

# Issues in Web Presentation for Cognitive Accessibility

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**Abstract.** For people with cognitive disabilities, access to mainstream content is crucial, for educational materials, and for access to other information and services essential to participation in society. Key features for these users are clear, simple presentation (of navigation and interaction as well as content), multimodal presentation to assist with difficulty in processing text, and access to definitions of unfamiliar terms. Simple configurability of presentation, ideally via online profiles, is also important. The Fluid project family is developing technical approaches for realizing these facilities automatically, without requiring content and service providers to develop separate sites for accessibility.

**Keywords:** Inclusive design, Web accessibility, cognitive disabilities.

## 1 Introduction

Access to information on the Web is increasingly a necessity of modern life. As a participant in a focus group of people with brain injury said, when asked about using the Web, “Without it, how could I buy insurance?” But access is often difficult for people with cognitive disabilities, even for sites that comply with accessibility guidelines (Small et al. [1]).

The features of Web sites that enhance cognitive accessibility are becoming clearer (see for example WebAIM [2]). Clear, simple presentation (of navigation and interaction as well as content), multimodal presentation (auditory as well as visual) to assist with difficulty in processing text, and access to definitions of unfamiliar terms, are all helpful. But how are sites with these desirable characteristics going to be created?

## 2 Simpler Web Pages: Why Not?

Unfortunately, experience shows that individual and institutional Web designers cannot be relied upon to deliver more accessible Web pages, just by following available guidelines. Surveys consistently show that compliance with accessibility guidelines is poor, showing that typical Web content providers do not place a high value on accessibility. For example, Loiacono et al. [3] find that more than half of major corporate Web sites show serious accessibility violations.

The situation is even worse for cognitive accessibility, because simple presentation, a key accessibility feature, in some ways works against other priorities that designers must attend to. To illustrate, consider a page on amazon.com, a popular e-commerce site, that describes a book for sale. The page is very complex; there are more than 150 controls displayed “above the fold”, that is, in the portion of the page shown on a single screen of a typical browser display. The total number of controls on the complete page is very much higher. Many of these controls are only rarely used. For example, what proportion of buyers will want to add a book to a “wish list”, or want to contribute an image of their own to the book page? Yet all viewers of the page get these controls.

The designers who created this page were not being careless. Rather, they were responding to a fact of life that has become clearer and clearer since Landauer and colleagues pointed it out in the early 80s: packing as much information as possible onto a single screen gives a more effective design, for typical users.

This is true because of negative consequences of splitting material among multiple screens. If a collection of items, or choices, is to be shown, the initial presentation can be made smaller only by pushing some information onto other screens. This creates two problems. First, the initial screen has to contain some kind of category descriptions, such as a product type, rather than the products themselves. But category descriptions inevitably lead to uncertainty about where a needed item is to be found [4]. Does “clothing” include shoes? Second, the need to move between multiple screens introduces overhead that is avoided when all of the items are shown on a single screen.

So there are good reasons why typical Web pages often seem cluttered, and have large numbers of controls. But these pages are often confusing and difficult for people with cognitive disabilities. Is there a way to provide simpler pages in the face of these good reasons?

### **3 Web Pages for Mobile Devices Are Simpler**

There is a common situation in which simpler pages are already being created: Web presentations intended for viewing on mobile devices, with their small screens. Like many organizations that operate on the Web, Amazon has a mobile version of its site, and these pages are radically simpler than those produced for laptop or desktop browsers.

Some users with disabilities prefer to use these mobile sites, when they are available, to avoid clutter. But there is a tradeoff in doing this, because the smaller screen (and controls) on a mobile device may themselves be more difficult for some users. A user who needs a large font size, for example, is likely to have difficulty working with the small screen on a mobile device.

It is possible for sophisticated users to solve this latter problem, and view the mobile version of a Web site on a large screen device. Special effort is required to do this, because normally the Web request a browser sends to a server identifies the kind of device that is making the request. This identifying information is used to determine which version of the site to deliver: requests marked as coming from mobile devices are given the mobile version of the site. But there are legitimate ways to control the

identifying information that the browser sends. For example, there is a Firefox add-on [5] that allows a user to request the mobile version of a site regardless of what device they are using.

#### **4 User Profiles Should Include Preference for Mobile Versions**

For many users, including many users with cognitive disabilities, it is too difficult to manage the procedure needed to request mobile versions of Web content. Further, having managed to do this on one computer, they must repeat the process if they need to use a different computer, for example a public computer in a library or senior center. The Global Public Inclusive Infrastructure initiative (GPII [6]) aims to allow users to set up a profile, maintained online on a server accessible from any machine, that could include a preference for mobile versions. Having set up such a profile, and given the necessary supporting infrastructure envisioned by GPII, a user would see mobile versions of content, whenever it is available, on any computer they might use. (The same profile facility will also support other preferences, such as for large fonts.)

The profile approach greatly increases users' ability to work independently. A user who needs assistance to create a profile can get the help they need once, and get the benefit of the profile thereafter without needing additional help.

#### **5 A Better Approach to Providing Multiple Versions of Content Is Needed**

The profile approach to accessing simplified content has some attractive features. One is that designers of mobile sites have already chosen which content to preserve on small screens, and which to suppress. This means that no third party is intervening to modify the provided content, perhaps distorting the content provider's intended result.

But not all Web sites have corresponding mobile versions. Providing a mobile site is expensive, requiring a great deal of work above and beyond what organizations have already invested in their sites for larger screens. Commercial organizations can often afford to make the added investment, because the mobile site can pay for itself through added revenue. But noncommercial organizations face a challenge. As mobile access to the Web continues to grow, an organization's users will come to expect, or even demand, good access to content. But the organization may realize no additional revenue from a mobile site. My own organization, the University of Colorado, has recognized just this dilemma: future students will expect mobile access, but the funds needed to provide it this will have to be diverted from other needs.

It should be possible to reduce the cost of providing alternate versions of a site by allowing content developers to assign a *priority* to different bodies of content. Implicitly, designers of mobile sites are already doing this, by choosing to present some content while suppressing other content. Making these designations explicit would allow a single collection of content to be shown on screens of different sizes, with low priority content only rendered when screen size permits.

Users could then request to see only high priority content, even if they are using a large screen, by placing an appropriate preference in their profile. Further, users (or

content developers) could choose among different treatments for low priority content. The simplest, but most restricted, treatment would be for low priority content just to be suppressed. An alternative would place low priority content on a subsidiary page, viewed when the user operates a “show me more” control to request it. A further possibility would have multiple “more” controls, associated with different categories of low priority content on a page.

## **6 The Fluid Project Is Developing Technology to Support Alternative Presentations of Web Content**

Fluid [7] is an international collaborative project to develop community source Web technology to enhance Web accessibility. One aspect of Fluid is the development a form of IoC (*inversion of control*) technology to support alternative presentation of Web pages. IoC technology allows developers to specify alternative implementations of needed functions, and rules that govern when particular alternatives are selected. In the framework being developed by Fluid, these selection rules will allow the rendering of Web pages to depend on information from the request sent by a browser (from which screen size can be determined), or by information from a user profile, or both, in addition to information encoded in the Web page itself. The framework will thus support all of the options just described, allowing low priority content to be rendered in any of a number of ways, based on user preference as well as screen size. This technology can be used by developers who want to support users who need simple presentations.

## **7 Accessibility Technology with Mainstream Benefits Has Significant Advantages**

While Fluid supports enhanced accessibility, its flexibility, as just explained, also enables it to meet the needs of any Web developer who needs to provide content on devices with different screen size, whether they are concerned about accessibility or not. This means that the use of the Fluid framework, with its attendant accessibility benefits, will spread more widely across the Web. The accessibility payoff of this is that any developer who uses Fluid to support different screen sizes will, with no additional effort, also provide enhanced support for users who need simplified presentations. This happens whether or not the developer cares about accessibility.

Wide adoption will of course enhance the sustainability of the Fluid technology itself. As a community source project, Fluid will benefit from a wide user base of organizations and individuals motivated to maintain and enhance the framework.

To encourage wide adoption, Fluid has additional design objectives. One is to work without constraining designers’ control of the appearance, or styling, of their pages. Another is to be maximally compatible with other libraries or frameworks that designers may choose to use. For example, Fluid carefully manages its use of names so as to avoid collisions between its code and the code used by other frameworks. Information about these design objectives, and currently available versions of the framework, is available at [7].

## 8 Conclusion

In the future we may have the technology to automatically create a clear, simple version of a body of content, based on advances in natural language processing. But in the meantime human effort is required to do this, and the benefits of clarity and simplicity in themselves are only rarely sufficient to motivate designers to pursue them. Fortunately, the powerful motive to deliver content on small screens leads to similar results. By adding infrastructure that allows users to express their preference for these clear and simple presentations, we can enhance accessibility for people with cognitive disabilities in the short term.

**Acknowledgements.** Thanks to the Coleman Institute for Cognitive Disabilities and the Rehabilitation Engineering Research Center for Advancing Cognitive Technologies, funded by the National Institute for Disability and Rehabilitation Research, for supporting the preparation of this paper. Thanks to Antranig Basman and Colin Clark, Fluid project architects, for explanations of the Fluid IoC framework.

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