional and performance issue of the information age (Schwartz, 2013). In interacting with a web service, there is an expected distribution of cognitive load to be generated across the population of users. Unfortunately, web services typically are designed to be accessible and usable only to a limited range of the distribution of web users and often to an idealized "normal user" without consideration of cognitive disability, and the effects of other factors: environment, task, individual or collective interaction.

Disability antidiscrimination laws set parameters to define when that "range of usage" is unfairly limited due to disability and hence discriminatory, which to date have been used in ADA actions primarily by the blind and deaf communities, and to a lesser extent by people with cognitive disabilities. The requirement for reasonable modifications is meant to mitigate such unfair restrictions, as long as they do not alter the essence of the task or present an undue burden to the content producer. This general conception applies across disability types and functional severity, although cognitive disabilities by description directly implicate issues of cognitive load.

Although screen reader software and augmentative technologies may transform electronic content to aural presentation, for instance, the structure of the website, its navigability, and the complexity of its organization may independently affect comprehensibility and hence cognitive load (Puzis, Borodin, Ahmed, & Ramakrishnan, 2012). Cognitive load or capacity is tested when considering multimedia and dynamic (constantly updated) web content and interactions across platforms and interfaces. For example, cognitive disabilities may result in memory processing limitations that affect attention capabilities, which reduce the ability to perform certain sequenced web-based tasks. Without the opportunity for alternatives, augmentations, sequenced feedbacks and supports, web use is effectively limited (Fairweather, 2008; Harper & Yesilada, 2011).

Feinberg and Murphy (2000) distinguished extraneous from intrinsic cognitive load in the development of online web educational materials. Intrinsic cognitive load is implicated in the processing of the substantive task at issue, while extraneous cognitive load is tapped when processing the presentation and format of web content. Often, without the opportunity for effective modifications, online services make cascading demands on cognitive resources, creating an overload that makes extrinsic and intrinsic cognitive processing unnecessarily difficult. A website's presentational (navigational) format itself, as Sweller and colleagues comment, may require considerable cognitive capacity (Sweller et al., 1990).

In principle, accessible and usable web design offers the opportunity to reduce *unnecessary* cognitive load, especially those substantive and presentational formats that are cumbersome or nonessential to the meaning of web content (Henry, Abou-Zahra, & Brewer, 2014). Of course, "unnecessary" cognitive load is a relative term and often depends on the perspectives of the content owner and producer, and the individual user.

Universal Design

When the opportunity for web content accessibility and usability is possible in the broadest sense, it trends towards "universal design" (UD), which enables participation by diverse users to the maximum degree possible (Steinfeld & Maisel, 2012). As formulated by Ron Mace, it is "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design" (Imrie, 2012, p. 1).

Reductions in task complexity, and conveyance of information via alternative channels of communication, reduce cognitive demands because capacity is effectively deployed and not expended on extraneous and multiple tasks and decision-making processes. Individual cognitive capacity may be increased with the use of universal adaptation and customization strategies (which may be thought of as individualized accommodations) that allow for tasks to be broken down into accessible and alternative components that are presented in different and multiple modalities.

In theory, UD exists when there is an equivalent opportunity for diverse individuals to

use web content easily and comprehensibly, and within reasonable bounds. To paraphrase Imrie, it is an “avoidance of discriminatory design” in the technological world, with similar although less ubiquitous consequence in physical world design (Imrie, 2012, pp. 875–876). In practice, UD represents an aspiration to achieve equal and individualized participation regardless of disability and other human characteristics.

Universal Design and Web eQuality

Without web equality, people with cognitive and other disabilities often “end up on the side of the [digital] divide with others who do not have access to or use technology” (Tanis et al., 2012, p. 53). This divide means a lack of access to comparable web content across multiple devices, platforms, and browsers (e.g., lack of cross-platform compatibility). The lack of functional and equivalent access to web content affects individuals across the spectrum of disability, as well as other “nonstandard” web users. However, people with cognitive disabilities are among those most profoundly affected by web content inequality. This is because, as a general proposition, *web equality for people with cognitive disabilities necessitates consideration of the meaning of web content*.

For instance, a web user with memory processing limitations likely will benefit (e.g., in terms of web accessibility and usability) from the opportunity to choose clearer and more concise language, which requires developers to consider the meaning of text-based web content they employ (Giannoumis & Kline, 2015). It is essential, therefore, to examine the intended purpose of web content and the design of the online service itself. Analysis requires examination of the “equivalent enjoyment of web content” from the perspective of the content owners and designers, and the content users and their contextual environments.

Given the web’s inclusive UD possibilities, it is fitting to aim for the development of a principled basis in law to web equality for people with cognitive disabilities. This endeavor is not to divert attention for web equality from those with other disabilities; rather, it is to focus attention on a stigmatized and ostracized segment of individuals on the disability spectrum. Moreover, the potential UD benefits of web content equality for those with cognitive disability transcend cognitive disability and apply to many

other coexisting conditions, such as to sensory and mobility related impairments.

Blanck (2014a) proposed that for people with cognitive disabilities there may at least two recognized meta-functional dimensions of web content equality: (a) *ease of use of web content*; for instance, in navigational and multimedia access and operability, and (b) *comprehensibility of web content*; for instance, in its understandability and substantive usability. These dimensions of web content equality are not zero-sum choices nor independent of one another. Rather, they reflect a continuum of user experience that must be considered in context, with or without the use of AT and other supports (Hornbaek, 2006). They are multidimensional concepts that are influenced by, and which affect individual preferences and differences, interaction with Semantic content on the web. Individuals with similar backgrounds and characteristics may prefer different ways to interact with web content in different situations and under varying conditions (Fairweather, 2008, p. 71).

Mazurek, Shattuck, Wagner, and Cooper (2011) conducted one of the first nationally representative studies of patterns in web use by youth with autism. The findings show youth with autism prefer solitary and challenging screen-based media (e.g., video gaming) at higher rates than socially interactive and collaborative online media (e.g., chat room participation), regardless of their economic status, and as compared to youths with intellectual disabilities.

Preference in web use does not necessarily equate with simplification (and is relative to context), and *greater comprehensibility (or simplicity) is not necessarily synonymous with intellectual challenge and cognitive demands*. Although people with autism may experience differences in sensory and speech processing, and in sensitivities to the human voice, these characteristics in social communications are not necessarily tied to individual intelligence and capabilities (Abramsa et al., 2013). Nevertheless, for many people with cognitive disabilities ease of use and simplicity directly tie to the nature of web content accessibility and usability (Vanderheiden, 2000). Dawe (2006) conducted an ethnographic study with young adults with cognitive disabilities, and with their parents and teachers on their use of AT and found overwhelmingly that these participants desired developers to “keep it small and simple, please!” and among the most desirable features were ease of use, functionality, and portability.

Toward Web eQuality

Fortunately, with regard to moving toward web equality, there is a growing body of expertise in accessibility to meet the increasing demand to make web technologies accessible, including an International Association of Accessibility Professionals (IAAP). Optimistically, before too long, binary views of web accessibility and usability will be relics of the past. Instead of “one size fits all” web content for standard users, there will be opportunities for auto-personalization “one size fits one” web content, reflecting a globalized alignment of the web as an enabler of human rights as envisioned by the CRPD (Heil, Parker, & Stephens, 1999; Treviranus, 2008; WebAim, 2013). Still, even with such technological optimism, there are complexities to the mass customization of web content, such as the need for developers to maintain design simplicity and ease of use with the proliferation of niche technologies, which is where open source ecosystems that promote universal access and use will come into play.

Hardware and software architectures will coexist with smart environments—homes, schools, libraries, workplaces, health care centers. Embedded ambient intelligence will converge in Cloud infrastructures, and web content will be semantically responsive and intuitive, and less design and code dependent (Berners-Lee, 1999). Content will be available in real-time on-demand services on and in the person (through wearables and nanorobotics made by personalized 3-D printers) in homes (through automation and appliances), schools (with online teaching materials) and workplaces (with job training and advancement programs) (Brown, 2015). The web will provide options for collaborative crowd-sourced feedback and services for individuals, groups, and communities from the management of health care and financial transactions, to emergency preparedness for natural and manmade disasters. Digital cooperatives not only will enhance the sharing and development of knowledge, but also will be central to the management and growth of a free and open information society (Vanderheiden, Treviranus, Gemou, Bekiaris, & Markus, 2013).

Functional eQuality. Although aspects of online solutions increasingly will be tailored for all people, the WCAG 2.0 and other standards also will have preferably trended towards functional use criteria for universal applicability (Harper & Yesilada, 2011). Discussion will not

be one of whether online services must be universally usable versus disability-specific.

Ideally, corresponding concepts of accessibility and usability will fade, replaced by a paradigm shift towards innovation in web content regardless of disability. The inventor of the web, Tim Berners-Lee (2007, p. 4), understood this centrality of choice and cohesiveness to web content equality when he said that its “flexibility and openness” make it possible “to build services and applications that are truly accessible for people with disabilities, as well as [for] people who need to *transform content for purposes other than that for which it was originally intended*” (emphasis added).

To “transform content for purposes other than that for which it was originally intended” is to provide meaningful and autonomous choice in the web ecosystem. It is to reach diverse audiences, without stifling innovation and creativity, without trampling on individual privacy, and by spurring market growth and consumer loyalty, and importantly, participation in one’s community. Before there was established law on the right to the web, Berners-Lee (1999) said:

We have to be careful that [the web] allows for a just and fair society. The Web must allow equal access to those in different economic and political situations; to those who have *physical or cognitive disabilities*; those of different cultures; and those who use different languages with different characters that read in different directions across a page. (p. 165, emphasis added)

A number of coming technologies will further support an inclusive web. Semantic web content will provide a basis for establishing a Cloud-driven Semantic Web, a “social-semantic” web that will provide the opportunity for contextually-aware multichannel communications, using facial expressions and tone of voice, eye blinks and movements, gestures, and sign languages (Greaves & Mika, 2008). Legal and policy regimes domestically and transnationally will need to keep pace with these advances to support and not stymie harmonization and innovation in web content ownership, licensing and open source agreements, and user agents built into the systems and accessed externally by web interfaces and the Cloud (NIDRR, 2013). These systems will experience constant updating, given dynamic operating

schemes and websites, and the means to aggregate and summarize web content.

These imaginings follow on existing automation capabilities to simplify user interfaces. Puzis and colleagues (2012, p. 42) comment that screen reader software presently allows users to develop their own macros for automation of certain tasks, such as to look up unknown words in a dictionary. These researchers, and others, are examining the means to automate web content to reduce unnecessary cognitive load and to maximize cognitive flourishing.

Human–computer interaction researchers are developing on-demand analytics for web content that incorporate individual learning, and reading histories and styles. IBM researcher Eser Kandogan (2012) is developing ‘just-in-time descriptive analytics’ using means in real-time “to help users easily understand the structure of data as seen in visualizations.” Kandogan’s image-to-text analytics identify informational trends automatically and “*decrease the cognitive load on users by automatically explaining structure in real-time as they interact*” (2012, pp. 73–74). With a similar outcome in mind, Bill Gates and his coinventors submitted a patent filing for a technology application to autogenerate video from electronic text (Slind-Flor, 2013). These advances will enhance web content equality through the integration of automated annotation and summarization techniques with semantic, perceptual, cognitive, communication, and lingual features based on personal preferences and capabilities, all in real-time.

Web tools. The W3C (2012) and other groups are developing complementary tools to support the inclusive web, such as the Web Ontology Language (OWL V. 2), for web applications to process content. Ontologies are vocabularies of web content—terms, words, microformats, and metadata—organized by rules and their relationships to other terms. These capabilities, when combined with collective and machine-based knowledge from cataloguing and search capabilities, offer personalized opportunities for people to interact with the web.

Raising the Floor (RtF) for People With Cognitive and Other Disabilities

Cloud-based educational, rehabilitation, job training, financial, and leisure programs and services increasingly act as daily life supports for people with an array of cognitive disabilities. The Cloud

has the potential to seamlessly augment communication, memory and concentration skills in real-time by aiding in customization and operability across digital devices, browsers, and systems (National Council on Disabilities, NCD, 2011). The Raising the Floor (RtF) Consortium, and its partners engaged with the Global Public Inclusive Infrastructure (GPII) initiative and projects such as Cloud4All and Prosperity4All, are developing a real-time Cloud-based ecosystem for customized user profiles to enhance online access for people with cognitive and other disabilities (Vanderheiden & Treviranus, 2011). The goal is to provide auto-personalized options for users to simplify operations and interfaces, and for individuals with disabilities who use AT (e.g., screen reader software) to make web operations adaptable and compatible across devices. The overarching aim of these projects is to create the means for individuals to effectively use any digital device and system encountered in their daily activities. This objective is furthered by use of open source and commercially viable Cloud-based technologies that support web equality.

To approach these goals, RtF is developing a MasterList (database) of strategies designed to support universal solutions for web content equality. The majority of the MasterList entries are directly applicable to individuals with cognitive disabilities; for example, the MasterList includes Cloud-based solutions designed to read text aloud, reorganize and simplify text, provide audio enhancements, support pronunciation and help support, provide customizability, simplify pages and browsers, and allow pauses.

There are other solutions to supplement web content with automated tools and AT. These include development of customized dictionaries and glossaries in multiple languages, and usage profiles to share with others, as well as customized cues for prompting use and function, and real-time assistance. Solutions allow for customize keyboard, mouse, and voice controls for text and input entry, along with use of specialized “hotkeys,” shortcuts to simplify actions. Error prevention, correction, and recovery solutions are provided. Privacy and safety functions allow for automatic and pre-set assessments of website credibility and authenticity for trusted websites. Security functions are presented to support ease of use and comprehensibility for a range of users in ecommerce, social media, and gaming, and multichannel support functions are suggested to

organize and adjust the amount of information presented. The use of GPS navigation provides for wayfinding, communication, and use of mobile devices in real time as well as to aid in information processing and comprehensibility of content.

The RtF, and the GPII and similar projects are making online technologies universally available to people with cognitive and other disabilities, which will benefit people with lower reading skills and digital literacy, print-related, lingual, and aging-related barriers. These efforts build on the principles in the ADA and the CRPD to promote web equality as a principal enabler for full and equal participation and active citizenship, across life circumstances (G3ICT, 2014).

Semantic Web and the “Internet of Things”

According to Giannoumis (personal communication), the idea that semantic web content provides a means for achieving universal design in practice *is the missing link* between what we know and understand about accessibility and what we want to achieve with universal design. In this article, I have tried to clarify this view and extend its centrality as the Semantic Web and the Internet of Things (“IoT”; e.g., web-activated household appliances) continue to evolve. As Giannoumis suggests, perhaps the main consideration regarding the principles of accessibility, usability, and universal design going forward in relation to the IoT is that new and non-traditional platforms and web interfaces will become even more ubiquitous, yet increasingly personalized.

At the present time, we are experiencing an inflection point at which web developer and service provider norms and standards are shifting from primarily user-driven interfaces to the IoT’s hybrid of user-intelligent machine interfaces. For example, rather than programming a website to interact with particular assistive technology, a developer will program everyday household appliances to interact with Cloud-based auto-personalization services. The objective is to allow users with diverse backgrounds and skills, and under varying environmental conditions, to access the IoT through platforms and input devices the *user* chooses, anyplace and anytime.

The shift toward the ubiquitous IoT, in user practice and from a developer organizational perspective, should reduce the need for prescribed

web content design standards. Rather, the pendulum of “responsibility” likely may swing from user-interaction designers and developers to international collaboratives aimed at maximizing innovative machine-to-machine interfaces, which the IoT envisions. However, despite attempts at harmonization, there are no globally accepted norms and values to spur such efforts, which is why the web and the IoT risk fragmentation (Gibbs, 2014).

Given the present situation, several questions come to mind on the future of the Semantic Web and the IoT in regard to people with cognitive and other disabilities:

1. *W3C*: How will the W3C, as the major web accessibility standards body, evolve with the Semantic Web and IoT paradigm shift?
2. *Web Service Providers*: How will web service providers respond to demand for universal machine-to-machine interfaces, and accessibility and interoperability for the IoT?
3. *Web Market Forces and Individual Rights*: How will U. S. law, policy, and market forces in intellectual property regimes, the Federal Communication Commission (“FCC”) “net neutrality” rules (2015), and individual free expression and privacy rights, promote universal design, and accessibility and usability, on the web and the IoT (van Schewick, 2015).
4. *People With Cognitive Disabilities*: How will these evolving and multidimensional forces, in the Unjited States and globally, affect individuals with cognitive disabilities to fully and actively participate on the web and the IoT going forward?

Section 508 Refresh

In 2015, the U.S. Architectural and Transportation Barriers Compliance Board (“Access Board”) proposed an update or “refresh” of the accessibility guidelines and standards for electronic and information technologies, including web services, under Section 508 of the Rehabilitation Act of 1973 and Section 255 of the Communications Act of 1934 (U.S. Access Board, 2015). According to the Access Board, this effort is in response to “a technological revolution” in web design and usage driven technologies, services, and products. For instance, in the fifteen years since adoption of the prior Section 508 standards, “smart” mobile phones and tablets have overtaken desktop computers as the primary means for information technology communications.

The proposed rules replace the current “product-based approach with requirements based on functionality” to ensure accessibility and usability for people with disabilities in “hardware, software, *electronic content*, and support documentation and services” (U.S. Access Board, 2015, emphasis added). They incorporate the WCAG 2.0 and make them applicable to web content, web electronic documents, and software. The Access Board identifies as among the potential beneficiaries of its proposal people who are deaf and hard of hearing, for instance, to have faster and enhanced natural language communications. It acknowledges that the proposal is intended to help improve online services and supports for individuals with visual impairments.

The Board does not take the opportunity to address those particular web accessibility and usability issues facing people with cognitive disabilities. It does acknowledge, however, that aspects of the proposed functional performance criteria relate to cognitive functioning; for example, in regard to improved functionality for web application timing adjustments, and for blinking, scrolling, and auto-updating information to aid in comprehension. The previously mentioned RtF MasterList identifies many of these same considerations.

An additional objective of the Access Board’s 508 refresh is to harmonize existing Section 508 and 255 standards with corresponding guidelines in the global communications and technology markets to spur international advancement and innovation. The Access Board references that in 2013, the European Commission published its draft Mandate 376 standards for “Accessibility requirements for public procurement of ICT products and services in Europe,” which was completed in 2014 and subsequently adopted by the major European standards organizations. Mandate 376, like the 508 guidelines, provides technical specifications for the public procurement of web and communications technology products to harmonize these products and services within Europe (Martínez & Pluke, 2014).

Mandate 376 tracks functional performance criteria similar to that identified in the Access Board’s proposed guidelines. However, Mandate 376 includes functional criteria for web usage (and for ICT) by individuals with limited cognition: “Some users will need [web services] to provide features that enable them to make better use of

their limited cognitive capabilities.” This clause addresses functional needs of people with cognitive, language, and learning impairments, as does the British Standards Institution accessibility requirements (2010; Giannoumis, in press). It includes specifications for adjustable timings, error indications and suggestions, and logical focus ordering as examples of design features that satisfy this requirement.

Conclusions

At this 25th anniversary of the ADA, online service providers face an inflection point in the provision of web services, given new technologies, changing markets, and emerging demographic trends (Nicolau, 2012). Vast numbers of consumers with disabilities with divergent interests and needs increasingly are using the web, and they will seek the opportunity to access the IoT. The trend is towards use of mobile devices with Cloud infrastructures over the life course. In the past, many of these individuals were among those least able to participate on the web, and with the least power to exert pressure for web content equality. This is the reason why a new generation of disability advocates, many born after the ADA was passed in 1990, are defending their right to web equality.

In 2015, a group of disability advocates, individuals who are deaf and with hearing impairments, along with the National Association of the Deaf (NAD), sued Harvard University and the Massachusetts Institute of Technology under ADA title III and Section 504 of the Rehabilitation Act (NAD, 2015). They alleged that much of these universities’ online web-based content was not captioned (and often was unintelligibly captioned), making the information not accessible and comprehensible, such as that of content on massive open online courses (MOOCs). These individuals stated: “Just as buildings without ramps bar people who use wheelchairs, online content without captions excludes individuals who are deaf or hard of hearing” (NAD, 2015).

Of course, law enforcement actions are one element of a larger and progressive policy framework needed to eliminate disability discrimination in education, employment, health care, housing, and access to the built and digital environments. Changes in disability law and

policy are being achieved incrementally through advocacy, where discrimination is challenged and brought to the fore. The ADA and the CRPD serve as principled bases in law to end segregation on the basis of disability.

Unfortunately, the community of individuals with cognitive disabilities and their families have experienced, and continue to experience, discrimination. Inaccessible and unusable web content is one aspect of that negative experience because it sends the message to “keep off the web.” Inclusion and active participation have always been the remedy to segregation and discrimination, and they are the principles set in disability right laws for equal opportunity, independent living, and economic self-sufficiency.

The ADA has yet to be applied in a principled manner to achieve web content equality for people with cognitive disabilities. Nevertheless, full and equal access to the web for all individuals increasingly is recognized. In 2015, in the case *Direct Marketing Association v. Brohl*, U.S. Supreme Court Justice Anthony Kennedy wrote:

The Internet has caused far-reaching systemic and structural changes in the economy, and, indeed, in many other societal dimensions. Although online businesses may not have a physical presence in some States, the Web has, in many ways, brought the average American closer to most major retailers. A connection to a shopper’s favorite store is a click away—regardless of how close or far the nearest storefront. . . . Today buyers have almost instant access to most retailers via cell phones, tablets, and laptops. As a result, a business may be present in a State in a meaningful way without that presence being physical in the traditional sense of the term. (p. 1135)

In the coming years, it may be that amending the ADA, revising its implementing regulations, and seizing the opportunity to modify the Access Board’s Section 508 refresh, are among actions required to ensure that web content equality is a right available to all people with disabilities, including those with cognitive conditions (Easton, 2010; Stock, Davies, Wehmeyer, & Lachapelle, 2011). Nonetheless, *eQuality*—the full and equal enjoyment of the web—for persons with cognitive disabilities is on the horizon at this 25th anniversary of the ADA.

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