


Creating an Inclusive Web Framework

Moving towards
accessible and usable
web design

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Abstract

This study delves into existing literature regarding web accessibility and usability. It looks into the relationship between accessibility and usability to highlight how both practices complement each other and, when used together, will create a better, and accessible, user experience. This research study employed a survey to understand how web designers, developers and professionals (the participants) perceived the relationship between web accessibility and usability. This survey also presented a table of combined heuristics and questioned whether the participants considered an integrated view using combined web accessibility guidelines and usability heuristics to be a good segue into a more comprehensive, and inclusive, web design framework. This research study is working towards an inclusive web framework that focuses around the user experience of users of all abilities with regard to the perspectives of web designers, developers and professionals in its' development.

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1 Introduction

The web has become an established source worldwide to access information about anything and everything. It allows for multimodal interaction as long as the layout and content are designed with this interactivity in mind. This multimodal affordance allows people of different abilities to connect with, use, as well as provide and share information. When the content and interaction of a website are designed with a focus on a diverse audience, more people are able to consume and share the data. An example would be someone who does not use a mouse due to low vision. With an awareness of this user's context, the website design should allow for such things as navigation using only a keyboard and/or a screen reader and a non-cluttered layout with good contrast between the foreground and background colours.

Web accessibility deals with removing barriers that prevent people with disabilities from accessing and interacting with a website. Web usability focuses on how the content of the website is presented—that it is clear, concise and that the navigation is consistent. Viewed as two separate disciplines, both practices have their ultimate goal on the "user"; one deals with user access and the other, traditionally, focuses on the experiences of the "average user". However, web usability and accessibility are more closely related than one may

think. The goal of usability is to make a website easy to use. The goal for accessibility is to make a site usable by people of all abilities. If a website cannot be accessed by a user, then it is unusable for that individual; its usability is subsumed by its accessibility. If a website is considered difficult to use by someone who is not disabled, it will be unusable or very difficult to use by someone who has a disability. People with disabilities may not have as many ways to adapt to a design. Currently, there is no (publicly available) model that integrates these two areas. Web accessibility and web usability are viewed as two distinct areas or vague subsets of one another; we need an inclusive web framework where accessibility practices are unified into the design process in parallel with usability practices. This design framework would then be used as a guide for web designers, developers, professionals and user researchers in all their web projects.

1.1 **Web Accessibility**

The World Wide Web Consortium's (W3C) Web Accessibility Initiative (WAI) defines web accessibility as people with disabilities can perceive, understand, navigate, and interact with the Web, and that they can contribute to the Web. ("Introduction to Web," 2005) Web

accessibility is the practice of removing barriers and maintaining equal access to the interaction and content of a website for people with a diverse range of abilities. It is Tim Berners-Lee (1997), W3C Director and inventor of the World Wide Web, who stated that “the power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect.”

Making the web more accessible is gaining world-wide momentum in web design and development. Standards create a conceptual framework for an equal digital environment. Policies and practices are what bring standards to life by integrating them into systems and processes. The W3C WAI Web Content Accessibility Guidelines (WCAG) 2.0 are the current standard that most of the world follows.

Web accessibility focuses on making websites accessible to people of all different abilities. It is based on the theoretical understanding that if a website is designed and developed using current worldwide standards and guidelines, then the information of the site can be accessed by all equally. But there is more to accessibility than strict conformance to standards.

1.2 **Web Usability**

The ISO 9241-11:1998 defines usability as “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.” (ISO 9241-11, 1998)

Jakob Nielsen refers to usability as a quality attribute that assesses the ease of use of interfaces. Nielsen defines usability by five quality components: learnability; efficiency; memorability; errors; and, satisfaction. (Nielsen, 2012)

Web usability focuses on how a user interacts with a website; it is contextual. It is the study of users’ interactions with websites and creating principles and enhancing practices according to these user experiences.

1.3 **What is Inclusive Design?**

Ideally, inclusion means that everyone is considered and included. To try to define inclusion brings to mind Plato’s “Theory of Forms”, that the idea of an ideal state or perfection may not be seen, but people understand what it is. Inclusion is the striving towards that “perfect state” of including everyone. The Inclusive Design Research Centre

(IDRC) defines “inclusive design” as design that considers the full range of human diversity with respect to ability, language, culture, gender, age and other forms of human difference (“What is Inclusive Design,” 2013).

With inclusion in mind, there needs to be a shift away from the “us” versus “them” mentality. Margit Link-Rodrigue points out that once we embrace inclusiveness, the marginalization of others as members of one specific group becomes difficult because we then begin to see others' needs as our own. It's about embracing our similarities and differences. (Link-Rodrigue, 2009) Jutta Treviranus notes that “inclusive design should trigger a virtuous cycle of inclusion, leverage the ‘curb-cut effect,’ and recognize the interconnectedness of users and systems.” (Treviranus, 2014) The “curb-cut effect” refers to the cut in the sidewalk that was designed for helping people who were using wheelchairs but have proved to be beneficial for many other people—someone pushing a baby stroller, using a shopping cart, skateboarding or someone who has slight mobility issues and finds it difficult to use steps.

To remove that wedge between “us” and “them”, disability needs to be universally understood as a mismatch between the needs and preferences of the user and the system or environment. (“What is

Inclusive Design,” 2013) To illustrate this mismatch between the needs of the user and the environment, we could show how disabilities can be viewed as a spectrum (or a continuum). We all may experience a disability or impairment in our lives due to aging, disease or environmental factors (Figure 1).

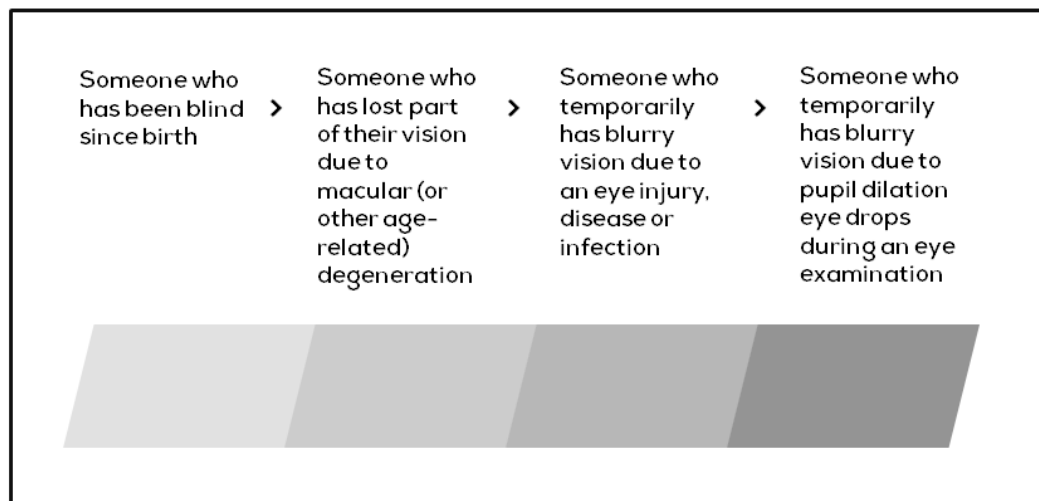


Figure 1. Image of disability as a spectrum.

Nielsen (2005) states that “it’s an oversimplification to distinguish between users with and without disabilities as if that were a dichotomy. It’s really a continuum of people with more or less severe disabilities.”

The ISO IEC joint technical committee states that the abilities and requirements of people change as they advance from childhood to old

age. The abilities of individuals in any particular age group will greatly vary. It is crucial to recognize that functional and cognitive limitations vary from comparatively minor, such as mild hearing loss or use of spectacles, to blindness, deafness or the inability to move part or all of one's body. (Guide 71, 2001)

With the idea of the "curb-cut" and framing accessibility as not only being essential for people with disabilities, but being beneficial for everyone, there is a positive move towards the ideal of inclusion. It is also important to note that all people should accommodate people of all abilities, without any restrictions or limitations. The Ontario Human Rights Commission (OHRC) points out that "The 'Code' protects people from discrimination and harassment because of past, present and perceived disabilities." ("Policy and Guidelines," 2000) The OHRC also recognizes that "persons with disabilities face many kinds of barriers every day. These can be physical, attitudinal or systemic. It is best to identify and remove barriers voluntarily instead of waiting to answer individual accommodation requests or complaints." ("Disability and human rights," 2011)

1.4 Purpose of Research

Web accessibility and usability can often be forgotten or are considered only after a new website is already in production. Both need to be addressed in the beginning of a project and throughout its lifecycle. Planning accessibility and usability at the beginning of a project saves time, effort and money. Design guidelines and principles for both accessibility and usability exist, but a framework for applying them need to be better defined.

In order to move towards inclusive web design, a framework must consider and include the abilities and limitations of a diverse audience. An inclusive web framework would benefit web designers, developers, web accessibility and usability professionals, as well as UX professionals, user researchers and project managers by providing a resource that will lead them through the guidelines and methods that should be considered when developing or updating a website. This model would complement the accessibility (WCAG 2.0) conformance-based guidelines with the context-based, user-focused, usability methods to provide a better understanding of a diverse range of users. This could be a move towards creating a robust, inclusive web framework.

1.5 **Objective**

Web designers and developers, particularly those new in the design field, need a resource that will help guide their design process so that what they create will be accessible and usable for a diverse audience. Users of different abilities need to be considered from the very beginning and throughout a web project.

There are copious resources about web accessibility, usability and design methodologies online and knowing where to start in the design process is often a challenge. Web designers and developers often formulate their own “best practices” guides based on their own experiences and perspectives. With the amount of data available, it is often necessary to collate our own guides and/or resources.

There is a challenge to raise awareness about the importance of web accessibility guidelines and web usability principles, with an emphasis on user-centred design (UCD) among web designers, developers, professionals, user researchers and project managers. In this study, I investigate whether there is a need for such a framework by suggesting the integration of web accessibility guidelines and web usability principles to broadly illustrate that both practices should be included in the design process. There is a need to understand how web practitioners view the relationship between web accessibility and

usability, and whether this relationship could lead to a more comprehensive model that would move the development of an inclusive web framework forward.

2 Theoretical Analysis

In this section, there is an examination of the relationship between web accessibility and usability and an introduction of the existing methodology of user-centred design (UCD) that bridges these two practices. Then the heuristics and guidelines of both practices are reviewed and combined to illustrate their close relationship. And finally, there is a look at the shift from the “average user” towards usable accessibility in a move to create an inclusive web framework.

2.1 The Relationship between Web Accessibility and Usability

With increasing legislation of web accessibility worldwide, many web designers and developers tend to focus only on the conformance of technical specifications. (This may be due to lack of awareness, timelines and/or budget of web projects.) Designers and developers utilize automated or semi-automated web accessibility evaluation tools to help them test the WCAG 2.0 conformance level of their website. All automated tools and many evaluation methods focus around the technical conformance of these guidelines. However, these tools do not take into account the user experience. Besides the WCAG’s Conformance Levels of A, AA or AAA, how do we know that a

site is accessible and whether a site is usable in all or most contexts? Web accessibility is not objective. It is not a binary situation; it is an intricate, user-specific situation.

Jakob Nielsen recognizes that a strict focus on accessibility as a scorecard or check-list item does not help users with disabilities. In order to help users accomplish tasks, designers must adopt a usability perspective. Nielsen continues by stating that the idea that accessibility exists in a vacuum is a fallacy. We cannot evaluate accessibility without considering users, their situations and their tasks. (Nielsen, 2005) The adherence to the technical guidelines should not be the only determinant of the accessibility of a website. It is important to understand the user, the context and the task that needs to be completed; knowing this will help determine whether something is accessible or not.

Cooper, Sloan, Kelly and Lewthwaite (2012) state that "accessibility is a property of the relation between the user and the resource in the context of how that is mediated; not a property of the resource." It is about understanding accessibility in use. Cooper et al. stress the need to address the requirements of the user and the usage context in establishing accessibility as an extension past the measurement of task completion to support a context-dependent, user experience.

The fundamentals behind UCD include the importance of the user requirements, understanding user journeys, as well as focusing on the user goals.

Shawn Lawton Henry (2007) recognizes that there “isn't a clear distinction between accessibility for people with disabilities and general usability for all. Although some things may be recognized as purely accessibility-related and some as usability-related; the gap is small with many issues being in a ‘gray’ area because there is a great deal of overlap.” One of the key distinctions between them is that web accessibility is being legislated to protect users with diverse abilities, whereas usability resides under “best practices” that is not a legal requirement.

Henry (2002) addresses the term “usable accessibility” to help broaden the definition of accessibility in order to show the difference between what meets minimum accessibility standards and what is usable by people with disabilities. The user is where usability meets and connects with accessibility—it is all about the user experience (Figure 2).

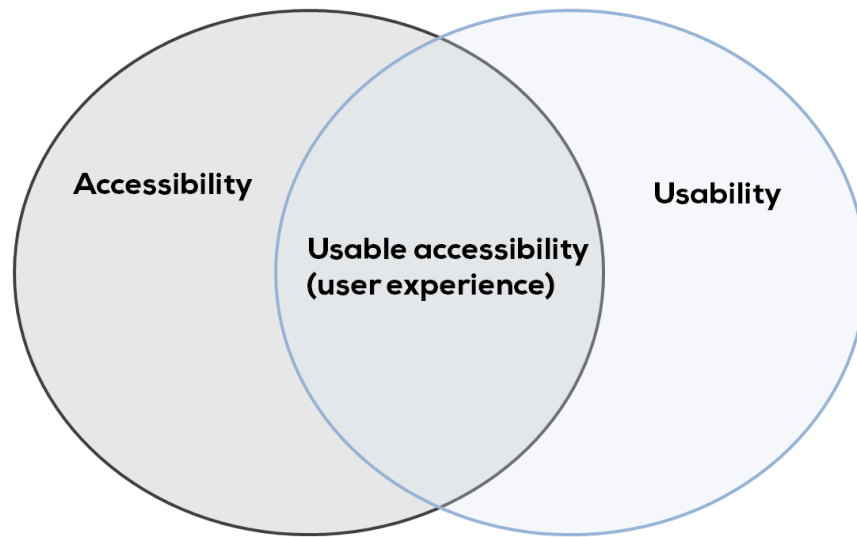


Figure 2. Illustration of relationship between web accessibility and usability.

We must broaden our scope of accessibility by moving beyond only the technical aspects. The technical aspects are important for standardization and uniformity at a “system” level, but we, as designers, developers and user researchers, must recognize that usability is also an important aspect of accessibility.

The W3C WAI, the governing body for current web accessibility guidelines (WCAG 2.0), promotes increased communication and coordination between accessibility and usability practice in the design and development of guidelines, websites, and other web tools to make them accessible, inclusive, and usable for everyone. (“Web Accessibility and Usability,” 2010) This is recognition that technical

guidelines are not enough. There needs to be a lens on the uniqueness of each user as well. There are many users who consume web content differently—using different modalities. With a diversity of people who have disabilities, it is necessary to understand that they have multimodal requirements. When a user has a disability, they have less freedom in the tactics they use in order to adapt to a website.

Web usability focuses on the user—their experience through usability testing, the creation of personas, user journeys and other methods. However, many usability professionals have focused their efforts on making information interfaces usable by the “average user”; this “average user” being one without any “disabilities.”

Usability.gov recognizes that “many usability resources provide the ideal number of users to test, but they rarely address the importance of diversity in the users to test. When selecting test pools, the testers often focus on the ‘average user.’” (“Usability and Accessibility,” 2014) The needs of the users who have disabilities are often not considered, which creates a gap or inconsistency in the development and sustainability of usability methodologies and methods. This gap needs to be addressed by including users of all different abilities in

usability methods, practices and policies. The consideration of all users will ensure equal and better user experiences.

Alastair Campbell notes that this overlap of accessibility and usability issues can be used to create a more robust experience—just like leveraging the “curb-cut.” By making a website usable and accessible, you can improve more things for most people. (“Is accessibility actually usability?,” 2009)

Trying to improve the web user experience for most people leads us, as designers, towards the ideal state of inclusion.

2.2 User-centered Design: A Methodology That Binds the Two

User-centred design (UCD) is a methodology that focuses on usability goals—the user’s needs, wants, expectations and limitations of a product or service. Each stage of the design process utilizes this methodology by stressing the importance of the user. The standard that is the basis of UCD processes is defined by the ISO 13407: Human-centred design process (1999), which states that the general approach to interactive system development focuses on human-centered activities throughout the development life-cycle with the

goal of making systems usable. ("Notes on User Centered Design," 2004)

In UCD, as well as understanding the needs and wants of a user, a designer also tests their designs in the real world with real users. Usability testing is an essential part of UCD. User testing helps designers to understand how the users perceive, operate and understand the design. (Pratt & Nunes, 2012) These elements are essential for web accessibility as well.

Whitney Quesenbery states that we, as designers, developers and user researchers, need to include participants with disabilities in usability testing. This includes people who use screen readers, screen magnifiers, alternative keyboards and other assistive technologies. Quesenbery also notes, as Campbell did, that making a website more accessible often makes for a better user experience for everyone. (Quesenbery, 2010)

The processes used in UCD are iterative and follow the core methods of planning, research/analysis, design, evaluating/testing and refining the design based on the evaluations. Shawn Lawton Henry believes that accessible design techniques fit well into these UCD processes. Henry (2007) suggests that with a few additions and adaptations, design teams can use UCD practices to focus design on accessibility.

The core principle of UCD is an early focus on users, their requirements and their tasks. This is a crucial principle and is the reason why it is necessary for a website to be built with accessibility and usability in mind. We need to define the "users" to be more inclusive of a wide range of users and their abilities. Accessibility must be implemented at this stage. Henry (2002) notes that "in order to evaluate usable accessibility, the website must be tested in various configurations, using assistive technologies, and to involve participants with disabilities in usability testing." Henry continues by stating that "in order to design inclusively, designers need to consider the widest range of possible users and environments." Different modalities of offering content must be considered and integrated into the design. For example, a user may: have issues with vision; be partially colour-blind; be unable to hear; have mobility and dexterity issues—affecting mouse and keyboard usage; have issues reading and/or comprehending text; and may not be able to process some types of information easily or at all. Addressing as many needs as possible early in the design process allows designers to create a website that more people can use. It also saves time and money because they are considered and designed for from the beginning of the project (at the planning stage). (Guide 71, 2001)

Evaluating a website with users with disabilities often reveals general usability issues as well, which impact all users. The issues that are identified during these user tests are often not found by using conformance-based (WCAG 2.0) automatic or semi-automatic evaluations alone. This type of testing offers contextual perspectives and can be defined as accessibility in-use or in-context. However, only performing usability testing does not always find the technical/conformance-based issues. A combination of usability testing and evaluating the conformance against WCAG 2.0 is needed to ensure that a website is accessible to a diverse range of users with different abilities and situations. (“Involving Users in Evaluating,” 2010)

To incorporate accessibility into UCD processes, designers must ensure that the use cases, user analysis, personas, scenarios, workflows, design walkthroughs, etc. include people with disabilities and older users. (“Involving Users in Web Projects,” 2010) In a discussion about “Economic Levers and Market” at the Designing Enabling Economies and Policies (DEEP) conference in 2012, Rich Donovan talks about how the use of extreme users and/or scenarios often drives new ideas and innovation. Donovan (2012) notes that “the iPad was designed and tested by—by extreme users. A two-year-old can use the iPad as a blue line person. So that is a good

example to take these extreme users and taking it to the mainstream consumer application." Incorporating users of all abilities in the UCD process is embracing the idea of Donovan's "extreme users."

The W3C WAI views optimum accessibility as being achieved with both conformance to standards and using real people (of all abilities). This can be achieved using and enhancing UCD principles and methods. ("Analysis and Changelog," 2012)

To bridge the gap between web usability and web accessibility (both theoretically and in practice), we can look at the heuristics of both. W3C WAI editors, Shawn Lawton Henry and Shadi Abou-Zahra, recognize that web accessibility and usability are closely related by their goals, approaches and guidelines. Henry and Abou-Zahra suggest that it is most effective to address them together, such as in the case of developing websites. ("Web Accessibility and Usability," 2010)

In a paper about accessibility and usability, Gloria A. Reece states that it is critical for designers and developers "to use a paramount and concurrent user-centered design approach when developing information technology that is accessible for all." (Reece, 2002) UCD provides a methodology that allows for the full integration of web

accessibility practices that will include users with a diverse range of abilities.

2.3 A Look at Heuristics:

A heuristic evaluation is the practice of evaluators who review and compare the user interface design against accepted usability principles and accessibility guidelines. A heuristic review is only one part of the UCD process. It pairs well with usability testing in finding web usability and accessibility issues. In terms of web usability, the most recognized heuristics are the set that were developed by Jacob Nielsen and Rolf Molich. (Nielsen & Molich, 1990) Equally popular are the internationally recognized WCAG 2.0 web accessibility guidelines developed by W3C WAI. ("WCAG 2.0," 2008)

This section connects Nielsen's 10 usability heuristics with the WCAG 2.0 guidelines—there are 12 guidelines organized under these four principles: Perceivable, Operable, Understandable and Robust (POUR). These connections are made to illustrate some similarities between the guidelines. (See Appendix F for Table.) Pairing these heuristics complements and helps broaden the understanding of each guideline and principle noted.

Let's dissect and connect:

1) Usability heuristic: "**visibility of system status**" states that the system, in this case the website, should keep users informed about what is going on, through appropriate feedback within reasonable time.

A user should know what is going on and what to expect.

This usability heuristic is similar to the following WCAG 2.0 guidelines:

- "**Help users navigate and find content. (2.4)**"
- "**Content should appear and operate in predictable ways. (3.2)**"
- "**Help users avoid and correct mistakes. (3.3)**"

The proper use of titles, headings, breadcrumbs and well-defined links are helpful for everyone in trying to establish where they are on a page. It also assists a user who may be using an assistive device, such as a screen reader, to navigate to the content they require. It assists users in cognitively understanding their position within a system, which will help them stay focused and complete their task.

2) Usability heuristic: **“match between system and the real world”** suggests the system (website) should speak the users’ language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. It suggests following real-world conventions, making information appear in a natural and logical order.

This usability heuristic is similar to the following WCAG 2.0 guidelines:

- **“Create content that can be presented in different ways (for example simpler layout) without losing meaning (information or structure) (1.3)”**
- **“Make text content readable and understandable. (3.1)”**.

If a user is using assistive technology or requires captions, a user should be able to use different modalities to access the content on the website. Content should be in plain language and if an abbreviation or an unusual word is used, definitions should be provided to assist the user.

3) Usability heuristic: **“user control and freedom”** means that users often choose system functions by mistake and will need a clearly marked “emergency exit” to leave the unwanted state without

having to go through an extended dialogue. Support undo and redo:
A user should be able to undo and redo functions.

Do not let a user feel trapped: They should be able to easily navigate away from a wrong path.

This usability heuristic is similar to the following WCAG 2.0 guidelines:

- **“Help users navigate and find content. (2.4)”**
- **“Help users avoid and correct mistakes. (3.3)”**

A great example of this is when a user mistypes a word in Google; Google then offers a suggested word based on what the user typed. This is a helpful way to recover from a mistake if there was one.

If a user gets a little lost, they should be able to figure out where they are or use the navigation or other well-defined links to move to another location where they may find the information they need.

4) Usability heuristic: **“consistency and standards”** suggests that users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

This usability heuristic is similar to the following WCAG 2.0 guidelines:

- **“Help users navigate and find content. (2.4)”**
- **“Make content appear and operate in predictable ways. (3.2)”**
- **“Maximize compatibility with current and future user tools. (4.1)”**

When navigation and the layout of content are consistent, it is easier to learn and becomes predictable. If a specific term is used for an action, that term should always be used for similar actions, e.g., “submit” for submitting a form.

When the main navigation is the same on every web page, if coded properly it would allow a screen reader to bypass redundant information...saving time and possible frustration. An example of this is the “skip to content” function.

Keeping things consistent on a site helps with the understanding of the website and minimizes cognitive overload.

5) Usability heuristic: **“error prevention”** means that even better than good error messages would be a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.

This usability heuristic is similar to the following WCAG 2.0 guideline:

- **“Help users avoid and correct mistakes. (3.3)”**

Error prevention will help minimize confusion, frustration and save time. A good example to illustrate error prevention is the use of online forms. Some online forms can be rather long to fill out. In order to prevent errors, beyond matching labels with input fields, it is good practice to identify required fields, offer format tips (e.g., for postal codes use “A1B 2C3”), and verify input for each field so the user can correct an issue immediately.

6) Usability heuristic: **“recognition rather than recall”** stated the importance to minimize the user’s memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.

This usability heuristic is similar to the following WCAG 2.0 guidelines:

- **“Help users navigate and find content. (2.4)”**
- **“Make content appear and operate in predictable ways. (3.2)”**

- **“Help users avoid and correct mistakes. (3.3)”**

Accessible tooltips are very helpful for providing extra information regarding a specific section on a website or online form. All information required for a specific area, should be noted in that area—on the same web page. This helps minimize cognitive overload if the information/content given matches the web page in context. If a user needs to remember an action that is required in Step 6 of a process, do not ask them to memorize it in Step 1 (many steps/screens ago). If a user found a web page via a search engine, the page they land on should have all the information needed to help them perform a task, e.g., placing an online order.

7) Usability heuristic: **“flexibility and efficiency of use”** suggests using accelerators—unseen by the novice user—may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

An accelerator is something that offers a shortcut—a quick way to do an action.

This usability heuristic is similar to the following WCAG 2.0 guidelines:

- **“Make all functionality available from a keyboard. (2.1)”**
- **“Help users navigate and find content. (2.4)”**
- **“Make content appear and operate in predictable ways. (3.2)”**
- **“Maximize compatibility with current and future user tools. (4.1)”**

An example of an accelerator is a keyboard shortcut, such as “ctrl+c” to Copy and “ctrl+v” to Paste.

Screen readers allow users to hop around from heading to heading and link to link. If a website has a “skip navigation” or “skip to content” option, this allows people using screen readers, or users only using a keyboard to bypass repeated information in order to get to the main content on the page.

8) Usability heuristic: **“aesthetic and minimalist design”** suggests that dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

This usability heuristic is similar to the following WCAG 2.0 guidelines:

- **“Do not use content that causes seizures. (2.3)”**
- **“Make text content readable and understandable. (3.1)”**

Users just want to get to the content they need to finish their task and move on. By eliminating any redundant or unnecessary content, it makes it easier for a user to be efficient. It makes a website less cluttered, easier to read and easier to understand.

9) Usability heuristic: **“help users recognize, diagnose, and recover from errors”** states that error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.

This usability heuristic is similar to the following WCAG 2.0 guidelines:

- **“Help users avoid and correct mistakes. (3.3)”**
- **“Make text content readable and understandable. (3.1)”**
- **“Make it easier for users to see and hear content. (1.4)”**

(Such as only using red to indicate an error.)

Do not allow a system code to be the error message such as “error 55519”—it is meaningless to the user and does not help them recognize and/or recover from the error. An error message should state the issue in plain language and suggest ways to correct the situation. The error message itself should be accessible by using plain, clear language and being coded so that assistive technologies can relay the message to the user.

10) Usability heuristic: “**help and documentation**” illustrates that even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

This usability heuristic is similar to the following WCAG 2.0 guidelines:

- “**Help users navigate and find content. (2.4)**”
- “**Make text content readable and understandable. (3.1)**”
- “**Help users avoid and correct mistakes. (3.3)**”

If information about a website or task on a website is needed, it should be easy to read, understandable and easy to find. A user may

already be frustrated if they are looking for help and documentation. The help should be clear, succinct and if there are any video tutorials, there should be captions, transcripts and descriptive text for non-stated visual information. This will help users who are deaf or cannot see non-stated details. It allows for multimodal conveyance of the information in order for the users to comprehend it.

All the usability principles appear to complement some core web accessibility guidelines. There are some accessibility guidelines that are repeated in the comparisons, such as "2.4: Help users navigate and find content" and "3.3: Help users avoid and correct mistakes."" A good user experience for users of all abilities, requires that a user understands how to navigate the website, that the site uses plain language, that the content and paths are clear, and that users are able to avoid mistakes and if they encounter an issue, that they are able to correct it.

Sambhavi Chandrashekar (2005) states that "where web content can be accessed by users who are disabled, its usability depends on the extent of incorporation of usability criteria in the design." If a user finds the website accessible, it does not ensure that they will find it usable. Chandrashekar also notes that "design guidelines on accessibility and usability for the disabled are available to web

developers today; their proper application to ensure a satisfactory user-experience on the Web for the disabled is not very well-defined." Integrating the web usability principles and the accessibility guidelines to create a more robust, combined heuristics may be a small step towards a better user experience for all.

2.4 Towards Usable Accessibility: An Inclusive Web Framework

Usability.gov recognizes that "web usability and accessibility are slightly different lenses to assess user experience. Using either approach alone may result in an inaccurate view of your website's user experience. Evaluating your website with both usability and accessibility in mind gives all users the best possible user experience." ("Usability and Accessibility," 2013)

We've had a look at the usability heuristics and how they complement and pair well with many of the web accessibility guidelines. As web designers, developers and user researchers, we need to shift our "mental models" from considering only "average users" to planning and evaluating for users with a diverse range of abilities. These heuristics and guidelines are not purported to be the be-all and end-all of web usability and accessibility. They are

suggested as a guide throughout the UCD process when the evaluations are being performed. And evaluations, like the other aspects of UCD, are iterative.

Cooper, Sloan, Kelly and Lewthwaite (2012) understand that “accessibility considerations need to be built into the everyday practices across the full web product life-cycle from conception and specification through development to delivery and maintenance.” Cooper et al. suggest that instead of developing new metrics for web resources, current practices which support the development of processes should be enhanced to provide more inclusive access to resources and services. Web accessibility can and should be built into user-centred design principles and techniques by broadening the definition of “users” and by utilizing (integrated) combined accessibility/usability heuristics evaluations as a tool (guide/resource).

Mike Paciello calls to action designers, researchers and usability specialists who need to “devise evaluation methods that easily and effectively engage people with disabilities in the processes of user interface design and usability testing.” Paciello continues to suggest that the key to user interface accessibility is to focus on the principles of user-centred design (UCD)—a design standard that encompasses

holistic usability design methods. (Paciello, 2001) In an interview with Whitney Quesenbery, Mike Paciello states, "It's really about the user experience. That means more than just removing barriers. We have to think about the personas for different types of disabilities and how to give them as good an experience as anyone else." (Quesenbery, 2009)

Whitney Quesenbery (2009) notes that the challenge for designers is to "find ways of including real people with disabilities throughout the design process, starting with initial user research and going all the way through final usability testing." Quesenbery continues to state that "this is an issue of familiarity. The more we include people with a range of disabilities, the easier it will be to anticipate effective ways to design for them."

UCD affords the expansion and inclusion of web accessibility from being perceived/viewed or prioritized as only about technical conformance to encompassing usability—specifically testing users of a diverse range of abilities. This broadens the focus from ensuring a website only follows the laws and any legislation to remembering why the website was created in the first place—for the users.

Jutta Treviranus (2014) states that "to support diverse participation and enable the design to be as closely linked as possible to the

application, the design and development tools should become as accessible and usable as possible. This dimension does not denigrate the skills of professional designers, but calls for those skills to become more accessible and pervasively applied.” Treviranus also states that “the responsibility of inclusive designers is to be aware of the context and broader impact of any design and strive to affect a beneficial impact beyond the intended beneficiary of the design.”

Defining the users: “For accessible user experience, it is critical that people with disabilities are considered among the target audience. When the user experience of people with disabilities is integral to the strategic goals of the product, other pieces of the accessible user experience process fall into place.” (Horton & Sloan, 2014)

An accessible user experience illustrates “usable experience”. An inclusive web framework must consider users with a diverse range of abilities in order to begin to approach an ideal state of inclusion.

3 Methods

In order to establish the needs of the people who would potentially follow and use an inclusive web framework, a survey was conducted to receive thoughts and feedback. This research study employed a survey comprised of a mix of qualitative (open-ended) and quantitative type questions. The purpose of this survey was to understand how web designers, developers and professionals view the (definitions and) relationship between web accessibility and web usability, and to learn whether a comprehensive view that would integrate both practices to be inclusive would be beneficial to them.

The survey process began with potential participants receiving an "Information and Consent" letter (Appendix C) that provided some information about the survey and focused on the rights of the participants. Once they signed and returned the digital document, a link to the survey was provided to them via email. (See Appendix E for content of survey distributed.)

3.1 The Survey

The survey was comprised of eight parts: 1) Professional Background, 2) Study-Related Questions (Definitions), 3) Study-

Related Questions (Defining Disability), 4) Study-Related Questions (Users and Guidelines), 5) Study-Related Questions (Design Philosophy), 6) Study-Related Questions (Testing with Users), 7) Study-Related Questions (Creating an Inclusive Web Framework), and 8) Demographics. Participation in the survey and answering any or all of the questions in this survey were voluntary.

Part 1: Participants were asked about their professional background, how long they have been in their field and how they keep up to date in their industry.

Part 2 (Definitions): Participants were asked what web accessibility and web usability meant to them. They were also asked if they have heard of user-centred design (UCD), whether they practiced UCD, whether they had heard of "inclusive design" and if so, what it meant to them.

Part 3 (Defining Disability): In this section, participants were asked what "disability" meant to them. This survey also asked if they were or had ever been "disabled". (All questions were voluntary.) An image was presented to the participants (see Figure 1 that was previously noted), which depicted "disability" as being part of a spectrum as opposed to being a binary characteristic. It illustrated visual disability as four different contexts. This image was followed by

asking the participant what their thoughts were regarding “disability as a spectrum.”

Part 4 (Users and Guidelines): This part of the survey asked participants about how they describe their web audience, whether they thought about cognitive functions and physical abilities when designing, building and/or testing. This was followed by asking participants if they refer to the World Wide Web Consortium (W3C) Web Accessibility Initiative’s (WAI) Web Content Accessibility Guidelines (WCAG) 2.0, and also if they follow any web usability principles, such as the ones published by the Nielsen Norman Group (NNG).

Part 5 (Design Philosophy): Participants were asked about what their strategies were for making a website accessible and usable. They were asked to provide any methods, techniques, tools or resources that they used in the process. This followed with questions about how they evaluate the usability and/or accessibility of a website, as well as what their thoughts were regarding whether there is a relationship between web usability and accessibility.

Part 6 (Testing with Users): This section asked participants about whether they test their web design with users and if so, how often they test. Participants were also queried about testing with users who

use assistive devices, such as JAWS or NVDA, and if they, themselves, test using assistive technology.

Part 7 (Creating an Inclusive Web Framework): In this part of the survey, a table was presented combining the Nielsen Norman Group's (NNG) Usability Heuristics and W3C's Web Content Accessibility Guidelines 2.0. This comparison was shown as a suggestion to a starting point for creating an inclusive web framework. The participants were asked about their thoughts on these comparisons. This was followed by a description about moving towards inclusive web design, where a framework must consider and include a diverse range of users' abilities. Participants were asked if they believe whether there should be a more comprehensive view that would integrate accessibility and usability practices to be inclusive. They were also asked if a website featuring these combined guidelines and heuristics would be helpful and/or useful for them. The final question in this section asked whether the participant had any other questions, comments or concerns.

Part 8 (Demographics): In this final section, the participants were asked to provide some demographical information: age, gender, education and country.

(For the purpose of this study, the first six parts were used to establish the “mental model” of the participants. This helps support the results in Part 7 regarding thoughts about the creation of an inclusive web framework being the main focus of this research.)

3.2 Survey Administration

The consent letter for this research study survey was updated and edited in an old version of MS Word (2003). The document was styled properly to aid its accessibility but some of the form functions, such as the checkbox, did not work well within this document.

The survey was created using SurveyMonkey (“Creating an Inclusive Web Framework,” 2014) and was conducted from March 31 to April 18, 2014. This platform was selected based on its accessibility and ability to edit the questions in the survey using basic HTML tags for creating tables and adding alt tags to images or other non-textual representations. (“Are your surveys 508 compliant and accessible?,” 2014) The invitation to participate (Appendix B) was distributed in the Accessibility Consulting, Inclusive Web Design, Tech & Design LinkedIn groups, as well as the W3C WAI IG mailing list (“Invitation to participate,” 2014) and it was also sent to personal contacts working in web usability and user experience (UX). One participant

was unable to access SurveyMonkey due to an IT/firewall restriction at work, so a PDF of the survey was used.

3.3 **Survey Response**

- 45 people received the “Information and Consent” letter (See Appendix C) after stating interest in participating in the study
- 31 people returned the signed “Information and Consent” letter
- 30 people completed the survey (including 1 via PDF)

4 Results

There were 30 responses to this survey; four of the responses had completed less than 50% of the questionnaire, so those responses were not included in the analysis. Of the remaining 26 responses, most completed 80% or more of the survey.

The remaining 26 responses were analyzed. With regard to professional background, 16 (61%) were web accessibility professionals, 12 (46%) were web developers, 12 (46%) were UX professionals (designer/researcher), 10 (39%) were web designers, 8 (31%) were web usability professionals and 8 were user interface (UI) professionals. Other roles noted were On-site SEO, UX Strategist, Web Strategist, Instructional Design Technologist, Applied Psychologist/Product Manager and Project Manager. Participants chose more than one role: 15 (58%) selected 2 or more of these roles. (See Figure 3.)

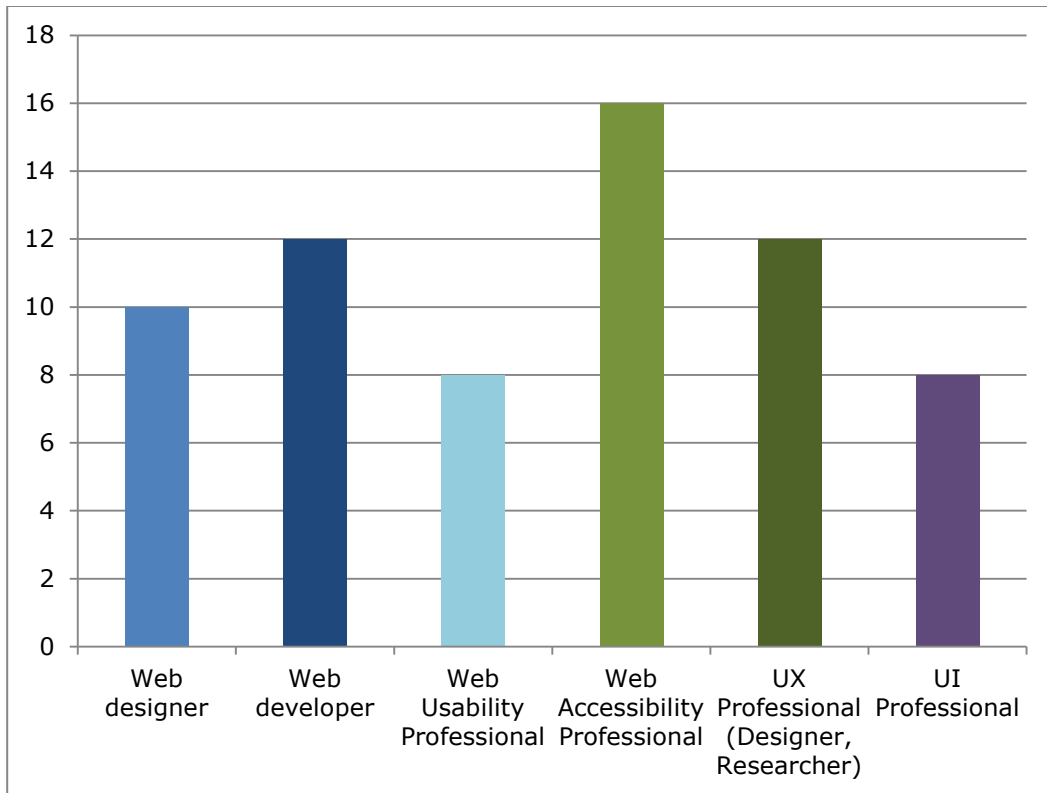


Figure 3. Participants' professional background.

Of the 26 participants, 1 (4 %) have been in their field for 1-3 years, 3 (12%) have been the field for 4-6 years, 5 (19%) for 7-10 years, 11 (42%) for 11-15 years and 6 (23%) have been in their field for 16+ years.

Figure 4 shows the sources that participants noted regarding how they keep informed in their fields. Other sources noted were mailing lists, Meetups, Twitter, standardization groups, self-directed learning as well as through their work.

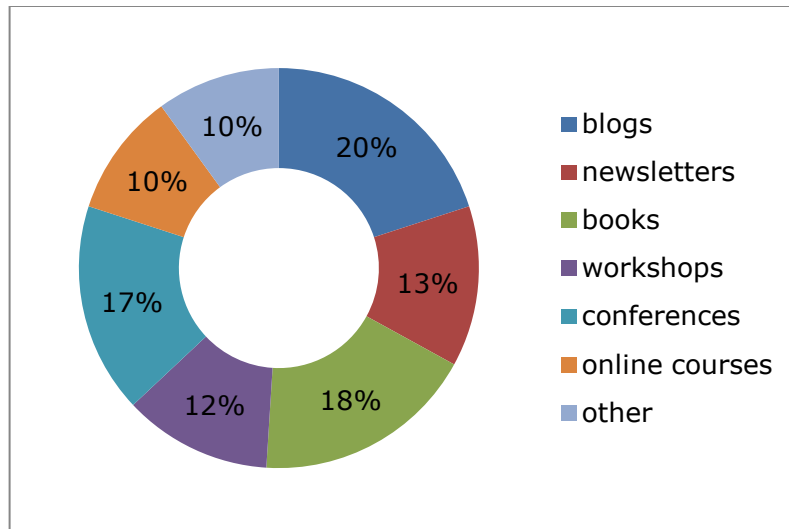


Figure 4. Sources of information participants noted in survey.

All 26 (100%) participants provided definitions regarding what “web accessibility” and “web usability” meant to them. All participants view web accessibility as access to the content of a website by people of all abilities and being able to use the website with assistive technologies. Four participants specifically noted removing barriers to accessing the web in addition to the accessing of content by all. One participant noted that web accessibility is becoming an increasingly misunderstood term because people often connect it with only “following WCAG 2.0. AA”. When defining web usability, “ease of use” or “easy to use” were the most common descriptions used (noted in 15 [60%] responses), followed by “intuitive” and “efficient”/“efficiency,” both terms representing 6 (23%) in the

meanings provided. It was widely understood that usability is about a person visiting a website who has a task to do and they want to get it done as quickly and easily as possible. One participant used the same definition for web accessibility and web usability. The definition noted people with disabilities and was slanted more towards web accessibility in particular.

When asked whether the participants had heard about user-centred design (UCD), 25 (96%) said "yes". Then asked if they practiced it, 17 (65%) stated they did, 5 (19%) stated that they did not practice UCD and 4 (15%) stated they did not but suggested they plan to in the future.

A question about whether they have heard about "inclusive design" received 24 (92%) affirmative responses and 2 (8%) stating that they have not heard of the term. One participant answered, "Inclusive design respects the diversity and tries to provide a system that does not discriminate their users by gender, culture, age, disabilities, or any other human difference. It's a design for all people." Another participant stated that it is "design that is inclusive of the full spectrum of human diversity. Design for an audience that has a mismatch between themselves and the technology/object they are trying to use."

When asked what "disability" meant to them, 25 (96%) participants provided a definition. There were 10 (38%) who defined themselves as being or have been disabled and 10 (38%) participants stated that they are not or have never been disabled. There were 2 (8%) who preferred not to answer this question. When offered an "other" field in this question, one participant answered, "Feeling disabled without their glasses, being tired and being temporarily disabled." There were a range of definitions provided by participants in the survey:

"Disability is something permanent, centered on physical, mental or sensory conditions based on medical evaluation. It is measurable and can be described in medical terms."

"Dis' is a negative word e.g. disadvantage, disappointment. Prefer 'range of abilities' as it is about possibilities rather than a focus on limitations."

"Could mean anything from low vision to a physical disability. Could be short-term or permanent. Companies can be very short sighted claiming their product is not used by 'disabled' persons whereas the truth is that any user may have slight or temporary

issues that could hinder the use of an application or web site.”

“A mismatch between the environment and the person. Could be due to a mental, physical or emotional condition/situation.”

When offered the image of disability as a spectrum, participants agreed with the idea of varying degrees of abilities defined via situations and circumstances. (Figure 1 as previously noted.)

“It's a much more interesting model, and goes closer to my preferred model of talking about ‘impairments’ rather than ‘disabilities’.”

“I think it reflects reality. No-one is just ‘disabled’ in any particular way. We are all on a series of spectrums for every type of ‘disability’.”

“Disability as a spectrum is a new concept for me but it is something that actually makes sense. In my perspective it focuses on the difference between all humans and not in the disability per se. For me, this means that someone with a disability isn't really someone with a disability, but someone that is different

of me, perceiving reality in a different way. From this point of view, a disabled person isn't disabled, but just different, like any other person that is different of me.”

“The concept of it being a spectrum is correct – the graph is wrong. This chart is not a spectrum of disability; it is a random collection of causes, onsets, and duration of visual impairment. None of these may cause disability if everything were designed just right. All of them can result in disability to varying degrees depending on design of things. The darker shading seems to suggest more disability but the last one could be least disabled or most disabled depending on the task and the tools available to a person (and their skill in using them).”

“Temporary and situational disabilities are a concept that helps people understand disability – but you have to be careful because situation disability is in no means equal to living with a permanent disability – they just can't be compared. Taking off your glasses doesn't provide you with the same gestalt view of being visually impaired. Just as using eye drops doesn't help you see

what it's like to be blind on a daily basis and face discrimination.”

In regards to designing, building and/or testing, 18 (69%) participants stated that they thought about cognitive functions during these phases, while 5 (19%) stated they did not. 23 (88%) participants stated that they thought about physical abilities, while 2 (8%) stated that they did not consider them.

Regarding guidelines and principles, 22 (85%) participants stated that they refer to W3C WAI's WCAG 2.0, while 3 (12%) stated that they did not refer to these guidelines. Other web accessibility standards noted were Section 508, AccessiWeb (France) and BITV (Germany). There were 19 (73%) participants who noted that they follow web usability principles such as the Nielsen Norman Group (NNG), while 6 (23%) stated that they did not follow any usability guidelines. Other usability heuristics and/or professionals noted were Usability.gov, as well as the work of Steve Krug, Don Norman and HaptiMap context cards (www.haptimap.org). There were 16 (61%) participants who referred to both accessibility guidelines and usability heuristics. One participant did not use either. Participants who defined themselves as developers, or developers and web

accessibility professionals showed a mode towards following the WCAG 2.0 and did not refer to any usability principles.

Another set of qualitative questions were about strategies used to make a website accessible and usable, as well as how the participants evaluated the websites to confirm adherence to guidelines and principles. All 26 participants answered these questions. The question regarding whether the participants thought that there was a relationship between web usability and accessibility was also completed by all 26 of the participants. All participants verified that there is a relationship between web accessibility and usability; with 22 (85%) suggesting that there is an overlap, linkage or alignment of the two fields; and 4 (15%) stated that accessibility was a subset/part of usability. One participant noted, "Accessibility is usability for special groups. There is no law that says things should be usable. But there are laws that say that thing should not be designed so that they are disproportionately and unnecessarily unusable by people who have disabilities. So accessibility is a subset of usability."

The following Table 1 notes the categories of the perceived relationship as well as the number of answers for that category and some quotes.

Table 1. Relationship between web usability and accessibility.

Do you think that there is a relationship between web usability and accessibility?		
Viewed as	# of responses	Quotes
accessibility as part of usability	4	<p>"Think accessible now, be ready to be usable tomorrow."</p> <p>"When we resolve an accessibility issue we are improving the usability of the site for some users in particular, but it can also improve the usability for all the other users."</p>
an overlap, related, linked or aligned	22	<p>"Usability is what accessibility will become when we stop treating people with impairments as if they deserve a lower quality of user-experience than people who don't have impairments yet."</p> <p>"There is overlap. Many things that benefit accessibility will also benefit usability."</p> <p>"Yes. In order to use something, it has to be accessible."</p>

		<p>"It is very difficult to draw a line between usability and accessibility. I think it depends upon the context we use each of them."</p> <p>"Yes, they are not the same but should go hand in hand since usability without accessibility is discriminating, and accessibility without usability is not efficient and is discriminating too!"</p> <p>"It cannot be accessible with low usability, high accessibility requires high usability. Calling something usable is like calling dinner "edible" it is only a perspective and not a goal."</p>
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When asked whether participants test their web design with users, 23 (88%) stated that they did and 1 (4%) stated that they did not test with users. One participant added that they perform adhoc tests amongst team members and another stated that they test with each iteration of design or functional change. One participant also noted that they test during the design phase and pre-launch. There were 17 (65%) participants who confirmed that they test with users who use

assistive devices like JAWS or NVDA and 6 (23%) said that they did not. Also, 23 (88%) participants noted that they test using assistive technology (AT) and 2 (8%) did not use AT. One participant added that their Quality Assurance team does test using AT. Another participant stated that "screen readers are so complex that no person who isn't very experienced in their use can properly understand how someone who depends on a screen reader uses them."

As a suggested starting point in the creation of an inclusive web framework, the Nielsen Norman Group's (NNG) Usability Heuristics and W3C's Web Content Accessibility Guidelines 2.0 were combined/juxtaposed in a table (Appendix F) and the participants were asked about their thoughts on these comparisons. To simplify the results, the responses are represented in a table along with some quotes (Table 2). There were 12 (46%) participants who agreed with or believed that the comparisons made in this table were good; and 5 (19%) of them who liked the table but suggested that updates were needed or would like to see more details. There were 6 (23%) participants who did not agree with the comparisons drawn in this table. One participant stated "too big a question, I have no idea how to respond to that. In surveys it is best to ask specific questions. This sort of question is best for interview, ethnographic research and contextual inquiries."

Table 2. Participants' comments about the table of combined heuristics

What are your thoughts about these comparisons? (WCAG 2.0 and NNG Principles)		
Viewed as	# of responses	Quotes
good/agree with these comparisons	12	<p>"The comparisons are reasonable and demonstrate that there is overlap between the WCAG and the NNG."</p> <p>"We can see that some of the usability heuristics and accessibility guidelines overlap; this is why I think that accessibility is a part of usability, and that they are intrinsically connected."</p>
looks interesting, but updates or more details are needed	5	<p>"Aesthetic and minimalist design is really subjective and could span multiple WCAG items (i.e. 3.3.5, 3.1)."</p> <p>"In the first row, NNG talks about Visibility of System Status and WCAG 2.0 talks about Enough Time, I think visibility is not only about time. I think the matching here is reliable."</p> <p>"Looks interesting however I would like to see more and especially how you will deal with nearly similar Statements and more interestingly with conflicting ones."</p>

<p>Do not agree or do not believe they map 1:1</p>	<p>6</p>	<p>"I don't think they map as 1:1."</p> <p>"This looks like apples and oranges. So I don't think much of them. the first line compares visibility to time the second compares transparency or to visibility the third compares freedom to predictability (which is generally the opposite) So I can find no relation between the first column and the second."</p> <p>"I don't agree with a lot of these comparisons. Some map and some have partial mappings but they aren't the same."</p> <p>"While I can see what you're trying to do, I don't think these are especially well matched. 1.3.1 Info and Relationships for instance is one of the biggest parts of WCAG and refers to conveying equivalent information and relationships. Very different than Aesthetic and minimalist design."</p>
<p>commented to how the question was presented</p>	<p>1</p>	<p>"Too big a question, I have no idea how to respond to that. In surveys it is best to ask specific questions. This sort of question is best for interview, ethnographic research and contextual inquiries."</p>

When asked about whether a comprehensive view that would integrate accessibility and usability practices to be inclusive would be beneficial, one participant noted, "yes, I find the WCAG 2.0 not easily testable and compliance doesn't necessarily mean something is accessible, so improvement is definitely needed." Another participant stated, "Yes!!! I also believe that usability champions must become accessibility champions and vice versa." There were 21 (81%) participants who supported a need for a comprehensive view, 4 (15%) who required more details and 1 (4%) who did not support it.

When asked if they would find a website that combined the web accessibility guidelines with web usability principles helpful and whether they would use it, 18 (69%) participants stated they would use this resource, 5 (19%) suggested that it depended on the quality of the resource or that they would possibly use it. Another participant noted that they would use it "if it was easy to read, fast to understand and easily and effectively applicable". A participant stated, "Definitely. The biggest challenge for designers is a single reference. Rather than everyone blending and creating their own, a standardized version would be helpful." It should also be noted that one participant stated "possibly. The question isn't clear and asks me to assess something I have not seen or made use of. This is the sort

of question that highlights a weak user experience research inquiry.”

However, 1 (4%) participant said they would not use this resource.

Participants offered some further questions, comments or concerns in the survey:

“Focus on the future-friendliness of accessibility. Break myths on borders between being impaired and disabled.”

“The only sure mode to build an accessible framework is to work in all software cycle with persons with disabilities.”

“Websites are being viewed on portable devices and often these devices have their own usability guidelines, so how can the designer organize all this information in a meaningful way?”

The final section of the survey focused on demographics. Age, gender, education and country were collected. For age ranges, 1 (4%) participant selected 18-24, 6 (23%) stated 25-34, 8 (31%) were 35-44, 6 (23%) were 45-54 and 4 (15%) participants noted the range 55-64 (Figure 5).

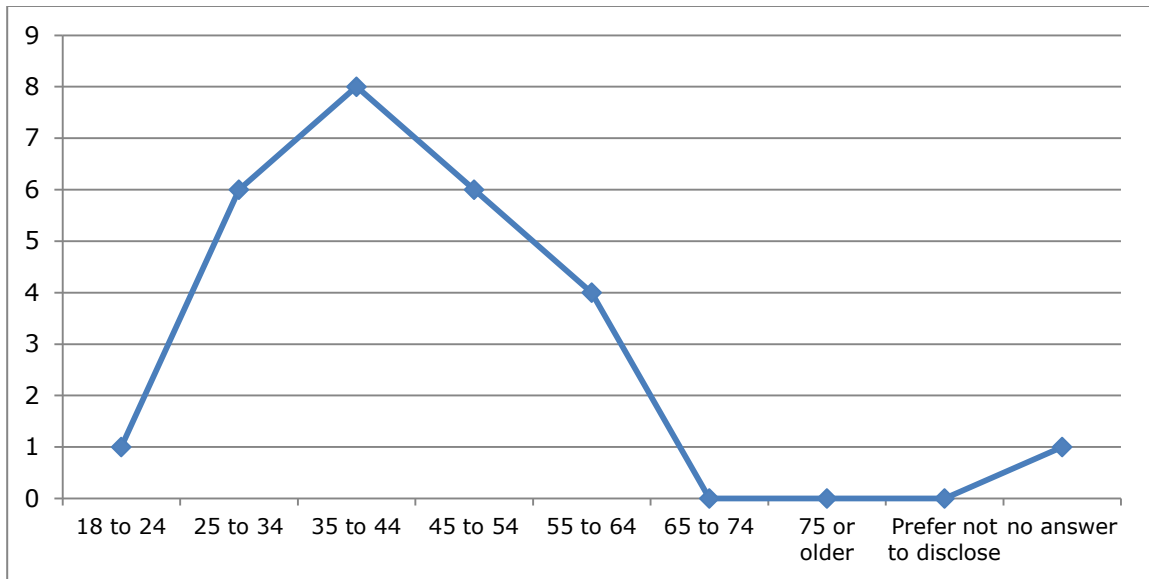


Figure 5. Age range of participants.

For gender, the options “Female”, “Male”, “Prefer not to disclose” and “Other (please specify)” were offered; 12 (46%) participants stated Female and 13 (50%) selected Male. For highest level of education completed, 1 (4%) participant noted High School, 12 (46%) selected “Undergraduate degree or diploma”, 7 (27%) said “Master’s degree”, 4 (15%) completed a “Doctorate or professional degree” and 1 (4%) stated that they were self-taught. The participants represent 11 countries, with Canada having the highest number of responses at 8 (31%) of the participants. The second country that was well represented was the United States at 5 (19%), 2 (8%) from the United Kingdom and Australia, respectively, and there was 1

participant from each of these countries: Belgium, Germany, Portugal, Italy, Sudan, France and Uruguay (Figure 6).

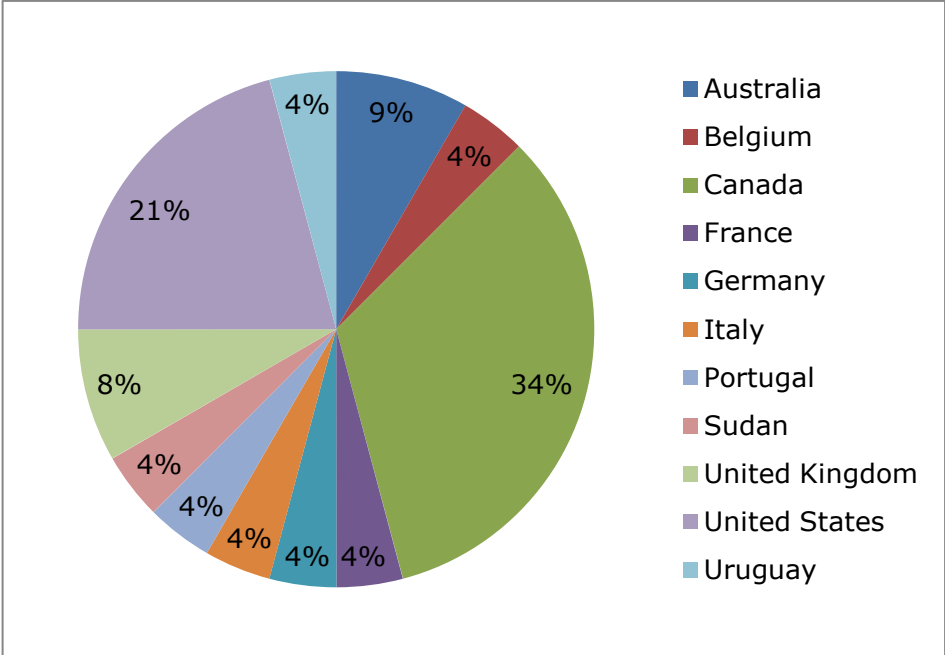


Figure 6. Countries represented in the survey.

5 Discussion

Due to the nature of this study, many of the participants who responded to the invitation for this research survey have a web accessibility or UX professional background. There is a high awareness of web accessibility guidelines, followed by adherence to usability principles. Many, especially UX professionals, adhere to both, but some participants referred to only one or neither.

In defining “inclusive design”, it is interesting to see that almost 25% of the responses noted the connection between “accessibility” and “usability” or “accessible” and “usable”. This suggests a shift in philosophies and practices when it comes to these two fields. There is a developing focus on the importance of the integration of these two professional areas.

The survey points to a unanimous belief (see Table 1) in the relationship/overlap between web accessibility and web usability, or that accessibility is a part of usability. The table that was shown with the paired heuristics of both received mixed results. However, 17 (65%) participants showed support by stating agreement or interest in the table but added that more updates and details were needed. Thoughts shared in the survey indicate an interest in pursuing this connection to help with the inclusion of users with diverse abilities in

the design process. (Table 2) A participant defined “inclusive design” as ending the separation of usability and accessibility, and “to stop considering accessibility as an altruist option, but rather as a benefit for all and future-friendliness.”

With many sources on the web regarding implementation of web accessibility and web usability, not many refer to the implementation of both. This proposed integration of web accessibility guidelines and web usability principles could potentially be a reference—an inclusive web design heuristics. It is important to note the responses that were not in agreement regarding the table with combined heuristics (Appendix F). One participant noted “this looks like apples and oranges. So I don't think much of them. The first line compares visibility to time, the second compares transparency to visibility, the third compares freedom to predictability (which is generally the opposite). So I can find no relation between the first column and the second.” Another participant stated, “While I can see what you're trying to do, I don't think these are especially well matched. 1.3.1 Info and Relationships for instance is one of the biggest parts of WCAG and refers to conveying equivalent information and relationships. Very different than Aesthetic and minimalist design.”

With approximately two-thirds of people agreeing or being interested in the connections made in the table, it is necessary to understand why other participants did not agree. The table had its limitations because it was simplified for an online survey and no information explaining the linkages were offered due to limited space. (See 2.3 A Look at Heuristics for more details on other possible mappings that were made.) What may have worked better would have been to offer a few web accessibility guidelines mapped with usability principles and explanations about these pairings as was done in “A Look at Heuristics”. Diversity in these responses highlight a need for a community of designers and professionals to collaborate on the development and maintenance of a resource that could become a comprehensive, integrated and inclusive web design heuristics—potentially leading to the creation of an inclusive web framework. A participant noted that “I think having this on a website would be helpful to use it as a persuasion tool to get business buy-in. But from a practitioner's point of view, I would prefer having a hub to chat and discuss multiple ways to meet these guidelines, just because seeing what other practitioners are doing helps me learn faster.” The creation of a trusted and inclusive resource requires many individuals, understanding their needs and experiences.

One participant pointed out that “It's really a set of heuristics that have been harmonised between usability and accessibility expert sources. That's useful, but I think giving it the label ‘framework’ makes it sound bigger than it is. If you want to really see a framework, look at BS 8878 or the Inclusive Design Toolkit.” One of my initial thoughts for the direction of this research study was to review the British Standards 8878 Web Accessibility Code of Practice. The main reason that I did not proceed was access to this document. In order to acquire it, one must purchase it from the British Standards Institute. It is an intellectual property and does not have any Creative Commons licensing. The Inclusive Design Toolkit is an excellent resource but focuses on products of all types as opposed to just the web. However, many aspects of this site should be used as a design reference and can easily be applied to web design. (<http://www.inclusivedesigntoolkit.com/betterdesign2/>)

When asked whether there could be a more comprehensive view that would integrate accessibility and usability practices to be inclusive (see Appendix E, Question 24), a participant stated, “The question isn't clear and asks me to assess something I have not seen or made use of. This is the sort of question that highlights a weak user experience research inquiry.” The table of combined heuristics was provided as a reference point to what an integrated resource could

potentially begin as; it was a seed question or an offering, so to speak. The survey itself was used as a litmus test (of sorts) to gauge how web design practitioners would respond to the development of an inclusive web framework. (The survey was long and could possibly have been more succinct and direct. However, each question did build upon the previous one and helped with the understanding of the participant's "mental model" and their perception of the web design world as they see it and work within it. The results from this survey are extensive and go beyond what can be covered in this paper.) When participants noted that they did not understand the question, it points to the importance of testing with a diverse group of users. Due to the time limit of this study, an iterative process of this survey was out of scope.

The idea of the combined heuristics table was not to show that they were identical, but that there were similarities and that connections could be made. This table was meant as a "touch-point" to be expanded into a reference that offers more information between accessibility and usability, as well as technical suggestions as noted in section "A Look at Heuristics".

(With regard to the concept of disability as a spectrum, the idea that situational vs. permanent disabilities should be noted as not being

equal. In fact all scenarios need to emphasize their uniqueness [need for offering personalization] and also how individuals adapt and use different tactics when they encounter a barrier. The image was relayed as a linear, possibly suggesting a time-based visual that does not convey the meaning as well as it could. A visual mapping of different contexts that are scattered and do not suggest a time factor may be used instead of the linear one that was presented in the survey.)

5.1 Further Research/Next Steps

Further research could continue with an investigation of the British Standards 8878 Web Accessibility Code of Practice, known as BS8878. It could be used as a reference to what an inclusive web framework should contain. Then the next steps could be the creation of an online community where the participants can create an online resource that represents an inclusive web framework, with chat capabilities. It could be a wiki or another collaborative kind of platform for inclusive web development that links to W3C and other trustworthy resources and guidelines. (It can be an inclusive web resource of the web design community, by the web design

community, for the web design community to benefit users with a diverse range of abilities on the web.)

6 Conclusion

This study highlighted shifts of perspectives in web accessibility and web usability; web accessibility needs to move beyond conformance-based, technical checklists and that usability needs to expand its definition of users from that of an "average user", to represent users with a wide range of abilities. To bridge the gap between web accessibility and usability, it is essential to incorporate usability, user-centred, methods into web accessibility techniques and to broaden the understanding of users.

Web designers, developers and project teams worldwide are becoming aware of legislation that supports the need for web accessibility. With a focus on web standards and accessibility guidelines, strict conformance to these guidelines tends to be understood as the main requirement for making websites accessible. Relying only on the conformance of the web accessibility guidelines is not taking into account the usability of the site. This is what Shawn Lawton-Henry emphasizes as an issue and proposes the use of "usable accessibility." (Henry, 2007) Due to lack of awareness or not being part of the design process, end-users are sometimes not part of the design cycle. If there is a usability phase in this cycle, the

testing of users if performed, often does not address the needs of users with a diverse range of abilities.

Throughout the survey conducted for this research study, participants noted that web accessibility is legislated by law in some places, where usability falls under “best practices”. Accessibility is strongly linked with law in order to protect the rights of individuals of different abilities. A distinction between accessibility and usability must be maintained to protect legislation; however, a comprehensive guide integrating these two fields would not change their meanings in terms of requirements by law or whether something is a “best practice.” A framework that integrates these practices would recognize the importance of each and how they work better together rather than separately or alone.

As one survey participant noted, “There is a strong correlation between accessibility and usability. By starting with clean, semantic markup, then building consistent patterns and styling, I think the relationship between accessibility and usability can be quite strong.” We can apply techniques to work towards usable accessibility and make them a habit—an ingrained part of our design process. As Margit Link-Rodrigue suggests, they will become “second nature”. And eventually, we will not think of them as web accessibility and

usability techniques, but we will see them as innate, inclusive web techniques. We will then experience a paradigm shift to inclusive design. (Link-Rodrigue, 2009)

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Appendix A Research Ethics Board (REB) approval letter



Research Ethics Board

February 24, 2014

Dear Angela Punshon,

RE: OCADU 163 "Creating a framework that integrates web accessibility, usability and user experience."

The OCAD University Research Ethics Board has reviewed the above-named submission. The protocol and the consent form dated February 24, 2014 are approved for use for the next 12 months. If the study is expected to continue beyond the expiry date (February 23, 2015) you are responsible for ensuring the study receives re-approval. Your final approval number is 2014-13.

Before proceeding with your project, compliance with other required University approvals/certifications, institutional requirements, or governmental authorizations may be required. It is your responsibility to ensure that the ethical guidelines and approvals of those facilities or institutions are obtained and filed with the OCAD U REB prior to the initiation of any research.

If, during the course of the research, there are any serious adverse events, changes in the approved protocol or consent form or any new information that must be considered with respect to the study, these should be brought to the immediate attention of the Board.

The REB must also be notified of the completion or termination of this study and a final report provided before you graduate. The template is attached.

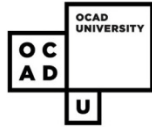
Best wishes for the successful completion of your project.

Yours sincerely,

A handwritten signature in cursive script, appearing to read "Tony Kerr".

Tony Kerr, Chair, OCAD U Research Ethics Board

OCAD U Research Ethics Board: rm 7520c, 205 Richmond Street W, Toronto, ON M5V 1V3
416.977.6000 x474



OCAD U

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of
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Appendix B Invitation to Participate in Research Study about "Creating an Inclusive Web Framework"

I am a Master of Design in Inclusive Design student at OCAD University and I'm conducting a research project to investigate the creation of an inclusive web framework to encompass the practices of web accessibility and web usability. I'd like to invite you to participate in a survey regarding your methodologies and/or design process and the tools your organization use. This survey will be completed online.

If you are interested, do you meet the following criteria?

- a professional and/or academic with 5+ years of experience in User Experience, web accessibility and/or web usability, OR
- a web designer and/or developer with 2+ years of experience in web design/development
- speak English
- have access to a browser to complete an online survey

The online survey will take 25-45 minutes to complete. You will have a chance to enter your name in a draw for an opportunity to be selected for one of three gift cards (e.g., iTunes, Visa or Chapters-Indigo).

- First draw: \$100.00 gift card (CAD)
- Second draw: \$50.00 gift card (CAD)
- Third draw: \$25.00 gift card (CAD)

Your feedback will be very helpful in my research project. Your participation will provide a great understanding of the field and the processes/methods that are currently being utilized. It will help with the understanding of digital inclusion and equal access for all.

Please reply by April 4, 2014 using the subject line "OCAD research study survey" and I will then forward you a link to the survey. Please find my contact details below.

Regards,
Angela Punshon
Graduate Student, Master of Design in Inclusive Design
OCAD University

This announcement is valid until April 4, 2014.



**Faculty
of
OCAD U Design**

**OCAD University
205 Richmond Street
Toronto, ON
M5V 1V6 Canada
www.ocadu.ca**

Appendix C Information and Consent Letter

Thank you for your interest in participating in this research project. After all the participants have completed the survey, I will review the data for analysis, and to also select quotes. You will have the opportunity to review any quotations before I finish the final research report. I will contact you with the details if I use one or more of your statements.

I will keep all information you provide confidential and grouped with responses from other participants. As a participant, I will assign a code to your profile and I will store your information and interview results with that code to ensure your personal details, such as your name, remains anonymous. You will remain anonymous unless you give me permission to use your quote, name and title. I will also store your personal data securely on a password-protected computer and only the research advisors will have access to this data. Furthermore, I will destroy all data from this study at the end of three years.

Your participation is voluntary. You may choose to skip any questions that you are not comfortable answering. You can also withdraw from this study at any time.

The survey will take approximately 25 to 45 minutes.

Your responses may be published in academic publications, research papers, and presented at conferences. You are also welcome to contact me if you wish to discuss the general outcomes of the study.

Please contact me at any time if you need any further clarifications about the study or the research being conducted. My contact details are provided at the end of this information letter. If you have questions about your rights as a participant, please contact the OCAD University Ethics Review Office through Jane Burns at jburns@ocadu.ca.

If you wish to participate in this study, please complete the consent form on the next page as indicated, and email this document back to me. Please retain a copy of this information letter and consent form for your own reference.

Consent to Use Survey Information

- 1) I understand that I am completing a survey as part of a study to learn more about the methods and tools used by professionals and academics in the fields of web accessibility and usability, as well as web designers and developers.
- 2) I understand that my participation is voluntary and that I have the right to withdraw my survey data at any point during or after the study.
- 3) I understand that the data collected by the researcher will be archived in an electronic database. These archived files may be shared through many channels, including conference presentations, public displays like posters and online.
- 4) I understand that secondary use of the data will be limited to research and educational purposes and that consent will be sought in the future for other uses, unless I choose to waive the need for such consent.

Please check one:

I consent to the use of my survey data for the purpose of the study – including public use such as presentations or posters.

- 1) I understand that my participation is voluntary and that survey data will remain private and confidential, unless I have given my consent to publish my name and title along with the quote.
- 2) I understand that my identity will be safeguarded through the use of pseudonyms and will not be revealed in presentations or reports, unless I have given my consent to publish my name and title along with the quote.

OR

I consent to the use of my survey data for the purpose of the study – however I do NOT want my survey data used publicly for things such as presentations or posters.

- 1) I understand that the survey data may reveal my identity but will not be associated with my name or any other identifiable information such my date of birth or address.

The study and the way my survey data will be used have been explained to me. I have been given an opportunity to discuss the study and my questions have been answered to my satisfaction. I understand my role and that I have the right to withdraw any survey data.

I _____ (please print) agree to participate in the *Creating a framework that integrates Web Accessibility, Usability and User Experience* study as described here.

Printed Name (Participant)	Signature	Date
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Printed Name (Person Obtaining Consent)	Signature	Date
--	-----------	------

Contact Information:

If you require additional information or have any questions please contact the Principal Investigator, Angela Punshon (researcher) at ap12fg@student.ocadu.ca.

This study has been reviewed and received ethics clearance through the Research Ethics Board at OCAD University [approval # **2014-13**].

If you have any questions about your rights as a research participant, please contact the Research Ethics Office through Jane Burns at jburns@ocadu.ca.

Thank you, once again, for contributing to this research project.

Regards,
Angela Punshon
Graduate Student, Master of Design in Inclusive Design
OCAD University
ap12fg@student.ocadu.ca
519-829-2482

Jutta Treviranus
Professor and Director, Inclusive Design Research Centre and Inclusive Design Institute
OCAD University
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416-977-6000 x.3950

This announcement is valid until April 4, 2014.

Appendix D Email to confirm survey participation

Dear {Participant_Name},

Thank you for returning your signed consent form.

Please use the following link to participate in the online survey:
https://www.surveymonkey.com/s/inclusive_web_framework.

At the end of the survey you will be asked to enter your name and email address to be entered into a draw for one of three gift cards (e.g., iTunes, Visa or Chapters-Indigo).

- First draw: \$100.00 gift card (CAD)
- Second draw: \$50.00 gift card (CAD)
- Third draw: \$25.00 gift card (CAD)

Thank you for your participation.

Best Regards,

Angela Punshon
Graduate Student, Master of Design in Inclusive Design
OCAD University
ap12fg@student.ocadu.ca

Appendix E Creating an Inclusive Web Framework Survey

1) Professional Background

What is your professional background? (Please choose all that apply.)

- Web designer
- Web developer
- Web Usability Professional
- Web Accessibility Professional
- UX Professional (designer, researcher)
- UI Professional

Other (please specify) _____

2. How long have you been in your field?

- 1-3 years
- 4-6 years
- 7-10 years
- 11-15 years
- 16+ years

Other (please specify) _____

3. How do you keep up to date in your field?

- blogs
- newsletters
- books
- workshops
- conferences
- online courses

Other (please specify any other sources) _____

2) Study-Related Questions

Please answer the following questions as descriptively as possible.

4. What does web accessibility mean to you?
5. What does web usability mean to you?
6. Have you heard of user-centred design (UCD)? If so, do you practice user-centred design?
7. Have you heard of the term "inclusive design"? If so, what does inclusive design mean to you?

3) Study-Related Questions: Defining Disability

8. What does "disability" mean to you?
9. Are you or have you ever been "disabled"?
Yes/No/Prefer not to answer/Other (please specify) _____
10. The following image depicts "disability" as being part of a spectrum as opposed to being a binary characteristic. It illustrates visual disability as four different contexts. (Refer to Figure 1.)
What are your thoughts regarding "disability as a spectrum" as opposed to a binary characteristic?

4) Study-Related Questions: Users

11. For each web project, how do you usually describe your web audience?
12. Do you think about cognitive functions when you design, build or test?
Yes/No/Other (please specify) _____
13. Do you think about physical abilities when you design, build or test?
Yes/No/Other (please specify) _____
14. Do you refer to the World Wide Web Consortium (W3C) Web Accessibility Initiative's (WAI) Web Content Accessibility Guidelines (WCAG) 2.0?
Yes/No/Other (please specify any other guidelines you follow) _____

15. Do you follow any web usability principles, such as the ones published by the Nielsen Norman Group (NNG)? Please list any other guidelines you follow. Yes/No/Other (please specify any other guidelines you follow) _____

5) Study-Related Questions: Design Philosophy

16. What is your strategy to make a website (or web-related project) accessible? Please include any methods, techniques, tools or any other resources that you use in the process.

17. What is your strategy to make a website (or web-related project) usable? Please include any methods, techniques, tools or any other resources that you use in the process.

18. How do you evaluate the usability and/or accessibility of a website?

19. Do you think that there is a relationship between web usability and accessibility? If so, please define it.

6) Study-Related Questions: Testing with Users

20. Do you test your web design with users? If so, how often do you test with users? Yes/No/Other (please specify) _____

21. Do you test with users who use assistive devices, e.g. a screen reader like NVDA or JAWS? Yes/No/Other (please specify) _____

22. Do you test using assistive devices? Yes/No/Other (please specify) _____

7) Study-Related Questions: Creating an Inclusive Web Framework

23. As a starting point in creating an inclusive web framework, I've combined the Nielsen Norman Group's (NNG) Usability Heuristics and W3C's Web Content Accessibility Guidelines 2.0. (Please note that this is not a complete list

of comparisons.) Please review this table and answer the following question.
(See Appendix F) What are your thoughts about these comparisons?

24. In order to move towards inclusive web design, a framework must consider and include all users' abilities. This framework would complement the accessibility (WCAG 2.0), guideline-based (conformance) evaluations with the context-based, user-focused usability methods to create a robust, inclusive web model. This framework should integrate accessibility and usability equally, which would fit well into current user-centred design methodology for web design and development projects.

Do you believe that there could be a more comprehensive view that would integrate accessibility and usability practices to be inclusive?

25. Would you find a website with these combined guidelines and heuristics helpful? Would you use it as a resource?

26. Do you have any other questions, comments or concerns?

8) Demographics

27. What is your age?

18-24

25-34

35-44

45-54

55-64

65-74

75 or older

Prefer not to disclose

28. What is your gender?

Female

Male

Prefer not to disclose

Other (please specify) _____

29. What is the highest level of education you have completed?

Options:

High School

Undergraduate Degree or Diploma

Master's Degree

Doctorate or professional degree

Self-taught

Prefer not to answer

Other (please specify) _____

30. Please enter your name and email address to be entered into a draw for one of three gift cards (e.g., iTunes, Visa or Chapters-Indigo).

- First draw: \$100.00 gift card (CAD)
- Second draw: \$50.00 gift card (CAD)
- Third draw: \$25.00 gift card (CAD)

Name:

Country:

Email Address:

Thank you for all your help as I work towards completing the [Master of Design in Inclusive Design program at OCAD University](#).

Appendix F Table Representing Combined Heuristics

Usability Heuristics (NNG)	Accessibility Guidelines (WCAG 2.0)
Visibility of system status	2.2 Enough Time: Provide users enough time to read and use content.
Match between system and reality	3.1 Readable: Make text content readable and understandable.
User control and freedom	3.2 Predictable: Make Web pages appear and operate in predictable ways.
Consistency and standards	3.2.3 Consistent Navigation: Navigational mechanisms that are repeated on multiple Web pages within a set of Web pages occur in the same relative order. 4.1 Compatible: Maximize compatibility with current and future user agents, including assistive technologies.
Error prevention	3.3.6 Error Prevention (All): For Web pages that require the user to submit information, at least one of the following is true: Reversible, checked or confirmed.
Recognition rather than recall	3.2.4 Consistent Identification: Components that have the same functionality within a set of Web pages are identified consistently.
Flexibility and efficiency of use	2.4.1 Bypass Blocks: A mechanism is available to bypass blocks of content that are repeated on multiple Web pages. 2.4.5 Multiple Ways: More than one way is available to locate a Web page within a set of Web pages except where the Web Page is the result of, or a step in, a process.
Aesthetic and minimalist design	1.3.1 Info and Relationships: Information, structure, and relationships conveyed through presentation can be programmatically determined or are available in text.
Help users recognize, diagnose and recover from errors	3.3.3 Error Suggestion: If an input error is automatically detected and suggestions for correction are known, then the suggestions are provided to the user, unless it would jeopardize the security or purpose of the content.
Help and documentation	3.3.5 Help: Context-sensitive help is available.