Evaluating Groupware Accessibility

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Abstract. Accessibility has been one of the biggest problems that people with disabilities face in the work place, due to today's rapid change in computer technology. This paper presents the evaluation of several console-based and web-based groupware applications including Outlook, AIM, Google Blog, and Group System's ThinkTank in terms of their accessibility. These applications were evaluated for accessibility based on various characteristics of the applications such as accessible front-end, hierarchy or list structures, input support, output support; screen reader adaptability; and keyboard access. Additionally, web-based groupware applications were evaluated using Web Content Accessibility Guidelines (WCAG) and U.S. Government's Section 508 guidelines. Fujitsu's Web Accessibility Inspector tool was also utilized to help evaluate the web-based applications. It is found that groupware applications have very limited accessibility through the support of keyboard access. Additional audio support and flattened hierarchies should be considered, to enable some persons with disabilities easy access to groupware applications. Future research should include persons with disabilities in evaluating groupware applications, to determine preferences. Since many groupware applications provide Application Program Interfaces (API), custom front-ends should be developed to include audio content and to flatten hierarchies and lists.

Keywords: CSCW, Groupware, accessibility, blind, visually impaired, dyslexia, user Interface, and assistive technology.

1 Introduction

According to a report by the U.S. Census Bureau [21], about 12.8% of the people in the United States between 21 and 64 years of age have at least one type of disability. Only 17.6% of the people with employment disabilities are employed [22]. With the trend of globalization today, it is more likely that a person in one organization will collaborate with other persons in other locations. Software applications that support collaborations among group members, groupware applications, are widely used in this situation. Although accessibility of the web sites has been gaining a lot of attention recently, only limited attention was given to the accessibility of the groupware applications. Thus, adding difficulty for people with disabilities in the work place.

This paper will discuss the guidelines used for web and application accessibility, the preliminary evaluation of web-based and console or windows-based groupware, and issues that were identified.

2   Groupware Applications

Groupware applications are office applications that support common tasks such as email, document sharing [18], chat, news [14], calendaring, and wiki [29]. Groupware applications can be categorized using a time and place framework [5, 6]. Groups can work in any of the following combinations: same-time, same-place; same-time, different-place; different-time, same-place; and, different-time, different place. Synchronous (same-time) groupware applications are applications that allow group members to collaborate at the same time. Asynchronous (different-time) groupware applications are applications that allow group members to collaborate at any time of their convenience. The collaborators can be at the same location or in physically different places. Electronic Meeting Systems (EMS) and systems that allow collaborative manipulation in the same location are examples of same-time, same-place groupware applications [20, 30]; Chat [19] and instant messaging are the applications of same-time, different-place groupware; team scheduling group calendars [5, 6] can be utilized for different-time, same-place collaboration; while most e-learning tools web discussion boards [14, 28, and 31], email, blog [16,18, and 27] are considered as groupware applications that support different-time, different-place collaboration.

3   Guidelines for Web and Application Accessibility

A number of guidelines and factors were discussed in the literature, when discussing the evaluation of web sites. However, no literature was found that consolidated these concepts into a comprehensive list. Additionally, no literature considered the differences between web accessibility and console-type and window-type accessibility. The next section presents an attempt at forming a comprehensive list for accessibility evaluation on web-based, console-type and window-type groupware applications.

3.1   Evaluating Groupware Applications

Schoeberlein and Wang (2009) presented guidelines or factors that need to be considered when evaluating groupware accessibility in association to different types of interface (console-type or window-type, and Web-based).

3.1.1   Windows-Based Application Evaluation Criteria
No guideline was found to specifically address the development and evaluation of console-based or window-based groupware applications. Schoeberlein and Wang (2009) identified factors (or criteria) that should be considered when evaluating the accessibility of console-type and window-type groupware applications:

- Support of accessible front-ends usage [14, 18, 27, and 30]: Groupware applications are often designed and developed without considering accessibility. Since many groupware applications include an Application Programming Interface (API), accessible front-end applications should be considered to reduce the complexity of the groupware interface.
- Hierarchical lists and single lists [27, 28] of choices: To reduce interface complexity of many groupware applications, lists of choices and hierarchical lists of

choices in a single panel should be considered, instead of complicated multi-paneled interfaces.

- Text-to-speech [14, 18, 27, and 30], text-to-Braille [14] and screen reader [28] support: These are vital for people with visual impairments. Accessible front-end applications could also extend the features of the API to include text-to-speech and text-to-Braille.

3.1.2 Web-Based Application Evaluation Criteria

For Web-based groupware applications, Web Content Accessibility Guidelines (WCAG) [24, 25, 27, and 28] and Web Accessibility Initiative's Accessible Rich Internet Applications (WAI-ARIA) guidelines [23] were identified as necessary for developing and evaluating accessible web-based groupware applications. These guidelines include requirements regarding web-page presentation of content and are the foundations for evaluating web-accessibility using accessibility tools, like Fujitsu's Web Accessibility Inspector tool [8]. Presently, all accessibility tools [26] validate Web pages for WCAG 1.0. Compliance of WCAG Guidelines can be met by following the guidelines for either version 1.0 or 2.0; however, as new Web pages are developed or updated, the WCAG 2.0 Guidelines should be implemented [24]. Comparisons between WCAG 1.0 and WCAG 2.0 [25] are available. In addition, screen readers compatibility and audio output support, which are necessary for groupware accessibility for persons with disabilities, should be a de facto requirement.

After comparing with the criteria identified for evaluating windows-based applications, it is noted that web-based applications need to address the following accessibility guidelines in addition to all the criteria for evaluating windows-based applications:

- W3C Web Content Accessibility Guideline (WCAG) [24, 25, 27, and 28] compliance;
- Web Accessibility Initiative's Accessible Rich Internet Applications (WAI-ARIA) [23] compliance; and,
- Apply an accessibility tool [26], like Fujitsu's Web Accessibility Inspector tool [8], to the web pages.

4   Research Methodology

Because of the wide variety of groupware applications available, groupware under evaluation should be selected carefully in order to explore the general status of this type of software in terms of its accessibility. Therefore, the following factors were considered when we selected groupware for this study:

- Category that the application falls into: we would like to have at least one groupware application in each category to be evaluated. However, since most of the groupware that support collaboration from different locations also can be utilized for co-location collaboration, emphasis was given to groupware that supports distributed group collaboration.
- Type of interface: Although most of the applications are now web-based, there are still numbers of console and window-based applications. Comparing the accessibility of web-based and window-based applications will help us identify current

problems associated with groupware interface design. Therefore, both web-based and console-based applications were identified for this study.

- Popularity of the application: We would like to investigate the groupware application that has large number of users as this kind of application can be regarded as representative of the type of application it belongs to.
- Availability of the tools: Although we would like to investigate multiple groupware applications, not all are available to the researchers at the time of study. There are some commercial groupware applications that claim to have a wide range of features. Unfortunately, we were not able to obtain an evaluation copy to assess the accessibility.

As representatives of a broader range of groupware applications, we have chosen Microsoft Outlook, America Online Instant Messenger (AIM), Google Blog and GroupSystems' ThinkTank as the starting point of this research (Table 1). These tools were selected since they represent a mix of group support features like: email, scheduling, chat, blog and group decision-making. Table 1 presents how the set of groupware applications fall into Time/Place framework. After the applications for evaluation were identified, they were assessed using guidelines in respect to its interface type (web-based or console-based and window-based).

Table 1. Groupware Applications – Time and Place

	Same Time (synchronous)	**Different Times (asynchronous)**
Same Place (local)	GroupSystems' ThinkTank	
Different Places (distributed)	AOL AIM	Microsoft Outlook email, Google Blog

5   Groupware Accessibility Evaluation

This section will present an accessibility review of Microsoft Outlook, AIM, Google Blog and ThinkTank, using the accessibility guidelines discussed in the prior section. In this section, a brief overview of the evaluation of each application will be followed by a detailed discussion on the appliance to each criteria identified earlier.

5.1   Window-Based Applications

5.1.1   Microsoft Outlook Evaluation
Microsoft Outlook [16] is a part of the Microsoft Office Suite. Although it most often is being used as an email application, it also includes support for other group activities such as Calendar, Task Manager, Contact Manager, etc. It is a Window-type groupware application that can be used either as a stand-alone application, or operates in conjunction with Microsoft Exchange Server and Microsoft Office SharePoint server to provide enhanced functions for group members, such as group calendars for meeting scheduling, task monitoring, and public folders exchanges, etc.

On reviewing Microsoft Outlook for accessibility, the following accessibility issues were identified:

- profile popup;
- hierarchy navigation;
- lack of text-to-speech support; and,
- Lack of text-to-Braille support.

On loading Microsoft Outlook a user profile may display requesting the user name and password to gain access to the email interface. Notification of popup message boxes should be presented in an auditory form, to allow persons with disabilities (e.g. visual impairment) to respond appropriately.

The hierarchy nature of Microsoft Outlook could be difficult to transverse for persons with disabilities. When moving through different levels of a hierarchy, orientation and place may be compromised. Deep hierarchies may be difficult to navigate, due to disorientation. In addition to the key press sequences to navigate the Microsoft Outlook interface, auditory tools, like JAWS [7], would be necessary to vocalize the hierarchy, the message description and the detailed message.

The lack of full text-to-speech output requires some persons with disabilities to purchase expensive auditory tools, like JAWS. Text-to-speech and text-to-Braille could be included to allow for alternative delivery channels for persons with disabilities.

5.1.2 America Online Instant Messenger (AIM®)

With about 89 million users world wide [3], AOL provides several versions of instant messaging software that support different platforms. AIM [1] is a Window-type groupware application for presenting, creating and reading chat messages. Through its buddy list window, users can see whether their buddies are online or available for chat. Another version of AIM®, AIM Express, now provides a web-based interface that allows its members chat in a browser without having to download the application.

On reviewing AIM for accessibility, the following accessibility issues were identified:

- hierarchy navigation;
- lack of test-to-speech support; and,
- Lack of test-to-Braille support.

The hierarchy nature of AIM could be difficult to transverse for persons with disabilities. In addition to the key press sequences to navigate the AIM interface, auditory tools, like JAWS [7], would be necessary to vocalize the hierarchy and the chat message.

Text-to-speech and text-to-Braille could be included to allow for alternative delivery channels for persons with disabilities.

5.2 Web-Based Applications

Google Blog and GroupSystems ThinkTank were identified for this study as representatives of web-based groupware applications. Since a subset of criteria for evaluating web-based applications are the same as the ones for assessing windows-based applications, the window-type characteristics were also used to evaluate Google Blog and ThinkTank for accessibility. Additionally, Fujitsu's Accessibility Inspector [8] was

used to evaluate Google Blog and ThinkTank for compliance to Web Content Accessibility Guidelines (WCAG) [24] and WAI-ARIA [23].

5.2.1 Google Blog

Google Blog [9] is a Web-based groupware application that allows users share their thoughts about current events or anything they'd like to discuss. The shared thoughts are called blogs (web logs). Owners of a blog, bloggers, are able to form or develop a community with people with similar interest, to receive feedback from their readers. This application also allows group blogging which enables a team of bloggers to contribute to a single blog, thus enables more close collaboration among members.

The following accessibility issues were identified for Google Blog:

- hierarchy navigation;
- lack of auditory input;
- Lack of text-to-speech support; and.
- Lack of text-to-Braille support.

The hierarchy nature of Google Blog would be difficult to transverse for a person with a disability. In addition to the key press sequences to navigate the Google Blog interface, auditory tools, like JAWS [7], would be necessary to vocalize the hierarchy and the blog content.

The lack of auditory input prevents some persons with disabilities no alternative for data input.

Text-to-speech and text-to-Braille could be included to allow for alternative delivery channels for persons with disabilities.

5.2.2 GroupSystems ThinkTank

GroupSystems [11] ThinkTank [12] is a Web-based groupware application for brainstorming, group decision-making and collaboration. It provides distributed or colocated groups with functions such as brainstorming, organizing ideas, prioritizing, voting, consensus building and documenting group knowledge.

The following accessibility issues were identified for ThinkTank:

- hierarchy navigation;
- Lack of auditory input;
- out-of-sync text-to-speech audio output; and,
- Lack of text-to-Braille support.

Navigating the hierarchy folder structure is usually accomplished by using a mouse to select an idea category folder with the left-mouse button click. For persons with disabilities, the keyboard can be used to select a category folder. The enter key is pressed to open the category folder and exposes a list of ideas in a central panel. Navigation up and down the hierarchy is accomplished by pressing the up-arrow and the down-arrow. Multiple tiered hierarchies can be difficult to navigate due to the complexity of orientation of such a structure. Often, several controls on the web page will have to be navigated in order to set the focus on the desired control.

The lack of auditory input prevents some persons with disabilities no alternative for data input.

The screen reading program adapted by ThinkTank, DeskBot Genie [4], can become out-of-sync with the currently selected item, causing disorientation. Often, the DeskBot Genie will repeat the same content over-and-over again, which may cause confusion and disorientation.

Text-to-Braille could be included to allow for alternative delivery channels for persons with disabilities.

5.3   Application Accessibility Comparison

We compared the applications against the criteria discussed in the Guidelines for Web and Application Accessibility section in the tables below. Table 2 compares the accessibility of groupware applications when applying the shared criteria used for evaluating windows and web-based applications.

Table 2. Shared Criteria Comparison

Groupware	AIM	Microsoft Outlook	Google Blog	GroupSystems ThinkTank
Accessible Front-end	API	API	API	None
Hierarchy / List	Yes	Yes	Yes	Yes
Audio Input	Yes, Voice Chat Room	Yes, Dictation	No	No
Test-to-Speech Support	Yes, Voice Chat Room	Yes, Limited to Buttons and Menus	No	Yes, DeskBot Genie
Test-to-Braille Support	No	No	No	No
Screen Reader Adaptability	Yes	Yes	Yes	Yes
Keyboard Access	Yes	Yes	Yes	Yes

Table 3 below compares the accessibility of web-based groupware applications when specific guidelines for web accessibility were applied.

Table 3. Web-based Accessibility

Groupware	Group Systems ThinkTank http://www.groupsystems.com/thinktank	Google Blog http://googleblog.blogspot.com
WCAG	Yes, some issues.	Yes, some issues.
WAI-ARIA	N/A	N/A
Accessibility Test	Fujitsu's Web Accessibility Inspector	Fujitsu's Web Accessibility Inspector

6   Discussion and Findings

Although some accessibility to Groupware applications is available through keyboard access, many viable alternative methods are limited or not available. Only two out of

four applications we studied provide very limited text-to-speech support while text-to-Braille is not included with any of the Groupware applications reviewed. It is assumed that persons with disabilities will use the keyboard in conjunction with a screen reader, like JAWS [7], to interact with Groupware application interfaces.

Popup message boxes can be disorienting for persons with disabilities. Auditory signals or messages should be included with popup message boxes, to alert persons with disabilities of the popup.

Hierarchy organization of information is the structure most often used in Groupware applications. It has been found in all the applications we studied. However, the multiple tiers of the hierarchies may be difficult for persons with disabilities to navigate.

Most of the applications we studied, including Microsoft Outlook [17], AIM [2], and Google Blog [10], supply an API, which can be invoked by accessible front-end applications. These accessible front-end applications could include support for text-to-speech, text-to-Braille, and flattened hierarchies. The purpose of an accessible front-end application would be to reduce the complexity of the Groupware application's GUI.

What alternatives can be offered to resolve the navigation difficulty of groupware applications? What alternatives are available to include text-to-speech without the expense of a screen reader like JAWS? One alternative would be to add a layered user interface, in the form of an accessible front-end groupware application, to hide the complexity of the groupware application interface. Takagi [18] presented a layered user interface for Lotus Notes, named the Notes Reader, but additional research is needed to test accessibility and usability. Additionally, adding a speech synthesizer and a speech API to read text would benefit persons with disabilities. This solution could reduce the complexity of the hierarchical interface and the dependence on a screen reader.

7   Conclusion

This research evaluated four typical groupware applications for accessibility using guidelines for evaluating web-based, console-type and window-type groupware applications.

Recommendations (Table 4) are provides for solving the issues identified during the evaluation process. Additionally, including text-to-speech, text-to-Braille, and speech recognition capabilities could enhance the APIs accessibility characteristics.

The accessibility issues of groupware applications prevent visually impaired and other persons with disabilities access to these highly graphical interfaces. Although many groupware applications met the accessibility requirement by enabling keyboard access or screen reader access, most applications provide only minimum access. From this evaluation, it appears that groupware applications are not usable by persons with disabilities, even though basic accessibility requirements were considered in the application design. Much work remains before the groupware is more accessible to users with disabilities.

This research is only the starting point in the effort of improving the accessibility of groupware due to limited coverage of groupware in this study. Involvement from users with disabilities is also needed in future study.

Table 4. Recommendations

Groupware	Accessibility	Operating Environment	API	Recommendation
Microsoft Outlook	Keyboard, screen reader	Windows	Yes [17]	GUI layering, text-to-speech, flattened hierar-chies, text-to-Braille.
Group Systems ThinkTank http://www.groupsyste ms.com/thinktank	Keyboard, DeskBot Genie	Web-based	No	Develop an accessible API to provide GUI layering, integrated text-to-speech, flattened category hierarchies, text-to-Braille.
AIM	Keyboard, screen reader	Windows	Yes [2]	GUI layering, text-to-speech, flattened hierar-chies, text-to-Braille.
Google Blog http://googleblog.blogs pot.com	Keyboard, screen reader	Web-based	Yes [10]	GUI layering, text-to-speech, flattened hierarchies, text-to-Braille.

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