Access-a-WoW: Building an Enhanced World of Warcraft™ UI for Persons with Low Visual Acuity

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Abstract. World of Warcraft™ (WoW) is a virtual 3D game that offers much in terms of entertainment and collaboration and enjoys extraordinary world wide popularity. However like many other applications that deliver the majority of information visually, the default user interface (UI) is potentially only marginally accessible to users with limited visual acuity. This paper describes the enhanced user interface (UI) we constructed to improve accessibility for these users. We performed a study comparing the two user interfaces; users had simulated low visual acuity. The results of the study suggest that our enhanced UI led to significant improvements in user performance and speed of game play. Our current enhanced UI and planned future work have great potential for expanding opportunities for a user group to participate in the WoW community more fully than is possible with the current UI.

Keywords: Human-Computer Interaction, Accessibility, Accessible Gaming.

1 Introduction

Computer games and 3D virtual environments have become prominent entertainment mainstays with video game sales rivaling those of blockbuster movies. Besides pure entertainment value, these games and virtual environments can be utilized to offer educational services as well as a setting for multi-user social and gaming interactions. However, because these environments are visually intensive, users with low visual acuity may have difficulty successfully interacting with certain elements of the user interface (UI). Furthermore, many commercial products do not give the user the option, or means, to substantially improve the accessibility of the product to fit ones needs.

World of Warcraft™ [1] (WoW) is a 3D virtual environment that includes elements of social interaction, quest completion and combat. Unlike other virtual 3D environments, such as Second Life [2], that emphasize social interaction and educational services [3], the gameplay elements of WoW place demands on the user for fast processing of primarily visual information; the speed contributes to the challenge and fun of the game [4]. Further, the size of the WoW user base is almost two orders of magnitude greater than that of Second Life (11.5 million versus 250,000 [5][6]) indicating a broad appeal to a potentially diverse user population.

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Inside of the WoW environment, users interact with the virtual world by relying mostly on the visual information provided to them in their game environment. This is a serious constraint for users with low visual acuity and can severely hinder these users' ability to perform necessary in-game tasks such as successfully navigating around the world. Due to the visual nature of the default user interface in WoW and the quick pace of the game, users with low visual acuity may find it difficult to use information from the UI in real "game time", thus finding the game hard to play and the worldwide community difficult to join.

This paper describes an alteration to the default user interface of an existing commercial 3D virtual world, World of Warcraft. By creating an enhanced user interface, we aim to improve the ability of a user with low visual acuity to perform vital in-game tasks such as navigating the virtual space and completing combat-based missions. Our hope is that our modifications and design principles can be applied to similar virtual environments to afford users with low visual acuity the chance to engage in and join these virtual gaming communities.

2 Related Work

With the growing popularity of 3D games and virtual environments, there has been a substantial amount of interest toward improving their accessibility, assessing games at both the macro and micro level. On the macro level, current research focuses broadly on improving the overall state of 3D game and virtual world accessibility. Bierre et al. performed case studies evaluating the accessibility features available on numerous commercial games [7]. Their focus was to evaluate how game developers and individuals within the gaming community attack accessibility issues facing various disenfranchised users (e.g. deaf or blind users). Grammenos et al. describes the concept of universally accessible games (UAG) (i.e. games designed to meet the needs of all users without alteration for a specific set of users) [8]. They validated their concept of UAG by designing, implementing and evaluating a set of case studies.

On the micro level, researchers have focused on improving the accessibility of existing gaming platforms or developing games with an emphasis on accessibility. Trewin et al. describe *PowerUp* [9][10], a virtual 3D world designed with accessibility in mind. In the system, users are given the option of setting several different accessibility options, aimed to improve the experience for users with varying impairments. AudioQuake [11][12], is an updated version of the first person shooter Quake, designed to be playable by users who are blind or suffer from low visual acuity. Other games augmented to be accessible for visually impaired users include *Blind Hero* [13] and *Rock Vibe* [14], both of which use a combination of haptic and auditory feedback.

Prior research efforts have focused on rebuilding visual interfaces of social virtual environments for users who are blind or visually impaired, but they have not had the WoW constraint of keeping the underlying game fast and fun. Second Life, a commonly utilized platform, shares similar qualities to WoW (e.g virtual world navigation). However, unlike Second Life, WoW requires the user to engage in quick responses to changes in the game state (e.g combat). Conducted research in the Second Life environment has included adding screen reading technology [15], and enabling a command-based interaction [16] to the client software. Using haptics in virtual environments for

users who are blind or have low vision has been explored [17], and Pascale et.al incorporated haptics technology into the Second Life software [18].

WoW poses a unique challenge as it encompasses elements of a 3D game and a large scale virtual environment. In order to keep the underlying gameplay elements fast and fun, the user must be able to receive and interpret the visual information in a timely matter. For users with low visual acuity, we have the opportunity to utilize their residual vision in order to display information visually [19]. By highlighting relevant information and removing non-relevant/distracting information from the screen, users will have a better chance of understanding and reacting to the visual data.

3 WoW State and UI Analysis

In WoW, each user has a 3D virtual avatar that completes quests and activities in a fantasy world. In this world, game state information from the UI: is context dependant, will vary throughout the user's gaming experience and is delivered to the user through a default UI (see Fig. 1). In the default UI there are two core sections that deliver the majority of information to the user: the open worldview screen and the action bars. The worldview screen has UI elements, such as the mini-map, that are spaced apart along the top and bottom edges of the screen, with the players' avatar located in the center. The action bars, located at the bottom of the screen, house clickable icons which represent the avatar's different abilities.

In general, the core game play of WoW consists of two states: navigation and combat. In the first, a user's primary concern is to effectively get from their current location to their destination; the main UI elements are the mini and world map. In the latter, the primary concern is to effectively kill their target while mitigating the amount of damage to their avatar; the main UI foci are: health, resources and combat abilities. Low visual acuity users may find the UI difficult in both situations, requiring alternating focus on elements located at the top/bottom/center of the screen.

Following a universal design strategy approach [20], our enhanced avatar centric UI reduces the need for users to continually change their focus among elements spread across the screen. Essential (depending on state) interface elements will appear around the avatar. For example, in the navigation a state, a user's mini map is more valuable than their combat bar, so the combat bar is not displayed (see Fig. 1).

3.1 Navigation

In the navigation state, key UI elements for location information are from the mini-map and the world map. Both show the user's orientation, large buildings and geographic structures (lakes, mountains, etc). However, the world map does so at a macro level, while the mini-map provides detail, localized around the player. While in the worldview the mini-map is the only resource a user has available, as the world map is available only in full screen.

When a user accepts a mission, icons are placed on the world-map to allow the user to know the location of their current destination. As this information can only be viewed in the full screen world-map view, users must repeatedly open their world

map to ensure they are moving in the correct direction. To alleviate this, in our enhanced interface, a waypoint arrow is placed above the user's avatar. Constantly updated, the waypoint arrow indicates the direction of the user's destination as the avatar moves through the environment. To improve the visibility of the user's position icon while viewing the world map, the world map size was increased by 40% and the player position icon size was increased by 100%, changes endorsed on a blog in the AbleGamers community [21]. Crosshairs were added to help focus the user's attention to their icon position (see Fig. 2).

Fig. 1. The default navigation UI (left) and our enhanced navigation UI (right)

Fig. 2. The default world map UI (left) and our enhanced world map UI (right)

3.2 Combat

In the combat state, the key UI elements are the action bar and the unit frames. In a combat situation the user must focus on the unit frames (located on the top left of the screen) to monitor their avatars health and resources, along with the health of their enemy, and the action bar (located on the bottom of the screen) to monitor their avatar's available abilities (see Fig. 3). At the same time, the user must also focus on his or her avatar to ensure they are properly facing and in close proximity to their enemy.

To focus the user's attention toward their avatar, in our enhanced combat UI, we removed empty slots from the action bar, increased the size of the ability icons by 100% (placing them under the avatar) and created arced health and resource bars around the avatar (see Fig. 3).

Fig. 3. The default combat UI (left) and our enhanced combat UI (right)

4 Implementation

The augmentation to the DUI was constructed using AddOns, scripting programs written in Lua, a lightweight scripting language. AddOns are injected directly into the client and run within the WoW scripting system [22]. These programs are able to capture information from the game client in order for it to be displayed to the user. They are popular within the WoW community because they give the user the ability to customize their interface to their liking. They are also viewed as a utility as they help players perform certain roles inside of the game. Although many developers have created AddOns for public use, none have been directly aimed at improving accessibility for users with low visual acuity.

Working with the WoW environment has constraints imposed by the developers. One major limitation is the inability for automated user actions. Actions such as auto-walk and auto-target/selection are prohibited and cannot be implemented in AddOns. Also, unlike Second Life which has been made open source, WoW is proprietary software and does not allow changes to the source code. This limits what accessibility features we can add to the game and forces us to focus on the visual information displayed in the UI.

Our EUI was developed using several different open source Addons from the existing WoW AddOn community [23]. By utilizing the capabilities of certain AddOns, changes to their settings allowed us to alter their functionality to meet our game state design goals. Other AddOns required us to insert new code into the original for added features. Users who experienced our EUI were not required to change or adjust settings in order for the UI to appear as the interface loads when the user enters the virtual world.

5 Usability Study

To test the effectiveness of our enhanced UI, we conducted a comparative usability study. Eight novice users, with 20/20 (or corrected) vision, participated in the study. The study compared the default UI to the enhanced UI (DUI vs. EUI), utilizing a repeated measures design. Each user completed the set of tasks in both UIs, in separate environments. The order of presentation of UIs, (i.e. the environment in which the user was in with each UI) was counterbalanced. Throughout the experimental section of the study, all users experienced simulated low visual acuity, set at 20/200 (which is the best vision a legally blind user could have), through the use of the Zimmerman Low Vision Kit™.

Users completed the following task sequence in each UI: navigation, combat, navigation and navigation. For each UI, the users were extensively trained and allowed to ask any questions about the interface before proceeding with the experimental task. During each navigation portion, the following measurements are collected. First, a map is brought up on the screen and the user gives a verbal statement of their position relative to a specified destination marked on the map. Second, X, Y coordinates of the user's current perceived position on the map, collected from a mouse click. Third, the distance travelled by the user's in-game avatar to the specified destination that was marked on the map. Throughout the task, at one-second intervals, the coordinates of the in-game avatar were automatically collected and summed to give the total distance travelled.

In the combat portion of the task the user engaged in a battle with a predetermined opponent at a location indicated on the map. In order to win the battle, the user was required to engage in specific behaviors. These behaviors included: using a health potion when health was below a predetermined threshold (50%) and using special abilities that inflict higher damage on the opponent. To execute these behaviors, the user had to find and track these elements in the UI. Several measurements were again taken for the combat portion of task. These included the total battle time, time until the user took their potion, length of time between the availability of special ability and its use, as well as whether the subject died in battle. Following the combat encounter in each UI, the user stopped interacting with the game and filled out a questionnaire about the just completed combat situation. The combat questionnaire asked users to rate various aspects of the interface in regard to their helpfulness or harmfulness while in combat (e.g. difficulty of tracking health and ability status, level of frustration, etc.). If the user's avatar died in combat, the user was manually started on the following navigation task by an experimenter while completing the combat questionnaire.

After completing the in-game experimental section of the study, users were asked to complete an exit questionnaire regarding numerous aspects of the interfaces (both the DUI and the EUI), as well as their interactions and perceptions of working with them. The exit questionnaire is focused on overall user satisfaction with the UIs in addition to their experience, and asks users to comparatively rate the experiences in both UIs (e.g. difficulty of navigation tasks, efficacy of numerous UI elements, level of frustration, etc.).

6 Results

The results of the study can be best grouped into two categories, performance data from the in-game portion of the study, and the questionnaire data comprised by the combat and exit questionnaires.

Looking first at the in-game performance data, it should be noted that there were no order effects across any of the dependent variables (DVs) so the data sets were collapsed into DVs for each of the two UIs (i.e. DUI and EUI). For navigation, there were two DVs: distance traveled and number of times the world map was opened. The difference in the UIs had a significant effect on these DVs, with the EUI leading to better performance. (Distance traveled ($F(1, 7) = 27.24$, $p < .01$. Number of times world map was opened: ($F(1, 7) = 23.86$, $p < .01$). There were four combat performance DVs: total battle time, time of first potion use, time of first ability use, and outcome of battle (i.e. win/live or lose/die). The UI difference was significant for length of battle time ($F(1, 7) = 11.681$, $p < .05$). There were no significant differences between DUI and EUI for time of potion use, time of first ability use, or outcome of battle.

Table 1. Means and standard deviations of significant variables

Variable	UI	M	SD
Distance Travelled	DUI	133.13	29.72
	EUI	67.88	23.59
World map openings	DUI	44.00	24.51
	EUI	0.75	1.50
Length of battle time	DUI	32.63	7.50
	EUI	44.13	9.34
User rating of battle rating	DUI	5.88	1.36
	EUI	8.00	2.07
User rating of overall frustration	DUI	7.00	2.56
	EUI	3.38	2.97

Reviewing the questionnaire data, there were two important factors in which the enhanced UI led to significantly higher user ratings. In battle, users rated the EUI significantly better ($F(1, 7) = 6.19$, $p < .05$) than the DUI. Users also reported significantly less ($F(1, 7) = 8.99$, $p < .05$) frustration in the EUI vs. the DUI overall.

While no significant differences were found between the DUI and EUI in the user ratings of navigation related tasks, or in specific interface elements, these areas did appear in a number of important correlations. The performance measure of world map openings (DUI) was significantly correlated with both the user rating of overall frustration (DUI) ($r(6) = .93$, $p < .01$) and the user rating of how frequently they viewed their world map (DUI) ($r(6) = .84$, $p < .01$). Along the same line, the performance measure of distance travelled (DUI) was significantly correlated ($r(6) = .92$, $p < .01$) with the user rating of overall frustration (DUI). Switching to combat, another performance measure, length of time until potion use (DUI), was significantly correlated with both the user rating of difficulty in tracking their health (DUI) ($r(6) = .85$, $p < .05$) and the user rating of battle frustration (DUI) ($r(6) = .95$, $p < .01$). Continuing

with combat, the performance measure of length of time until ability use (DUI) was significantly correlated ($r(6) = .82$, $p < .05$) with the user rating of battle frustration (DUI). Finally, the user rating of battle frustration (EUI) was significantly correlated ($r(6) = -.72$, $p < .05$) with the user rating of the battle interface.

7 Discussion

At this time, WoW is the most played online video game ever. Access to this phenomenon should not be available only to people with high visual acuity. Our study has shown that with improvement, this need not be the case. Navigation and combat comprise the fundamental game states of WoW, and the analysis of results can best be understood when breaking along those same lines.

Looking first at navigation, the EUI led to a number of significant improvements over the DUI. These improvements included significantly less distance travelled between tasks, and significantly fewer world map openings throughout the task. Both of these factors show that the user in the EUI as being better equipped to navigate inside WoW. Reviewing the correlation data, we see that ease of navigation played an important role in overall frustration. Overall frustration in the DUI was positively correlated with both the number of world map openings in the DUI and the distance travelled in the DUI. Due to the significant reduction in both world map openings and distance travelled in the EUI, we see why users reported having significantly less frustration in the EUI vs. the DUI. When creating and/or adapting a product for people with visual impairments, reducing frustration is a vital component.

Moving to combat, the EUI was again shown to provide important improvements in the subjective experience of the user, but also their objective performance as well. In combat, users in the EUI had significantly longer battle times than in the DUI. Though this could be interpreted to mean that in the DUI users were able to defeat their enemy more quickly, this would be a mistake. Unfortunately for the users in the study, coming out victorious in their combat situation proved rather difficult, which casts the battle time statistic in a different light. Instead of users in the DUI defeating their enemy more quickly, a more accurate interpretation would be that users in the EUI survived longer in the battle than when in the DUI. Bringing in the correlation data, another important story unfolds. User reported frustration in battle for the DUI was positively correlated with both time until potion use in the DUI as well as time until ability use in the DUI. Time until potion use in the DUI was also positively correlated with user reported difficulty in the DUI with tracking their health in combat. What all this means is that, in the DUI, users had trouble tracking and finding certain elements in the UI, which led directly to worse performance in battle, and as a result, higher frustration levels during combat. In addition, just as frustration played a role in the overall rating of EUI besting the DUI, frustration seems to have been a strong factor for users when rating the battle interface, as the EUI was rated significantly better than the DUI in combat. This relationship between frustration and interface ratings is corroborated by a negative correlation between user reported battle frustration in the EUI with the user reported battle interface ratings in the EUI.

Outside of navigation and combat, the positive correlation between the performance measure of world map openings in the DUI and the user reported measure of

how frequently they viewed their world map while in the DUI was an important result. Though this correlation does not shed light on the purpose of the study, it does reveal that the subjects of the study were reliable in the ratings of their own performance, which serves as a validation to the methodology used in the study.

Despite the alteration constraints put in place by Blizzard Entertainment, our study has shown that even minor improvements can vastly improve navigation, combat and reduce frustration in users whom the original creators chose to disenfranchise. Future work on the project plans to include improvements aspects of the interface utilized in other important aspects of WoW (such as quest completion, which requires the user to identify a specific person and read a piece of text). In addition, incorporating the performance and questionnaire results to create a newer enhanced version that will attempt solve many of the shortcomings in the EUI. Finally, we plan to expand our assessment of users' individual spatial and navigational abilities by utilizing psychometric tests.

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