

E-Commerce Web Accessibility for People with Disabilities

Osama Sohaib and Kyeong Kang

1 Introduction

An e-commerce website is the central way an e-retailer communicates with their online consumers. E-retailer seeks to provide positive online purchasing experiences for online consumers of all ages. A website design encourages or discourages a consumer's online purchasing intentions [9]. In the context of business-to-consumer (B2C) e-commerce, website design features have different effects on forming consumers' trust and distrust [36]. In particular, B2C websites those are accessible content, information and easy to navigate influences consumer trust to buy online and must appeal to consumers [8, 11]. However, online shopping websites need to be accessible to all consumers of all ages, including those with disabilities. For-example, nowadays dynamic websites content (CSS—Cascading Style Sheets, Flash and JavaScript, etc.) are used in most of the e-commerce websites to provide a good visual presentation to attract or retain consumer. Though, these dynamic webpages are inaccessible to disabled people, such as visual impaired person, since screen readers are not adept of handling it. Many researchers such as [52, 53] have revealed dynamic contents using Flash animation, JavaScript, and graphic links etc. is a threat to web accessibility. The inability to shop online because of such interfaces increases web inaccessibility of e-commerce websites for people with disabilities.

A prior version of this paper has been published in the ISD2016 Proceedings (<http://aisel.aisnet.org/isd2014/proceedings2016>).

O. Sohaib (✉) · K. Kang
University of Technology Sydney, Sydney, Australia
e-mail: Osama.Sohaib@uts.edu.au

K. Kang
e-mail: Kyeong.Kang@uts.edu.au

People with disabilities have limitations for going shopping, which put them at inconvenience because of their physical handicap. However, Internet has opened new possibilities of online shopping. In particular, disabled people can gain a sense of emotional stability by online shopping. Though, if e-commerce websites are inaccessible, consumers with disabilities do not have the equal access they are guaranteed by law. Many online consumers may have various types of disabilities, such as sensory (hearing and vision), motor (limited use of hands) and cognitive (language and learning disabilities) impairments. An accessible web site can utilize all of assistive technologies such as screen readers, voice recognition, alternative pointing devices, alternate keyboards, and the website displays [23]. Even though these technologies can help people with disabilities, webpage navigation, conveying image and flash based content are some of the serious issues for people with disabilities. Web accessibility is an important element in the design of e-commerce websites [24, 43]. Therefore, there is a serious need of web accessibility in B2C e-commerce websites for user of all ages and in particular for people with disabilities such as sensory (hearing and vision), motor (limited use of hands) and cognitive (language and learning disabilities) impairments.

The combination of technology and people in human computer interaction is a vital part of modern society that enables a wide range of economic benefits. In particular, the emerging growth of business-to-consumer (B2C) e-commerce allows everyone to put up his or her own business online, locally or globally. For-example, online shopping in Australia has become the new norm where more than 50% shop online [31]. According to 2012 digital media research, 75% of Australian made purchases from overseas online shops [39]. The web accessibility is an important factor that needs to be considered in Australian e-commerce [44]. Lazar and Sears [24], the authors discussed that web accessibility should receive attention in e-commerce websites. The B2C website provides the consumers with instant online access to products without physical barriers. In order to get the most out of revenue from online trade, businesses must focus on an accessible B2C e-commerce website, which should also give a real and convenient shopping experience for consumers of all ages. In particular, people with disabilities, such as color blindness. Because of the Internet availability, online shops provide consumer the ease of buying and selling products. However, the required web technological infrastructure is either insufficient or does not exist in terms of web accessibility guidelines. For that reason, the Web Content Accessibility Guidelines (WCAG 2.0) developed by the World Wide Web Consortium (W3C) help to make the website accessible for users of all ages and with disabilities such as colour blindness, deaf users, and age related vision problems. Therefore, the purpose of this study is to evaluate Australian B2C e-commerce website accessibility for consumers with disabilities in particular.

According to WHO [55] 2011 report 15% of the total population experience some form of disability. Although disability is a universal issue, it is particularly predominant in Australia. According to Australian Bureau of Statistics (ABS) Survey of Disability, Ageing and Carers, 2015 [56], 18.3% of Australians have a disability (Sight 30%, Hearing 10%). The research will be used as a guide for future

improvement in e-commerce website accessibility. By assessing the web accessibility of online stores now, e-retailers may avoid legal problems in the future and possibly design accessible website. For that reason, this study analyses the Web Content Accessibility Guidelines (WCAG 2.0) in Australian B2C e-commerce websites using an online accessibility self-evaluation web service called “A-Checker” [1], to determine to what extent they meet the requirements of the web content accessibility guidelines (WCAG 2.0).

In particular, this study intends to focus on the following research questions. (1) What accessibility issues do Australian B2C e-commerce websites currently face? (2) What recommendations can be proposed in order to improve web accessibility in Australian B2C e-commerce websites? This study is organized as. The next section provides background and literature review. Then, research method is presented, followed by results and discussion. Finally, the study provides recommendations and concludes.

2 Background and Related Studies

2.1 Issues for Consumer with Disabilities in E-Commerce

As identified in the literature such as [51], the main disabilities that can hinder website accessibility are presented in Table 1.

The following examples may help to explain the types of barriers that can be encountered by an online consumer with a sensory (hearing and vision), motor (limited use of hands) and cognition (language and learning) disabilities.

Visual objects: Product images are placed on the e-commerce website. Websites that use flashing images could trigger symptoms for those with seizure disorders [15]. Flash animation makes web content inaccessible [52, 53]. These flash-based content or graphic images are an example of a barrier for consumers who are visually impaired. They are unable to see the product image and therefore unable to buy it. Such as the use of screen readers cannot read images, animations,

Table 1 Disabilities types and website accessibility issues [51]

Disability form	Symptoms ⁷
Visual impairment	Partial vision; color blindness; may require usage of screen readers, or screen magnifier tools
Hearing impairment	Hearing difficulties; may require sound caption
Cognitive disability	Reading or comprehension difficulties; dyslexia; memory loss
Motor skills impairment	Inability to use keyboard/mouse; inability to make fine movements; may require usage of special assistive devices such as a voice browser, special joysticks and trackballs, and special keyboards that can be manipulated by fingers or using a head-wand

navigational buttons, as well as some difficulties with reading layout tables and charts [51]. In addition, color is perhaps one of the most used design elements to pass on information in websites. Therefore, a color-blind consumer (such as red-green color deficiency) making online purchase will find it difficult to process information and make purchasing decision based on color as a visual clue.

Audio objects: An e-retailer has recorded product information available to consumer on the website as an audio clip or digitized audio. Then the consumers who have difficulty in hearing or deaf cannot hear to buy the product.

Language difficulty: If the product information displayed on the website page is written in unnecessarily complicated language, such as the use of technical terms in specifications of electronics products. Then it may present serious difficulty for consumers with language, learning or cognitive disabilities (for-example, reading disabilities, thinking, remembering, sequencing disabilities). In addition, all consumers can face language comprehension barriers.

Objects Interaction: When an e-retailer focuses on more advanced image interactivity technology, such as three-dimensional (3D) virtual models, 360° rotation view, which allows the manipulation of product images. These will represent a barrier for a consumer who cannot grip the mouse to imitate actual experiences with the product. For-example, consumers with various forms of motor impairments may have increased difficulty using a mouse or keyboard. Such as, rollovers and drop-down menus are difficult to use without a mouse.

2.2 *Web Accessibility*

The World Wide Web Consortium (W3C) [49] defines web accessibility as “people with disabilities can perceive, understand, navigate, and interact with the web”. People with disabilities include visual, speech, physical and neurological disabilities. There are varieties of web accessibility guidelines, but the most relevant are ISO 9241-151, Section 508 of the US rehabilitation Act and Web Content Accessibility Guidelines (WCAG) developed by the W3C. ISO 9241-151 and Sect. 508 comply with W3C. Web Content Accessibility Guidelines (WCAG) version 1.0 was developed in 1999, and then in 2008 more recommendations were made in WCAG 2.0 [50]. WCAG 2.0 is not limited to HTML but support various technologies [26].

The guidelines covered by WCAG 2.0 are: Perceivable, Operable, Understandable and Robust. The aim of “Perceivable” is to direct the user to perceive the user interface components. The “Operable” guides the users that how the interface should be operated and how to navigate. The “Understandable” means the web contents should be understandable by all users. The “Robust” describes that the information should be interpreted by the variety of users in the same way. WCAG 2.0 provided a testable success criterion for each accessibility guideline to determine whether a web page has met or failed the level of conformance. Three levels of conformance for web content accessibility guidelines (WCAG) are: Level A, Level AA and Level AAA.

Web developers must satisfy the Priority 1 (Level A) minimum level of conformance, Priority 2 is the Level AA includes all Levels of A and AA success criteria that the developer should satisfy. Priority 3 (Level AAA) is the highest level, the developer may satisfy the requirements for the webpage to help make accessible. These guidelines make web access easy for old age people and to people with disabilities. People who have cognitive and/or sensory, physical disabilities benefit from using accessible websites. The most common disabilities affecting the use of the website are hearing and visual impairment. In addition, people with difficulty gripping object, such as the use of a mouse requires additional access to web.

Methods for appraising web accessibility include automatic and expert evaluation. A number of researchers used automatic evaluation tools in their studies, such as in e-government, internet banking, schools, universities and company's website etc., for example [19, 20, 22, 25, 27, 35, 46, 47]. Other studies used a group of web accessibility experts for measurements, such as [3, 28, 37]. In addition, a number of researchers assessed web accessibility using both automatic and expert evaluation methods, such as [17, 18, 26, 34, 38, 41]. There are a various free web accessibility online tools examining web pages and automatically evaluating their compliance with Web Contents Accessibility Guidelines (WCAG), such as LIFT, Truwex, A-Prompt, WebXACT (also referred Bobby), WAET, K-WHA, A-Checker, etc. These techniques has the advantage of providing useful evaluations of web accessibility as well as quantitative results [6]. In [23] the authors found that 78.9% of the webmasters were aware that there are automatic tools to check web accessibility. This means that the missing knowledge is not the main reason for the absence of development of accessible websites. The web accessibility evaluation in e-commerce has been limited, in particular in the context of business-to-consumer (B2C) consumer. The following section discusses web accessibility in e-commerce.

2.3 Web Accessibility in E-Commerce

The significance of web accessibility standards in e-commerce has been known around the world [2, 45]. Noonan [32] investigated accessible e-commerce in Australia and recommends that e-commerce developers should consider accessibility in their web design. "As public organizations and private businesses rely more on web based technologies for online shopping, information, and service delivery they must implement strategies to ensure all users can fully access web content" [36], and proposes a web accessibility model to benefit all public organizations and private businesses. As noted in [37], "e-commerce sites lose up to 50% of potential online sales because users cannot find what they want". An accessible website provides a satisfying experience to end-users, hence increasing sales and revenue for seller [5]. In [29] the authors analysed usability and accessibility errors of African e-commerce websites compared to Europe using an automated tools. In [30] the authors recommend putting their own accessibility guidelines for African countries to ensure accessibility for all users.

According to Dolson [10], “The physical disabilities of a merchant’s visitors are a factor that he or she should consider”. In [40] the author believes that getting more loyal customers and avoid legal challenges are the other two reasons to design for accessibility. If the consumer gets the relevant information, then the trustworthiness of the website is increased and hence leads to higher purchase intention [14]. Faulkner [12] developed a Web Accessibility Toolbar (WAT) for Internet Explorer in collaboration with Vision Australia, the Paciello Group (Europe) and of the web accessibility tools consortium, to assist in evaluating a web page for compliance to the Web Content Accessibility Guidelines (WCAG 2.0). It is well recognized that information on the e-commerce websites varies in quality. To the extent that consumer perceive that e-commerce website presents quality information, they are more expected to have confidence and will perceive the merchant as trustworthy [21]. Therefore, there is a need of quality measurement criteria accessibility for e-commerce [16].

3 Methodology

The most practical method for measuring website accessibility is content analysis. Therefore, content analysis approach is used to investigate web accessibility in e-commerce websites. In particular, the unit of measure for this study is Australian Business-to-Consumer (B2C) e-commerce websites. The sample for this study was generated by region from Alexa, a provider of global web metrics. In (www.alexa.com) website, by clicking the link “Browse Top Sites” and selecting country Australia, 500 website were provided. After deletion of irrelevant links (such as, non B2C e-commerce websites), remaining top 30 B2C e-commerce websites was finalized for further analysis.

3.1 Instrument

Automated analyses were performed using an open source web accessibility evaluation tool called “A-Checker” version 0.8.6 [1] to test all the web pages of selected websites for conformance to web content accessibility guidelines version 2.0 (WCAG 2.0). The online web service “A-Checker” is developed by a research group at the University of Toronto [48] that tests single web page for accessibility conformance. “A-Checker” identifies three types of problems.

- **Known Problems (KP):** These are problems that must be fixed and have been identified as accessibility barriers.
- **Likely Problems (LP):** These are problems that are likely to be fixed and have been identified as probable barriers.
- **Potential Problems (PP):** These are problems that require a human decision for modifying or not to modify your webpage.

3.2 Procedure

Data analysis took place in November 2015. The homepages of the selected B2C websites were tested in order to gain insight into what issues web pages might contain. The URL for each web page was entered into a required field and checked for accessibility. Options such as ‘HTML validator’ and ‘CSS validator’ were enabled and ‘view by guideline’ report format was selected. All three types of problems (known problems, likely problems and potential problems) were checked and recorded for each level of web content accessibility (WCAG 2.0) compliance of each website. Such as, each webpage was tested for Level A, Level AA and Level AAA of WCAG 2.0. Data (errors) were placed into an Excel sheet and descriptive statistics was conducted using SPSS v.22. If the webpage had the minimum level of conformance error (Level A), it failed the test. If no error were recorded, the webpage passed the test.

4 Results

The results showed that Australian online stores are not paying attention to at least a minimum level of conformance (Level A) of web content accessibility guidelines for their online business websites. None of the 30 Australian B2C e-commerce websites meets the minimum success criteria (Level A) of WCAG 2.0. Table 2 shows the descriptive statistics of the errors identified. For “Level A” conformance (the minimum level of conformance), a high number of known problems (KP) in Australian websites (mean = 19.1) showed accessibility barriers that must be fixed. The results also showed quite a high number of (Level A) potential problems (PP) that requires human decision to fix. The figures are worse for ‘Level AA’ known problems (KP) are (mean = 119.1) followed by ‘Level AAA’ known problems (KP) (mean = 123.6). The occurrence of these accessibility barriers will make it difficult for people with disabilities to shop online.

Table 2 Group statistics of success criteria

Success criteria	Mean
Known Problem (Level A)	19.13
Likely Problems (Level A)	5.87
Potential Problems (Level A)	782.13
Known Problem (Level AA)	119.17
Likely Problems (Level AA)	5.74
Potential Problems (Level AA)	833.48
Known Problem (Level AAA)	123.65
Likely Problems (Level AAA)	1.48
Potential Problems (Level AAA)	863.39

The main problems reported in Australian B2C e-commerce websites were:

- Missing label for text element and input assistance such as “label text is empty” (65% of pages).
- In addition, problems that need to be fixed are: the contrast between the color of text and its background. The most and severe violations against web content accessibility guidelines (WCAG 2.0) were:
 - Level A 1.3. Ensure that information and structure can be separated from presentation (55% of pages).
 - Success Criteria 1.3.1 Info and Relationships (Level A)
 - “Input element, the type of “text”, missing an associated label”
 - Level A 3.3. Input Assistance: Help users avoid and correct mistakes (73% of pages).
 - Success Criteria 3.3.2 Labels or Instructions (Level A)
 - “Label text is empty”
 - Level AA 1.4. Distinguishable: Make it easier for users to see and hear content including separating foreground from background (68% of pages).
 - Success Criteria 1.4.3 Contrast (Minimum) (Level AA)
 - “The contrast between the color of text and its background for the element is not sufficient to meet WCAG2.0 Level AA”.

5 Discussion

The analysis reveals a growing need for addressing the current problem of web accessibility in Australian B2C e-commerce. Websites are not designed with equal access for all users in mind. Table 3 presents the complexity levels of some accessibility errors, which shows how easy it is to fix the errors [13, 46]. It is highly desirable that e-commerce firms make greater efforts to ensure that the consumers with disabilities have equal access to their websites.

The Australian government has endorsed the Web Content Accessibility Guidelines (WCAG 2.0) and made a mandatory requirement for all e-government websites to conform to Level AA [33]. The Australian government also needs to legitimate and strongly encourage e-businesses to develop accessible e-commerce applications for the widest audience. In a worldwide context, web development is now growing for e-business. From a human computer interaction viewpoint, accessible websites are becoming ever more important. The web technology creates new opportunities for e-commerce firms, but as well as challenges. Companies invest in e-business since the web has become the platform to perform business efficiently and effectively. Many business models are applied to attract and engage consumers to revisit their websites frequently. However, the presentation of B2C web design features are not conveyed through web accessibility guidelines to

Table 3 Complexity level of some web accessibility errors

Type of accessibility errors	Priority (Level)	Ease of fixing
Alt text is not used for each region of an image map	1 (Level A)	Easy
For tables not used for layout (e.g., spreadsheet), identify headers for table rows and columns	1 (Level A)	Easy
If color is used to convey information, ensure information is also provided in another way	1 (Level A)	Moderate
Did not provide alt text for images that convey content	1 (Level A)	Easy
Did not provide label tags for form fields	1 (Level A)	Moderate
Page does not have logical heading structure	1 (Level A)	Moderate
Programmatic objects should not cause screen to flicker	1 (Level A)	Hard
Used tables to format text documents in columns	2 (Level AA)	Hard
Did not ensure that background and foreground colors contrast sufficiently	2 (Level A)	Easy
Did not provide descriptive titles for links	2 (Level AA)	Easy
Used absolute (pixels) rather than relative sizing and positioning (% values)	2 (Level AA)	Moderate
When scripts created pop-up windows or changed the active window, page did not ensure that user was aware that this was happening	2 (Level AA)	Moderate
Used deprecated language features	2 (Level AA)	Moderate
Did not identify language of text	3 (Level AAA)	Moderate
Did not specify logical tab order among form controls, links, and objects	3 (Level AAA)	Moderate
Did not provide keyboard shortcuts to frequently used links	3 (Level AAA)	Moderate
Did not provide summary and caption for tables	3 (Level AAA)	Moderate
Did not group related links	3 (Level AAA)	Moderate
Did not provide linear text alternative for tables that laid out content in parallel word-wrapped columns	3 (Level AAA)	Hard
Did not provide abbreviations for long row or column labels	3 (Level AAA)	Easy
Live regions are not specified with appropriate WAI-ARIA attributes	3 (Level AAA)	Hard

consumers of all ages including disabilities. Therefore, e-commerce websites must also follow web accessibility by law [42].

5.1 Contributions and Recommendations

It is extremely recommended to B2C e-commerce firms to ensure that their website is according to WCAG 2.0 [14], which means that consumers with disabilities can purchase online. In addition, based on the [7, 46] recommendations, this study

present the following suggestions to B2C e-commerce websites for people with disabilities such as sensory (hearing and vision), motor (limited use of hands) and cognitive (language and learning disabilities) impairments.

Consumer with vision difficulties: Web accessibility is particularly important since blind or color blind consumer has much more difficulty browsing the web [4]. Therefore,

- Product images should be displayed denoting their purpose and not appearance. Such as the use of ALT-tags to allow screen reader to skip unimportant images.
- Use short description for images. For-example, by stating a colour name.
- “People with low vision can use screen readers such as Job Access with Speech (JAWS), available from <http://www.freedomscientific.com/products/fs/jaws-product-page.asp> or Window Eyes (i.e., a screen reader for Microsoft Windows)”.
- “In order to learn how a screen reader for a person with vision loss would orally present the text of a website, developers can use a Firefox plug-ins such as Fangs Screen Reader Emulator (<https://addons.mozilla.org/en-US/firefox/addon/fangs-screen-reader-emulator/>)” [46].
- Color Oracle software can be used by designers freely (from <http://colororacle.org>) for color-blind people [21].
- Avoid text font that are difficult to read with limited resolutions. The Color Blindness Simulator is also available online (<http://www.colblindor.com/coblist-color-blindness-simulator/>) to close this gap.
- Avoid low contrast design. Achieving effective contrast is easy by following the WCAG 2.0 recommendations, such as effective colour contrast ratio. There are amply of tools out there calculate contrast ratio. Such as Lea Verou’s Contrast Ratio checker. <http://leaverou.github.io/contrast-ratio/>
- Coady [54] provided five ways to improve e-commerce design for color-blind users.

Consumer with hearing difficulties

- Such consumer should be provided with text captioning (closed captioning) for all audio content.
- Variety of tools available of closed captioning such as MAGpie 2, Docsoft software and YouTube also offer closed captioning services.

Consumer with learning and language difficulties

- Text on web pages should also be resizable to improve readability.
- Allow the consumer enough time when requiring input, such as in making online transactions.

The results of this study may help online shopping managers who could use the insights analysed in this research to modify their approach. Developers and website designers can use these understandings to increase desirable outcomes by focusing the web content accessibility guidelines (WCAG 2.0), to increase the chances for an

online business to succeed in countries with diverse degrees of Internet users. Practical implications extend to business firms to make changes to their online business strategies to trigger their online sale better by targeting consumers with disabilities.

5.2 Conclusion and Limitations

The results show that B2C e-commerce websites in Australia are not paying attention to meet at least the minimum success criteria (Level A) of web content accessibility guidelines (WCAG 2.0). With the widespread of mobile technology, online shopping has grown significantly in recent years. Therefore, consumers with disabilities are increasingly demanding an accessible online shopping. Web content accessibility gives the opportunity for disabled people to use websites. Web accessibility for B2C websites is also important for legal and a business reasons point of view. It is also helpful to increase serviceability of B2C to engage online consumers of all ages and to increase e-retailer reputation and revenue.

This study has limitations, the B2C websites selected, which may affect the generalization of the study to other specific B2C websites. In addition, other online accessibility evaluation tools and expert evaluation may report diverse web accessibility errors.

References

1. A-Checker. Web accessibility checker. <http://achecker.ca/checker/index.php> (2006). Accessed 15 Sept 2015
2. Bernard, E.K., Makienko, I.: The effects of information privacy and online shopping experience in e-commerce. *Acad. Mark. Stud. J.* **15**, 97–112 (2011)
3. Brajnik, G., Yesilada, Y., Harper, S.: The expertise effect on web accessibility evaluation methods. *Hum. Comput. Inter.* **26**(3), 246–283 (2011)
4. Brunsman-Johnson, C., Narayanan, S., Shebilske, W., Alakke, G., Narakesari, S.: Modeling web-based information seeking by users who are blind. *Disabil. Rehabil. Assistive Techn.* **6** (6), 511–525 (2011)
5. Chelule, E.: E-commerce usability: do we need guidelines for emerging economics? In: *IADIS International Interfaces and Human Computer Interaction 2010* (2010)
6. Cho, J., Lee, D., Hong, S.: A study on the web site accessibility evaluation. *Bus. Res. Cent. Dong-A Univ* **26**(26), 161–179 (2005)
7. Crow, K.L.: Four types of disabilities: their impact on online learning. *Techtrends* **52**(1), 51–55 (2008)
8. Cyr, D.: Website design, trust and culture: an eight country investigation. *Electron. Commer. Res. Appl.* (0), 1–12 (2013)
9. Cyr, D., Bonanni, C., Bowes, J., Ilsever, J.: Beyond trust: web site design preferences across cultures. *J. Glob. Inf. Manag. (JGIM)* **13**(4), 30 (2005)
10. Dolson, J.C.: Accessibility: how many disabled web users are there? <http://www.practicalecommerce.com/articles/1417-Accessibility-How-Many-Disabled-Web-Users-Are-There> (2009). Accessed 10 Oct 2015

11. Éthier, J., Hadaya, P., Talbot, J., Cadieux, J.: Interface design and emotions experienced on B2C Web sites: empirical testing of a research model. *Comput. Hum. Behav.* **24**, 2771–2791 (2008)
12. Faulkner.: S. Web Accessibility Toolbar for IE. <http://www.visionaustralia.org/business-and-professionals/digital-access/resources/tools-to-download/web-accessibility-toolbar-for-ie—2012> (2012). Accessed 15 Sept 2015
13. Flowers, C., Bray, M., Algozzine, R.: Content accessibility of community college websites. *Community Coll. J. Res. Pract.* **25**(7), 475–485 (2001)
14. Ganguly, B., Dash, S.B., Cyr, D.: The effects of website design on purchase intention in online shopping: the mediating role of trust and the moderating role of culture. *Int. J. Electron. Bus.* **8**(4/5), 302–329 (2010)
15. Golden, N.: Access this: why institutions of higher education must provide access to the internet to students with disabilities. *J. Entertainment Technol. Law*, **10**(3), 363–411 (2008)
16. Hasan, L., Abuelrub, E.: Assessing the quality of web sites. *Appl. Comput. Inform.* **9**(1), 11–29 (2011)
17. Hong, S., Cho, J., Lee, D.: Government website accessibility: comparison between Korea and the United States. *Inf. Syst. Rev.* **7**(1), 81–96 (2004)
18. Hyun, J., Hong, K., Shin, K., Min, H.: Web accessibility compliance of major web sites in Korea. *J. Rehabil. Eng. Assist. Technol. Soc. Korea* **1**(1), 37–43 (2007)
19. Hyun, J., Kim, B.: Web accessibility compliance of internet bankings in Korea. *J. Korea Soc. Inf. Technol.* **7**(2), 77–93 (2008)
20. Kang, Y., Hong, S., Lee, H., Cha, Y.: Website accessibility evaluation of the welfare centers for the disabled. *J. Korea Acad-Ind. Coop. Soc.* **12**(11), 5260–5271 (2011)
21. Kim, D.J., Ferrin, D.L., Rao, H.R.: A trust-based consumer decision-making model in electronic commerce: the role of trust, perceived risk, and their antecedents. *Decis. Support Syst.* **44**(2), 544–564 (2008)
22. Kuzma, J.M.: Accessibility design issues with UK e-government sites. *Gov. Inf. Q.* **27**, 141–146 (2010)
23. Lazar, J., Alfredo, D., Greenidge, K.: Improving web accessibility: a study of webmaster perceptions. *Comput. Hum. Behav.* **20**, 269–288 (2004)
24. Lazar, J., Sears, A.: Design of e-business web sites. In: *Handbook of Human Factors and Ergonomics*, pp. 1344–1363. John Wiley & Sons, Inc. (2006)
25. Lee, J., Lee, B.: Web accessibility evaluation of cyber universities' contents in Korea. *J. Korea Contents Soc.* **7**(4), 224–233 (2007)
26. Li, S.-H., Yen, D.C., Lu, W.-H., Lin, T.-L.: Migrating from WCAG 1.0 to WCAG 2.0—A comparative study based on web content accessibility guidelines in Taiwan. *Comput. Hum. Behav.* **28**(1), 87–96 (2012)
27. Loiacono, E.: web accessibility and corporate America. *Commun. ACM* **47**(12), 82–87 (2004)
28. Luchtenberg, M., C. Kuhli-Hattenbach, Y. Sinangin, C. Ohrloff, R. Schalus.: Accessibility of health information on the internet to the visually impaired user. *Ophthalmologica.* **222**(3), 187–193 (2008)
29. Maswera, T., R. Dawson, J. Edwards.: Analysis of usability and accessibility errors of e-commerce websites of tourist organisations in four african countries. In: Frew, A. (ed.) *Information and Communication Technologies in Tourism 2005*, pp. 531–542. Springer, Vienna (2005)
30. Maswera, T., Edwards, J., Dawson, R.: Recommendations for e-commerce systems in the tourism industry of sub-Saharan Africa. *Telematics. Inform.* **26**(1), 12–19 (2009)
31. Morgon, R.: State of the nation's \$24 billion online retail trade: internet shopping becomes the new Australian norm. <http://www.abc.net.au/news/2013-06-04/more-than-50-per-cent-of-australians-shopping-online/4731590> (2013). Accessed 10 Sept 2015

32. Noonan, T.: Accessible e-commerce in Australia. http://www.timnoonan.com.au/ecrep10.htm_Toc463495402 (1999). Accessed 10 Sept 2015
33. NTS. Accessibility. <http://webguide.gov.au/accessibility-usability/accessibility/> (2011). Accessed 11 Sept 2015
34. O'Grady, L.: Accessibility compliance rates of consumer-oriented Canadian health care web sites. *Inform. Health Soc. Care* **30**(4), 287–295 (2006)
35. Oh, K., Kim, Y.: Investigation of web accessibility on hospital websites in Korea. *Proc. Korean Soc. Internet Inf.* **9**(2), 375–380 (2008)
36. Ou, C.X., Sia, C.L.: Consumer trust and distrust: An issue of website design. *Int. J. Hum. Comput. Stud.* **68**(12), 913–934 (2010)
37. Park, H., Ban, C.: Implementation and evaluation of the on-line aptitude test system for people with visual impairment supporting web accessibility. *Disabil Employ* **20**(1), 51–78 (2010)
38. Potter, A.: Accessibility of Alabama government web sites. *J. Gov. Inf.* **29**, 303–317 (2000)
39. PwC. Australia and New Zealand online shopping market and digital insights. <http://www.pwc.com.au/industry/retail-consumer/assets/Digital-Media-Online-Shopping-Jul12.pdf> (2012). Accessed 15 Sept 2015
40. Roggio, A.: The importance of web accessibility for e-commerce. <http://www.getelastic.com/the-importance-of-web-accessibility-for-ecommerce/> (2008)
41. Seo, E., Kim, H.: Comparative analysis of web accessibility in national libraries. *J. Korean Soc. Libr. Inf. Sci.* **42**(3), 345–364 (2008)
42. Smallman, W.: Should e-commerce websites support web accessibility by law? <http://www.blahblatech.com/2006/11/should-e-commerce-websites-support-web-accessibility-by-law.html> (2006). Accessed 10 Sept 2015
43. Sohaib, O., K. Kang.: The importance of web accessibility in business to-consumer (B2C) Websites'. In: 22nd Australasian Software Engineering Conference (ASWEC 2013), pp. 1–11 (2013)
44. Sohaib, O., Kang, K.: Individual level culture influence on online consumer iTrust aspects towards purchase intention across cultures: A S-O-R model. *Int. J. Electron. Bus.* **12**(2), 141–162 (2015)
45. Sohaib, O., K. Kang.: The role of technology, human and social networks in serviceable cross-cultural B2C websites. In: 19th International Business Information Management Conference (IBIMA), Barcelona, Italy (2012)
46. Solovieva, T.I., Bock, M.J.: Monitoring for accessibility and university websites: meeting the needs of people with disabilities. *J. Postsecondary Educ. Disabil.* **27**(2), 113–127 (2014)
47. Sullivan, T., R. Matson.: Barriers to use: usability and content accessibility on the web's most popular sites. In: Proceedings of the 2000 Conference on Universal Usability (2000)
48. W3C. Complete list of web accessibility evaluation tools <http://www.w3.org/WAI/ER/tools/complete> (2012). Accessed 5 Nov 2015
49. W3C. Introduction to web accessibility. <http://www.w3.org/WAI/intro/accessibility.php> (2005)
50. W3C. Web content accessibility guidelines (WCAG) 2.0. <http://www.w3.org/TR/WCAG20/> (2008). Accessed 1 Oct 2016
51. Kamoun, F., Almourad, M.B.: Accessibility as an integral factor in e-government web site evaluation. *Info. Technol. & People*, **27**(2), 208–228 (2014)
52. King, A., Evans, G., Blenkhorn P.: Webbie: a browser for visually impaired people. In: Proceedings of the 2nd Cambridge Workshop on Universal Access and Assistive Technology, pp. 35–44 (2004)
53. Power, C., Jurgensen, H.: Accessible presentation of information for people with visual disabilities. *Univ. Access. Inf. Soc.* **9**(2), 97–119 (2010)

54. Coady, C.: 5 Ways to improve your ecommerce design for colourblind users. <https://www.shopify.com.au/partners/blog/86314118-5-ways-to-improve-your-ecommerce-design-for-colourblind-users> (2016). Accessed 5 Oct 2016
55. WHO.: New world report shows more than 1 billion people with disabilities face substantial barriers in their daily lives. www.who.int/mediacentre/news/releases/2011/disabilities_20110609/en/index.html (2011). Accessed 14 Sept 2016
56. Australian Bureau of Statistics (ABS).: Disability, ageing and carers, Australia: first results. <http://www.abs.gov.au/ausstats/abs@.nsf/mf/4430.0.10.001> (2015). Accessed 5 Oct 2016