

# Accessibility Approach to Adopting Web Technologies

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## ABSTRACT

As new web-based technologies emerge the challenge to make them accessible to people with disabilities intensifies. This communication paper discusses the findings of an Australian assessment of the technical accessibility of the Portable Document Format (PDF), and the user experience by 23 people with a disability. The questions posed and answered by this research in relation to PDF are the same questions that are asked of any web technology, and the same challenges will apply. This paper puts forward a number of recommendations based on the research to enable governments to take an inclusive approach towards the adoption of web-based technologies in the future.

## Categories and Subject Descriptors

H.5.2 [User Interfaces - Evaluation]; K.4.2 [Social Issues - Assistive technologies for persons with disabilities]

## General Terms

Design, Human Factors, Standardization.

## Keywords

PDF, Web accessibility, WAI, WCAG, Assistive technologies.

## 1. INTRODUCTION

PDF documents are widely used by organisations as a way of disseminating information. However, anecdotal evidence suggests that PDF files do not enable people with a disability to navigate and access the content in the same way as they can with HTML and text formats (Word, RTF) [3]. Therefore, the Australian Human Rights Commission contend that it is not appropriate to use the PDF format as the only means of conveying or receiving information, a position supported by the Australian Government.

Adobe Systems (Adobe) and vendors of assistive technologies (ATs) have taken noticeable steps to address access to PDF files for people with disabilities over the past few years. In light of this, and in order to review their current policy position, the Australian

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Government Information Management Office (AGIMO) commissioned the Online Accessibility team at Vision Australia to establish a comprehensive body of knowledge regarding the accessibility of the PDF format [2].

This paper presents the findings of this research that will have international significance, and demonstrate that people who use a screen reader face the greatest issues. Interestingly, these issues are not around the PDF format, but are related to the technical capability of the AT, design of the document and skill of the user. These issues are representative of the accessibility challenges that need to be addressed for other web-based technologies to ensure these are available and usable by people with a disability.

In the next section we will outline the methodology used in each phase of our assessment. In section 3 we then outline the key results of the technical evaluations and experiences of people with a disability using PDF documents, in an Australian context. We then present our recommendations to remove accessibility barriers for people with a disability in relation to access to PDF and emerging web-based technologies, enabling governments to endorse the use of these technologies for all citizens.

## 2. METHODOLOGY

The research was conducted in three phases with the findings of each phase informing the next.

### 2.1 Phase One: User Consultation

Vision Australia facilitated three focus groups with people who were blind or had low vision to establish how, when and why they access PDF documents; and identify common problems or barriers they experience when using the format.

In addition to the focus groups, a public consultation exercise was conducted by AGIMO to uncover attitudes towards the accessibility of the format from industry and end-users alike. The basis for the project was confirmed through these activities, as was the involvement of users.

### 2.2 Phase Two: Technical Evaluation

To ensure that the research was relevant to the Australian context, the most commonly used ATs in Australia were first identified. The level of technical support provided by these technologies for the PDF format was then undertaken to establish if technical developments do indeed result in adequate support for users.

The technical assessment was conducted in two parts. Firstly, interviews were conducted with the vendors or Australian

resellers of the technologies to establish their judgment regarding the level of support their ATs provide for the format. Secondly, to assist in verifying these claims, technical testing of these ATs and their ability to interact with elements of the PDF format was carried out using applicable success criteria from the World Wide Web Consortium, Web Content Accessibility Guidelines (WCAG) version 2.0. All technical testing was conducted by Adobe.

Three categories were created to describe the resulting level of technical support the AT provided for the PDF format. In categorising the technologies we considered the evidence from all of the research undertaken in Phase 2.

### 2.3 Phase Three: User Evaluations

The technical definition of whether something is accessible needs to be balanced by the actual user experience; therefore a round of evaluations was conducted with 23 people with a range of disabilities<sup>1</sup> using example PDF documents. The participants attempted tasks with four PDF documents optimised for accessibility against Adobe's characteristics of an accessible PDF document [1], and four representative government PDF documents. Participants used the ATs identified in Phase 2 of the project as providing Sufficient and Partially Sufficient support, and other access methods befitting their specific requirements.

The sessions recorded quantitative data including task success rates, and qualitative data including comments made by the participants during the sessions and a record of any issues encountered during the evaluations. The findings from the evaluations established if the PDF format enabled people with a disability to interact (access, read, navigate, input data) with the information and provide a positive user experience.

## 3. RESULTS

The technical evaluation showed that there is strong technical capability for PDF files provided by the most commonly used screen reader (JAWS) and the most commonly used screen magnifier (ZoomText) in Australia. However, all other ATs had some difficulty interacting with PDF files.

The user experience evaluations showed that most people with a disability, with the exception of people relying on screen readers, are able to use PDF files and complete common tasks around reading, navigating and interacting. However, the results also showed that three core factors can be detrimental to a positive experience (Table 1). The user having access to a PDF file that has been carefully optimised for accessibility, specific AT, and the skill to use it effectively are all required. Without these, the lived experience is significantly diminished and will often mean the user cannot successfully interact with the document.

Even where a user is able to successfully interact with a PDF file, user feedback indicated that the lived experience is generally not equivalent to using web pages (HTML). None of the ATs provide the full range of functionality to access and navigate information in PDF files that is available on web pages, thereby restricting the user's ability to use the document efficiently and effectively.

<sup>1</sup> The participants consisted of 10 blind, 1 deafblind, 5 low vision, 3 mobility, 1 hearing and 3 cognitive impaired people.

**Table 1. Core factors affecting the user experience**

Factor	Number of Issues <sup>2</sup>
Inaccessible document design	76 (51%)
Insufficient AT support	41 (28%)
Lack of user skill	24 (16%)

The following subsections discuss the user groups most affected and the key factors that led to inaccessibility.

### 3.1 User groups most affected

The research showed that all people with a disability can have difficulties accessing PDF files. However, the consultation feedback and the results of the user experience evaluations emphasised that the main difficulties occur for people who are blind or have low vision, in particular users of screen reader software.<sup>3</sup>

In Australia, there are over 480,000 people with visual impairments and this number is set to increase to nearly 800,000 by 2024 [4]. In comparison, the AT usage numbers obtained as part of the technical evaluation were much lower – approximately 3,500 screen reader users and 5,000 screen magnifier users. The difference between these numbers highlights a lack of statistical data publically available about how many people with a visual impairment are online and what interaction methods they rely on to use a computer.

The user consultation sessions also highlighted that people who are blind or have low vision generally have very negative experiences when interacting with PDF files. When PDF files are inaccessible, they are often required to use a workaround process that involves extra time, effort and resources. In many cases these people actively avoid PDF files because of their previous experiences.

### 3.2 Inaccessible document design

The responsibility of document creators to consider accessibility was a strong theme during the user consultations and the importance of correct document design to provide a positive experience with PDF files was clearly shown during the user experience evaluations.

Participants in the focus groups described a number of authoring issues, primarily around failing to provide structural mark-up and appropriate tags for textual content, tables, forms, images and graphs. In addition, the use of scanned documents – where the text appears as an image – are completely inaccessible for people relying on screen readers and the poor quality of some scanned images can also make these unreadable for many low vision users.

<sup>2</sup> While users were completing the tasks, individual issues they encountered were recorded. The number of issues comprises unique issues encountered by each user group on each task.

<sup>3</sup> The overall task success rate for blind participants (screen reader users) was 66%, whereas the overall combined success rate for the other user groups was 97%.

It is concerning that issues related to document design occurred even when organisations believed they had created documents with accessibility in mind. Combined with the lack of an agreed definition for what constitutes an accessible PDF, this clearly demonstrates that there is insufficient knowledge, resources and tools to help document authors reliably create PDF files that are accessible to people with disabilities.

The effect of document design was also observed when comparing the satisfaction of blind participants (screen reader users) between using representative PDF files and the documents that had been optimised for accessibility. The users reported a significant increase in satisfaction and there was a noticeable improvement in task completion<sup>4</sup> when using the optimised documents.

### 3.3 Insufficient AT support

The user consultations highlighted the role that access to the right AT plays in using PDF files. Older versions of ATs were clearly identified as creating accessibility problems with PDF and this was confirmed during the technical evaluation. Users also observed that recent versions of their AT provided notable improvements.

Certain groups of AT were singled out as providing very poor technical capability with PDF files, particularly portable Braille notetakers that are used by people who are blind, such as the BrailleNote. The lack of technical capability provided by this AT product group was confirmed in the technical evaluation.

Overall the technical evaluation resulted in the following:

**Sufficient:** 33% of the ATs used by people who are blind or have low vision provide a technical capability that enables the AT to interact with PDF files. [JAWS screen reader, ZoomText and Magic screen magnifiers].

**Partially Sufficient:** 44% of the ATs used by people who are blind or have low vision provide some technical capabilities, but also exhibit some potential issues that may impact upon the interaction with a PDF file [NonVisual Desktop Access (NVDA), System Access To Go (SATOGO) and Window Eyes screen readers and the PacMate portable Braille notetaker].

**Not Sufficient:** 23% of ATs provide inadequate technical capability for the AT to interact with PDF files [VoiceOver screen reader and the BrailleNote portable Braille notetaker].

The ATs that did provide strong technical capability for PDF files were the most commonly used ATs in Australia – JAWS (screen reader) and ZoomText (screen magnifier). These technologies are also the most expensive to purchase and upgrade (JAWS is AU\$1500 to purchase and AU\$335 to upgrade; ZoomText is AU\$730 to purchase and AU\$415 to upgrade). The lower cost options available, such as NVDA and SATOGO, both failed to provide sufficient technical capability for PDF files. Available funding for equipment is limited to supporting people entering or maintaining employment. However, since the unemployment rate of people who are blind or have low vision in Australia is around 63% [5], this funding is unattainable to many. The prohibitive

<sup>4</sup> Overall task completion rates for the blind participants were 79% using the optimised documents and 26% using the representative documents.

cost of AT is also likely to contribute to the difference in statistics and usage figures described in subsection 3.1.

Interestingly, the user experience evaluations identified issues attributed to the AT that were not identified during the technical evaluation. The technical evaluation was conducted against applicable success criteria from WCAG 2.0. As a result, user experience issues, such as the ability to navigate by elements such as paragraphs within the PDF file, were not tested as they are not part of the requirements under WCAG 2.0. However functionality, such as these navigation techniques, is important to allow the user to effectively and efficiently use a PDF file.

When questioned about the lack of support their products provide for PDF files, the AT vendors were not always aware of the issues found or the expectations of their users. They also expressed a common view that their development was guided by industry trends and until more “accessible” PDF files are available, their focus is on providing greater support for emerging web technologies such as Web 2.0, ARIA and HTML 5.

### 3.4 Lack of user skill

The findings from the user consultations, which are supported by the user experience evaluations, show that the Adobe Reader interface is an unfamiliar environment for many people with a disability. In both the consultations and user experience evaluations the participants displayed a significant lack of knowledge about how to use the Adobe Reader with their ATs to access and effectively interact with PDF files.

While users generally expected the PDF file to work like a web page, the wide range of issues they experienced, particularly the lack of technical capability provided by their ATs and poor document design, led to confusion.

The user consultation sessions indicated that most users actually avoid PDF files altogether. As a result they have no knowledge of the functionality within the Adobe Reader or how the experience of using a PDF file differs from other formats such as HTML and Microsoft Word, with which they may be more familiar.

## 4. DISCUSSION

The findings of this research demonstrate that the correct combination of AT, document design, and user skill will result in a situation where PDF files can be accessible and used by people with a disability. However, when this situation occurs it is still the exception rather than the rule. Until there is further improvement in each of these areas, the use of PDF files without providing alternatives will result in some people with a disability being discriminated against because they are unable to access this information.

The question of whether PDF is accessible is the same question that will apply to the introduction of any new web-based technology (AJAX, Web 2.0, HTML 5), and the same challenges will apply.

- There is often a considerable lead time between the introduction of a technology and the AT providing sufficient accessibility support for it.

- To participate, people with a disability will need to learn the skills to use this technology, and often this involves discovering alternative ways of using it.
- Implementing any technology in an accessible way requires the use of specific techniques to deliver the information in a way that supports the end user's interaction method. These techniques need to be established and taught to the people responsible for implementing the technology.

Therefore, based on the findings of the Australian assessment of the accessibility of the PDF format, Vision Australia proposes the following five recommendations for governments to enable the adoption of PDF and other web technologies. Through these recommendations governments can adopt a pro-active approach to promoting access and participation for people with a disability in the online environment.

1. **Collect comprehensive data on the ATs used by people with a disability to access computers and the Internet.** Without accurate usage data and what AT's and versions people are using, governments cannot measure the impact of introducing a technology such as PDF where only some ATs provide sufficient technical capability.
2. **Provide people with a disability access to ATs that enable the use of web technologies.** Access to ATs presents a significant barrier to participation and, as was seen with PDF, potentially limits government's ability to adopt widespread use of web technologies. Therefore, governments should remove cost as a barrier to acquiring the necessary AT, and consequently increase participation, access to online information and services and reduce the digital divide.
3. **Use incentives for the development of AT to support web technologies.** The technical capability of most ATs to provide accessibility support for formats including PDF is limited. Providing incentives or funding the development of AT products to support web technologies of importance to a government, such as PDF, is one way to change this circumstance. In particular, focusing on the development of low cost AT alternatives such as NVDA is potentially a positive way to improve accessibility and promote innovation.
4. **Educate designers on how to create accessible information and why this is important.** From the user experience testing, inaccessible document design accounted for 51% of the unique issues experienced by the participants. There is a lack of consistent and understandable information about what constitutes an accessible PDF file, and this also applies to other web-based technologies. Further research is required to develop this knowledge and present it in a way that document authors can apply it in their day to day work. Development of testing approaches to help document authors validate their own work is also essential.
5. **Fund training and support programs for users of AT.** People who are blind or have low vision experienced significant problems when using the PDF files. Computers use visual interfaces and the cues that support most people to adapt to a new technology or interface are often unavailable to people who rely on ATs, particularly screen readers.

Without appropriate training and support, these users are effectively locked out or required to expend significant effort to learn and develop strategies to access the information.

## 5. CONCLUSIONS

To support governments in an inclusive adoption of new web-based technologies this paper proposes that further research, support and training are required. The Australian assessment of the technical and practical accessibility of the PDF format identified barriers that impact on the ability of people with a disability to participate in the use of PDF files. Interestingly, none of the problems that lead to inaccessibility of PDF files are a direct result of the PDF format, but are attributed to AT support, document design and user skill.

As governments promote more effective communication with their citizens, web-based technologies will play an increasing role. Therefore, accessibility must be addressed and support must be provided for the developer of the technology, the AT vendor and end user.

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