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Social Networking Sites and Equal Opportunity: The Impact of Accessibility

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Abstract

The European Union has recognised the importance of information technology in addressing issues of social inclusion and equal opportunity and has defined eInclusion as part of the i2010 initiative (European Commission, 2005). The use of social networking applications by individuals and by companies is growing and industry analysts have identified the benefits to organisations of using Web 2.0 social collaboration tools (Boulton, 2008). This research examines the use of social networking sites by people with visual impairments, exploring whether there is full access and therefore social inclusion. Or is there, as is claimed (Whittle, 2007), a situation that although “sites such as Facebook and MySpace are meant to have ushered in a new era of online collaboration, (but) not everyone is invited to the party”? If there is a social exclusion from sites that integrate with the enterprise for business reasons, what are the implications for established accessibility guidelines and for e-business theory?

Keywords: accessibility, web 2.0, social networking sites

1 Introduction

Tim Berners-Lee imagined that the web could be *the* means for universal communication twenty years ago: “The dream behind the Web is of a common information space in which we communicate by sharing information” (Berners-Lee, 1998). With the onset of “Web 2.0”, it appears that the *users* of the web themselves are closer than ever in bringing about this dream *through their own social interactions online*. Web 2.0 promises social inclusion and opportunity for all, with its fundamental tenets on collective wisdom, seamlessly built data relationships, open participation, collaboration by all and user created content.

The importance of this development was emphasised by the EU Commissioner for Information Society and Media: “We are now living through a new disruptive phase of the Information Society. Some people call it Web 2.0 or social networking. ... What is new about these uses of the Internet is that they exploit [its] connectivity to support people networking and creating content.” (Reding, 2006)

E-businesses are increasingly using Web 2.0 technology that has widely spread among Internet users in the last 5 years (McKinsey, 2007), seeking to integrate stakeholders’ knowledge from outside of the organisation. This tapping into the “cognitive surpluses” (Shirky, 2008) of individuals meets business objectives through freely provided participation, information and user generated content. “Companies realize the social networking applications can support broader business initiatives by building communities of employees, partners and customers” (IDC, 2007). For the enterprise, such integrations allow for increased access to candidates for employment, business opportunities, targeted promotion of information about products and services, a means to gather feedback from the market place, inputs for future design, and so on.

It is clear that the use of Web 2.0 is a growing area for business, personal and social applications. But, have the developers of these sites considered accessibility and have Web 2.0 users the knowledge or even the awareness of how to create accessible content?

2 Theoretical background

2.1 Web 2.0 in the workplace

The OECD (2007), reflecting the social inclusiveness nature of “Web 2.0,” prefers to use the term “participative web,” defining it as “an Internet increasingly influenced by intelligent web services that empower users to contribute to developing, rating, collaborating, and distributing Internet content and customising Internet applications”. Key components of this “participative web” are weblogs, wikis, social networking sites, micro-blogging, image sharing sites, user created content, and so on.

The use of Facebook, Twitter, YouTube and other social media applications in the enterprise is growing, with industry analysts making a solid case for the positive contribution of Web 2.0 social collaboration tools (Boulton, 2008). Social networking site functionality is being increasingly built into core communication and other enterprise collaborative and business intelligence applications (IDC, 2007).

Employment opportunities are increasingly being sought and pursued through social networking sites across the EU (Bowser (2008). Companies are becoming aware that they are often cutting themselves off from the market place of prospects, partners and competitive information and from developing their employees if they do not use Web 2.0 (Dignan, *et al*, 2008). Enterprises view Web 2.0 technology as a strategic investment (Chu, *et al*, 2007).

Major technology vendors are now providing the technical bridges between the potential of the “social web” and the needs of “real business” (Moltzen, 2008). SAP recently declared their direction to incorporate blogs, wikis, YouTube and so on into their enterprise products: “We will open several communities where people can contribute - customers, partners, ourselves. ... We will not change things without a vote

from the community. When the community is involved in designing the software, and modifying it, and making short online videos explaining it... will spread like wildfire through a community. We will have hundreds of thousands of applications of this type built on this software-oriented architecture-by-design system” (Lauchlan, 2007). Other software vendors follow suit.

The recognition of the e-business application potential for integration with social networking sites has also been reflected in Customer Relationship Management (CRM) software. This allows organisations to combine social networking sites with their own applications, so that users can share data, such as sales leads, with their channel and other business partners (McGee, 2007). CRM applications now contain software links to allow for direct integration into Facebook, LinkedIn through APIs, and so on.

The availability of Web 2.0-centric development tools from Google, IBM, Adobe, Yahoo!, and others allows e-businesses to integrate their applications and data sources with social networking sites and other Web 2.0 services into a single interface (Moltzen, 2008).



Figure 1: Advertisement for database administrator (DBA) jobs on Facebook

Human resource professionals are using social networking sites (see figure 1) “Recruiters are taking a close look at those networks, since it’s like going through someone’s Rolodex ... in the past, proprietary databases were unique to a search firm, including information on larger networks, but these days, most rely on LinkedIn instead” (Millard, 2008).

What about accessibility? Zajicek (2007) defines accessibility in terms of “inclusivity” in a way of particular interest to participation on the web: “A community web site is accessible if it includes the user in its group and the user wants to be included. If you are excluded from a service, then it is not accessible to you. If you do not relate to that which is being provided, then you could argue it is not accessible to you.”

2.2 Current Guidelines and Laws

To address issues of web and e-business accessibility, there are a wide variety of guidelines and regulations, best known of which are the voluntary guidelines of the Web Accessibility Initiative (WAI, 1999) and the mandatory requirements of the U.S. Section 508 of the Rehabilitation Act (Amended) 1998. Others include the Disability Discrimination Act (DDA) (1995) in the UK, the Disability Act (2005) in Ireland, and many local, national, and international legislation and aspirations. There are two kinds of law - legislation which covers public sector services delivered through information and communication technology (for example, Section 508) and specific disability legislation (for example, the DDA, and the Americans with Disabilities Act [1990]).

Not everyone agrees conformance to guidelines such as the WAI's Web Content Accessibility Guidelines (WCAG), is the best approach to bringing about universal access (Kelly, Sloan, *et al*, 2006) and the evidence from the UK's Disability Rights Commission is that it does not (Burnett, 2003). Part of the problem is that WCAG also requires software vendors to follow the guidelines not only for platform development, but also for user-created content.

What Kelly, Sloan, *et al* (2006) propose in response to Web 2.0's emergence is an "Accessibility 2.0" approach based more on user-centric principles, richer sets of stakeholders, an "always beta", faster moving, flexible, and more process orientation; and a move away from the "one-size fits all" model of the largely WAI-driven approaches. Accessibility 2.0 would see WCAG positioned as part of "a suite" of approaches rather than a standard with which to comply. This builds on the Accessibility Summit of 2006 which suggested the needs of the user should be focused on along with flexibility on the technical side which would "form part of a range of activities that taken as whole would form an accessible experience" (Kelly, 2006).

3 The User Survey

The primary research was a survey of Irish users of social networking sites (such as Facebook, MySpace, Bebo, and others) to measure Web 2.0 inclusiveness, as these sites "allow individuals to present themselves, articulate their social networks, and establish or maintain connections with others" (Ellison, Steinfield and Lampe, 2007). Social networking sites are naturally people centered, mimicking real world social interactions and relationships. For such applications to facilitate inclusion, they must be accessible so that all users can have equal opportunity to participate in communities of knowledge (IDC, 2007).

Individual, professional, voluntary, and educational sources were mined for potential respondents who were users of Web 2.0 sites and services. The survey was also distributed to visually impaired users using announcements sent to the Irish-based Visually Impaired Computer Society (VICS) forum (<http://vicsireland.org/>), the "Accessibility 2.0" interest group on Facebook and other social media such as Twitter. 20 sighted users and 29 users with visual impairments completed the survey.

Patterns of usage for both sighted users and those with visual impairments were compared and analysed against findings from the literature. The survey questions were designed to discover respondents' awareness of Web 2.0 sites and services, their willingness to share information and collaborate using the web, and the challenges they

faced with regard to information sharing and collaboration within a number of contexts, of which the economic was one.

The survey was validated for accessibility and usability. This latter category took into account the accessibility of the survey form itself, and was reviewed by staff in Trinity College, a representative from Knowbility (<http://www.knowbility.org/>), and a representative from the Centre for Inclusive Technology (<http://www.cfit.ie>), using assistive technology, in advance of being sent to the respondents. The usability of the survey was tested using a dry run with volunteers.

The main feedback was to refine some of the terminology (*e.g.*, “participative web”, or “social web” can be used interchangeably with Web 2.0, and so on, to explain “accessibility” to non-visually impaired users) and some rephrasing of questions to make them clearer. All reviewers welcomed the thrust and intention of the research.

To ensure accessibility, a web survey tool was chosen that has been certified by one of the leading practitioners in the field as meeting Section 508 standards was chosen: “by using our standard survey designs, your survey will meet all current U.S. Federal Section 508 certification guidelines” (<http://www.surveymonkey.com>, 2008).

The survey was carried out in the spring and summer of 2008.

4 Results of the Survey

Some users with visual impairments experienced difficulty and did not complete all survey questions despite the pretesting and checking. Rewording and restructuring of some survey options and adding details of switching into Forms mode in JAWS addressed this. This problem was due to the different assistive technologies’ handling of web forms and also to the varying user expertise with the same assistive technology (Thatcher *et al*, 2006). This needs to be borne in mind for all researchers in the area.

4.1 Respondent Profiles

Over two-thirds (69%) of the visually impaired respondents were completely blind, with low vision making up the second most common visual impairment. Screen readers like JAWS, Windows-Eyes, and others were reported as the most common assistive technology used (79.3%).

Comparing the ages of the respondents from the two categories, those without visual impairments were mostly (60%) in the 25-35 age groups, with another 30% in the 35-45-age range. The majority of those respondents with visual impairment were also in the 25-35 age groups (34.5%); however, the remainder had more even age distribution. We know from research that aging impacts disability (Microsoft, 2003), but we cannot make inferences from that variable here for any respondent, but this would be an area for further research (Venkatesh, *et al*, 2003).

In terms of occupation, the sighted respondents were mostly private sector managers or employees (65%), with the self-employed representing 20%. Visually impaired respondents in the public and private sector category represented 35%, self employed 7% and unemployed 24%.

4.2 Willingness to Share Information and Collaborate Using the Web

Awareness

Critically, for visually impaired respondents, social networking sites like Facebook, Bebo and MySpace are much less widely used (35.7%) when compared with sighted respondents (63.2%). This trend is also evident from employment-related network sites (for example, LinkedIn) with visually impaired respondents recording usage of 21.4% compared with the sighted usage of 57.9%.

Visually impaired respondents mentioned other sites, indicating an awareness of the potential offered by the Web 2.0 concept. These included “traditional” message board sites, the Accessible Friends Network, MSN Groups, Yahoo! Groups, Ning.com, RSSMicro.com, Vipipedia and internal work-related wikis.

Usage

Respondents without visual impairment expressed very strong or strong reasons for social networking services as - being part of social groups of common interest (52.9%), obtaining opinions on goods and services by real users (strong and very strong both 29.4%), finding out information about jobs and career development (58.8%), wanting to find out more information (55.6%), as well as the anticipated making of new friends or linking up with new ones (44.4%).

Visually impaired users showed a significant weaker interest in using such sites to make new friends and link up with old ones (34.8%), but a very strong to neutral reason for being part of social groups of common interest (26.1% each). Using the sites for career development was recorded as very strong and strong interest (27.1%) offset by a very weak interest (30.4%) at the other end of the scale. However, obtaining opinions on goods and services from real users and finding out more information was recorded as a strong reason (50%) and very strong reason (56.5%).

Both sets of users are interested in using such sites for e-business-related reasons (finding out information about products employment, and so on). Some visually impaired users did recognize social networking use for employment reasons, although not as strong, which may have implications for the use of such sites for career development (table 1).

Table 1: Reasons for using social networking sites by non-visually impaired (NVI) users and visually impaired (VI) users

	Respondent	Very Strong	Strong	Neutral	Weak	Very Weak
Be part of a social group of common interest	NVI	11.8%	52.9%	17.6%	11.8%	5.9%
	VI	26.1%	26.1%	26.1%	4.3%	17.4%
Find out more information	NVI	27.8%	55.6%	11.1%	5.6%	0%
	VI	56.5%	34.8%	0%	4.3%	4.3%

Make friends	NVI	16.7%	44.4%	5.6%	11.1%	22.2%
	VI	21.7%	21.7%	13%	8.7%	34.8%
Obtain user opinions on products	NVI	29.4%	29.4%	11.8%	17.6%	11.8%
	VI	31.8%	50%	9.1%	4.5%	4.5%
Read opinions and recommendations of others	NVI	17.6%	41.2%	41.2%	0%	0%
	VI	27.3%	45.5%	9.1%	0%	18.2%
Find out job or career information	NVI	0%	58.8%	29.4%	0%	11.8%
	VI	21.7%	21.7%	26.1%	0%	30.4%

In terms of actual usage activities, non-visually impaired users expressed strongest usage when looking up information (94.4%), followed by reading comments feedback and ratings (77.8%) and having accounts on social or employment related sites (77.8%). Visually impaired users showed a strong preference for looking up information too (80%), with a lower score for reading comments, feedback, and ratings (72%). However, having accounts on social or employment related sites recorded a much lower score (40%) than non-visually impaired users (72%), while posting information to such sites recorded a figure of 44% for non-visually impaired and 24% for visually impaired users (table 2).

The evidence from users is participation in e-business related activities on social networking sites, with lower figures for social and employment related networking site accounts for people with visual impairments.

Table 2: Social networking site activities

	Respondent	Percentage
Looking up information	NVI	94.4%
	VI	80%
Read comments, feed back, reviews or ratings	NVI	77.8%
	VI	72.0%
Have a social or employment related networking site account	NVI	72.0%
	VI	40.0%
Posting information to a social or employment related networking site	NVI	44.0%
	VI	24.0%

4.3 Challenges to Inclusion

The survey also explored the reasons that users considered to be the main challenges experienced when using Web 2.0 sites and services (table 3):

Table 3: Challenges to use of social networking sites for non-visually impaired (NVI) and visually impaired (VI) users

		Major Impact	Slight Impact	Neutral Impact	Not an Impact
Age	NVI	5.9%	17.6%	17.6%	58.8%
	VI	5%	10%	15%	70%
Occupation	NVI	11.8%	23.5%	17.6%	47.1%
	VI	5%	15%	15%	65%
Peer pressure	NVI	6.3%	12.5%	37.5%	43.8%
	VI	0%	5%	20%	75%
Privacy concerns	NVI	11.8%	58.8%	17.6%	11.8%
	VI	21.1%	47.4%	10.5%	21.1%
Untrustworthy content	NVI	5.9%	47.1%	29.4%	17.6%
	VI	0%	45%	30%	24%
Lack of accessibility	NVI	0%	18.8%	25%	56.3%
	VI	80%	20%	0%	0%

For both groups of respondents, the major challenges are from privacy fears and content mistrust. Age, occupation, or social circle did not appear to be a major challenge.

However, for visual impaired respondents, the greatest challenge was the lack of accessibility support in the technology itself (80%). These challenges are all known quantities in terms of redress by published accessibility guidelines (table 4):

Table 4: Accessibility challenges in social networking sites

	Major Issue	Slight Issue	Neutral	Not an Issue
Videos with no soundtrack or text transcript alternative	45%	40%	10%	5%
Inability to determine content on visual elements (for example, no caption, title or alternative text on images)	65%	20%	5%	10%
Complicated, wrongly marked up data tables that confuse screen readers	31.6%	42.1%	21.1%	5.3%
Complex tables used for layout	31.6%	15.8%	36.8%	15.8%
Content with directionality instructions (for example, “look on the left” text)	22.2%	38.9%	33.3%	5.6%

Use of specific colours to indicate functionality	35%	25%	33.3%	10%
Colour-combinations on text or backgrounds	20%	5%	20%	55%
Inability to control text size on content	11.1%	5.6%	27.8%	55.6%
Inability to expand links or show hidden text	31.6%	21.1%	26.3%	21.1%
Continued....	Major Issue	Slight Issue	Neutral	Not an Issue
Additional requirements to add plug-ins (special applications) before the content can be accessed.	35%	20%	35%	10%
Inability of screen readers to detect changes on dynamic page	70%	25%	0%	5%
Use of an inaccessible Captcha on sign-up	94.7%	0%	5.3%	0%
Unclear text-speak language and abbreviations in content	30%	25%	25%	20%
Badly designed online forms for data entry	70%	25%	0%	5%
No keyboard support on keys, links, hot-keys, shortcut keys, and so on.	20%	30%	20%	30%
No ability to control interactive elements such as audio and video players	63.2%	10.5%	21.1%	5.3%
No ability to navigate	30%	25%	15%	30%

Visually impaired respondents were asked to rank the seriousness of the different types of accessibility issue they experienced using the sites and services mentioned. The major issue reported by most respondents was the use of an inaccessible Captcha (Completely Automated Public Turing test to Tell Computers and Humans Apart) at sign-up time (94.7%), an example of which is shown in figure 2.

The image shows a screenshot of the Myspace.com sign-up form. The form is titled "Join MySpace Here!" and includes a link for "Already a member? login". The form fields are as follows:

- Email Address: [Text input]
- Password: [Text input]
- Confirm Password: [Text input]
- Display Name: [Text input]
- First Name: [Text input]
- Last Name: [Text input]
- Country: [Dropdown menu, selected: Ireland]
- State: [Dropdown menu, selected: -- Please Select --]
- Post Code: [Text input]
- Date Of Birth: [Day, Month, Year dropdown menus]
- Allow others to see when it's my birthday: [Checked checkbox]
- Gender: [Radio buttons for Female and Male]
- Preferred Site & Language: [Dropdown menu, selected: Ireland]
- Verification: [Image of a captcha with the text "73W48KKK" and a small circular icon below it]

Below the captcha image, there is a text prompt: "Please enter the text from the image above: The letters are not case-sensitive. Do not type spaces between the numbers and letters." followed by a text input field.

Figure 2: Example of an inaccessible sign-up Captcha from Myspace.com

Other major challenges included: the inability of screen readers to detect changes on dynamic pages (70%); badly designed online forms for data entry (70%); lack of ability to determine content of visual elements (65%); and no ability to control interactive elements such as audio and video players (63.2%). Serious and slight problems with complicated, wrongly marked up data tables that confuse screen readers when combined, accounted for a score of 73%, and videos with lack of soundtrack or text transcript combined resulted in a score of 85%.

4.4 Comments from Respondents on Accessibility

Comments were also recorded about the kinds of challenges experienced by the visually impaired user, reflecting accessibility issues, including those detailed in table 4, but also issues with assistive technology:

- “When I try to fill in form fields, oftentimes, when I’m in a particular combo box, it does not read what I’m supposed to fill in.”
- “Half the problem is JAWS hasn’t learned to read updated dynamic content even though it can often actually be used in IE, even if not Firefox, and found Window-Eyes a non starter with much of it.”
- “Use of inaccessible Flash controls is a major problem.”

From the comments of the users it is clear that, while all of the known issues relating to accessibility for visually impaired web users are a challenge, so are many anticipated ones related to the technology used on social networking sites. An example of these would be in relation to Asynchronous JavaScript and XML (AJAX) (Gibson, 2007) used to deliver a rich user experience on Web 2.0 sites and services. The use of inaccessible Captchas, of course, precludes any further involvement by such users unless they obtain help from another person to proceed.

The implications for social inclusion here are clearly in line with the AbilityNet report (2008) on social networking sites, but also indicate that the concerns expressed over the ability of existing WCAG-centric guidelines to deliver an accessible web deliverable are valid (Kelly, Sloan, *et al*, 2007), (Burnett, 2006) and that a new approach is necessary.

5 Delivering Accessibility - Accessibility 2.0?

The survey concluded with the opportunity for respondents to submit their opinions and ideas about improving Web 2.0 accessibility. The respondents were asked how developers could be encouraged or persuaded to develop accessible web sites.

Visually impaired respondents were very specific and discussed areas of education, lobbying, technical and usability issues. One sentiment, which was unsurprising, was “Lobby government agencies, European and UN agencies. Educate web developers. Support all regulatory organizations such as W3C, *etc.*” However, this was not the most common concern. Respondents indicated a pressing need for Web 2.0 site and service developers to reach out to the users with visual impairment: “Visually impaired people need to make their opinions and experiences count and try to find organisations or individuals who have clout with web design or who are doing accessibility testing so they can give feedback and experience.”

Many felt that non-visually impaired users were unaware of the impact of publishing content that was not accessible. However, education in this regard on its own was not sufficient, and what was needed was the provision of publishing tools (that prompted for captions or text alternatives, for example), the rewarding of accessible content by other users (through ratings and comments), and a considered avoidance of inaccessible features by the site developers themselves: “The Captcha - certainly as long as it is only visual, which it usually is - is a retrogressive, even an immoral, idea. Tell them to use more text in their labelling so that it is also accurately descriptive. Endeavour to make sure that if they use Flash content it is accessible by means of buttons in the player for that type of Flash.”

In keeping with the Web 2.0 ethos of participation, users also saw their own involvement as a way forward to delivering accessibility – through testing, design feedback, and positive reinforcement of accessibility efforts. Although there was recognition that the widely accepted guidelines had a role to play, and there was a legal aspect involved (especially in terms of discrimination), what was largely missing was input from the users of social networking sites themselves: “Rewards for the good guys (some kind of web design Oscar?) are likely to work better than imposing legislation (which country’s legislation can you use anyway?).”

6 Significance of Findings

The survey’s respondents with visual impairments recognized the importance of the collaborative and participative features of Web 2.0 sites and services and their role in online economic activity while expressing a desire to be socially included. They also realized the economic implications of such exclusion; they use social networking sites and, in many cases, expressed similar usage preferences to sighted users.

When questioned on the challenges presented to using social networking sites, accessibility support (or lack of) is by far the greatest challenge to the visually impaired user. There are other issues of concern to all; issues like privacy, content trust worthiness and issues like age, occupation, and social circle are similar between visually impaired and sighted users.

Some of the worst accessibility violations identified included the use of Captchas at sign-on, the inability to detect dynamic changes on site content (for example through AJAX), badly designed forms for data entry, lack of ability to determine visual content with text alternatives, problems with audio and video player control, incorrectly marked up tables, and lack of soundtrack or text transcripts on content.

None of these accessibility failings is an unknown quantity from an accessibility or usability viewpoint. Even the more “recent” accessibility issues relating to key Web 2.0 technologies such as AJAX are currently being addressed through WAI-ARIA (Worldwide Web Consortium [W3C], 2008) or other guidelines (Gibson, 2006). It is necessary for these to be implemented.

7 Conclusion

These findings have serious implications for the prospect of social inclusion given the increasing adoption of social networking site integration by enterprises. Visually impaired respondents recognized the marketing, learning and employment potential of such sites, but were presented with some very serious accessibility challenges. These respondents mentioned being “disheartened”, “unable to keep up with colleagues” and “banished” from these sites. They are excluded from interacting with other users and the enterprise, from employment opportunities, creating business relationship, obtaining product information, giving feedback, and so on.

This is contrary to not only the accessibility guidelines such as the WCAG but also the claims of Web 2.0 thought leaders, and the aspirations of the EU and other public policy bodies. In some cases, of course, where social networking sites are used to provide goods and services, such exclusion may even be illegal under the equality legislation now enacted in many countries (Bowser, 2006). However, reliance on the law is a reactive and slow process, and legal protection varies, whereas social networking site usage is global and fast moving.

Such exclusion negatively impacts at a community and individual level, as visually impaired users are excluded from economic opportunity. It is not acceptable for e-business enterprises to further their business objectives by integrating with third-party applications such as social networking sites that are inaccessible by design. Besides this illegality and poor sense of corporate social responsibility, such exclusion also militates against emerging e-business theory as they fail to address the business grounds for accessibility (RNIB, 2005), (Forrester, 2003) or to truly leverage collective intelligence from everyone in the user community (Anderson, 2006).

From this research, it is clear that the accessibility approach adopted by traditional e-businesses and web applications which relies on voluntary externally owned guidelines and punitive legislation is one that has not delivered accessibility for social networking sites. As a result, many people remain excluded because of technical issues, some of which have been known about over a decade. What is needed is recognition of this

failure and a move towards a more holistic participative model involving all stakeholders, to bring about accessible social networking sites through an iterative process, therefore delivering greater social inclusion.

E-businesses are beginning to examine the benefits of using Web 2.0, especially in the form of social networking sites, to collaborate with business partners and to communicate with consumers and potential employees. However, if accessibility is not addressed, both the enterprise *and* the individual lose out. There is a need for further research in this area, exploring the issues raised in this paper and how “Accessibility 2.0” might work in practice.

If policy-makers and technology innovators continue to rely on purely guideline and legal-based web accessibility, the likelihood of dealing with accessibility challenges in other important, emerging and often web 2.0 related computing platforms, such as mobile (Hartley, 2008), (Abrahams, 2008), is not very promising, thus increasing exclusion from economic opportunity and activity even further.

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