Using and Understanding the Information Implicit in the Layout of Web Pages

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ABSTRACT
Web pages rely on complex modular layouts to convey their contents and facilitate their navigation. While this is very effective for sighted users, current screen readers cannot interpret these visual representations. This affects blind users because it makes it harder to understand and navigate Web pages. This paper presents WARP V.I.P., an Adaptive Spatial Hypermedia project that aims to: 1) augment assistive technologies to allow blind users to understand the information implicit in the Web page’s layout; 2) provide blind and sighted people with a similar user experience for the same Web pages; 3) allow blind people to manipulate Web page components. This paper discusses the challenges involved and how the project addresses them with: formative studies, design and implementation, and evaluation.

Categories and Subject Descriptors
K.4.2 [Social Issues]: Assistive technologies for persons with disabilities; H.5.4 [Information Interfaces and Presentation]: Hypertext/Hypermedia.

General Terms
Human Factors, Design, Experimentation

Keywords
Spatial hypermedia, interpreting Web page layouts.

1. INTRODUCTION
Since early in their evolution, humans have relied on both oral and visual communication. However, for most of human history, long-lasting documents were limited by the available media to visual representations of information. It is until very recently that there has been a medium, such as the Web, that can simultaneously support both visual and auditory representations. This is a very significant advantage because it allows people who are sighted or blind to use and interact with the same document.

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ASSETS’99, October 26–28, 2009, Pittsburgh, PA, USA.
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However, Web pages are not unaffected by the practices and traditions of previous media. The long-standing use of visual documents has produced widely-used design conventions, and, due to their proven effectiveness and the fact that both authors and readers are accustomed to them, it is only natural that these practices and conventions have been carried over to the Web.

Mainstream Web pages such as news and shopping sites are often designed using modular layouts. Modular layouts use a combination of vertical and horizontal shapes as well as other two-dimensional visual techniques to implicitly organize their contents, convey the structure of their information, and represent relationships between their components [2]. These layouts allow sighted users to parse pages in seconds; understand the general structure of the whole document, establish points of reference, and identify entry points to start reading the contents [2].

People who are blind have a very different experience when reading Web pages with modular layouts. It takes several minutes to present by speech a whole Web page. Two-dimensional structures e.g., tables and modular layouts conflict with the linear nature of speech [4]. Most importantly, screen readers cannot interpret the visual design used in modular layouts. This limits the users’ access to the structure of the information and produces a higher cognitive load since users are forced to infer the structure using partial information. As a result, users are limited in their ability to parse, navigate and understand complex Web pages.

2. VISUAL AND AUDITORY DOCUMENTS
Designing Web pages that can present their contents visually (on screen) and audibly (by screen reader) in ways that are clear, effective and aesthetically pleasing for both sighted and blind users is very challenging. This can be addressed in three ways.

Simplifying the Web page design. While Web pages can be presented visually and audibly (and thus serve blind and sighted audiences), authors often target sighted audiences and design their pages accordingly. Consequently, authors use visual techniques that fit their needs best. E.g., modular layouts are frequently used in news and shopping pages because they are very flexible, facilitate the production process, provide advertising advantages, improve legibility, and users prefer them [2]. Therefore, while designing Web pages with simpler layouts could remedy the limitations of screen reader users, it is unrealistic to expect that all authors will stop using complex layouts and visual designs.

Providing alternative Web page versions. Some Web sites maintain two versions of their pages, one for sighted users and
another for visually impaired users. This approach is sometimes problematic. Maintaining multiple versions requires more work. Also, blind users often complain that the “accessible” versions are not updated frequently, and that they dislike having to use an alternative version instead of the “normal” version.

Augmenting assistive technologies. Rather than demanding that all authors simplify their page designs or that Web sites maintain multiple page versions, it seems more sensible to focus on improving assistive technologies such that they can understand the information implicit in the design of the Web pages and that they communicate it to the users effectively. The WARP V.I.P. research project investigates how to infer the information implicit in the Web pages’ layout, how to present that information to blind users, and how to make it easier for blind users to use and manipulate elements in Web pages. The following section discusses how the project is addressing these challenges.

3. WARP V.I.P. PROJECT

WARP V.I.P. aids Visually Impaired People by interpreting the structural information implicit in the page layout and presenting it to the users in appropriate ways. WARP V.I.P. is an Adaptive Spatial Hypermedia research project that builds on WARP [3]. Spatial hypermedia differs from traditional navigational hypermedia in that, whereas navigational hypermedia systems such as the Web rely on the explicit specification of links, spatial hypermedia allows links and relationships to be represented implicitly. Spatial Hypermedia accomplishes this by using spatial parsers to analyze the relative position and visual similarity of objects on the screen.

Research projects such as HearSay [1] demonstrate the benefits of informing users about the structure of Web pages. However, these systems parse the HTML code, rather than the final visualization of the page. This limits the approach to static pages and excludes dynamic pages (such as BBC news\(^\text{1}\)) that allow users to customize the visual form of the page. This limits the approach to static pages and excludes dynamic pages that allow users to customize the page. Rather than demanding that all authors simplify their page designs or that Web sites maintain multiple page versions, it seems more sensible to focus on improving assistive technologies such that they can understand the information implicit in the design of the Web pages and that they communicate it to the users effectively. The WARP V.I.P. research project investigates how to infer the information implicit in the Web pages’ layout, how to present that information to blind users, and how to make it easier for blind users to use and manipulate elements in Web pages. The following section discusses how the project is addressing these challenges.

3.1 Formative Studies

The initial phase of the project is focused on understanding how both sighted and blind people parse, interpret and use pages with modular layouts [2]. This required conducting user studies for both populations. The studies were designed to generate comparable data that could shed light on how to create systems that can provide a similar experience to both audiences.

3.2 Design and Implementation

It is critical that the interface mechanisms are designed such that they effectively convey the content and structural information. These interfaces must allow both user groups to interact with Web pages and manipulate their elements. Several designs combining visual, auditory and tactile channels are being tested.

3.3 Evaluation

The interface mechanisms are being developed iteratively, cycling between design, implementation and evaluation. As the various systems and interfaces evolve more evaluations will be conducted, finalizing with a final comparative evaluation between the different interfaces and screen readers.

4. CONCLUSIONS AND FUTURE WORK

This paper briefly discusses the limitations of screen readers to interpret complex visual designs and layouts. The paper briefly explains its implications for blind people and presents WARP V.I.P., an adaptive spatial hypermedia project that aims at:

- Improving how blind people parse and interpret Web pages
- Improving how blind people use and manipulate Web pages
- Providing similar experiences for blind and sighted people.

WARP V.I.P.’s goal is to improve the users’ ability to parse, navigate and understand Web pages. The project has been informed by formative studies with sighted and blind populations. Once the design-implementation-evaluation iterations conclude, a final comparative evaluation will be conducted.

5. ACKNOWLEDGMENTS

This work was partially funded by a VP Research Grant from the University of Texas at Austin.

6. REFERENCES


\(\text{1 }\) http://www.bbc.co.uk/