APPENDIX F: VOICE-CONTROLLED WEB BROWSING FOR THE ELDERLY APPLICATION TEST RESULTS

Kirti Nathoo

School of Electrical & Information Engineering, University of the Witwatersrand, Private Bag 3, 2050, Johannesburg, South Africa

# Introduction

Voice-enabled web pages were designed to investigate the possibility of improving web browsing for the elderly. Numerical and link name referencing techniques were incorporated to determine which techniques are most suitable for simple and complex web pages. Both visual and feedback methods were integrated to improve the usability of the application. The application was decomposed into three iterations. Each iteration was implemented and extensively tested. Iteration test results were recorded in surveys specifically designed for each iteration. Surveys can be found in appendix E. The test results are discussed and analysed.

# test results

## Iteration 1

Iteration one was tested on seven elderly users. Of the seven users, two were computer literate. 90.12% of the total errors recorded amongst all the sections were the result of application errors. Application errors were cases wherein voice commands were misread, not recognised or not accepted. The remaining percentage was due to user errors, i.e. mistakes made by users whilst using the application. In the numerical referencing section 70.3% application errors were recorded in comparison to the link name referencing section wherein 29.16% errors were recorded. The high error percentage in the numerical referencing section may be due to the similarities between numbers spoken. Numbers are short single syllable words that may decrease the accuracy of speech recognition. In total 48 application errors were recorded for the referencing sections.

Upon analysis of the recorded results it was observed that 57.14% of users prefer using numerical referencing for simple websites. 28.57% prefer link name referencing and the remaining 14.29% are fond of both techniques as illustrated in figure 1.

Figure 1: User preference of referencing styles for simple websites

28.57% of users felt that numerical referencing performed better in comparison to 57.14% of users that felt that link name referencing performed better as shown in figure 2. This performance is the perceived performance of the referencing styles observed by users.

Figure 2: Users perceived performance of referencing techniques

Of the seven users tested, 71.42% of the group felt that link highlighting was the most valuable form of visual feedback as observed in figure 3. None of the users liked the pop ups as a visual feedback technique. 28.57% of the remaining users liked the verbal feedback method.

Figure 3: Preference of visual feedback techniques

42.85% of the group of users tested prefer a combination of numerical and link highlighting techniques. The remaining 57.14% of users were equally divided between the combination of link name referencing and link highlighting and link name referencing and verbal feedback.

Upon analysis of the results and the large number of application errors recorded for the numerical referencing section, it was considered that perhaps the numerical referencing section experienced a large number of errors because it was the first referencing style that was being tested. Users might have still been becoming accustomed to using the application and different referencing styles. This possibility informed the design of the second iteration.

## Iteration 2

Due to the large number of application errors recorded for the numerical referencing section in the first iteration, the application was restructured and retested. Iteration two was tested on five new elderly users. Of the five users tested, three users were computer literate. No user errors were recorded in either of the referencing sections. Of the application errors recorded, 68.18% were recorded for numerical referencing and the remaining 31.8% was recorded for link name referencing. In total 44 application errors were recorded for the referencing sections. This was not significantly less than the total of 48 application errors recorded in iteration one. This indicated that numerical testing was fairly tested in the first iteration.

Upon observing the results collected it was calculated that 60% of users preferred using numerical referencing in comparison to 20% of users who preferred link name referencing. The remaining 20% are fond of both techniques as observed in figure 4.

Figure 4: User preference of referencing techniques for iteration two

Although 60% of users prefer numerical referencing as observed in figure 4, 60% of users actually felt that link name referencing performed better than numerical referencing. None of the users felt that numerical referencing performed well and the remaining 40% felt that both techniques performed equally as illustrated in figure 5.

Figure 5: Perceived performance of referencing styles for simple websites

Users were asked additional questions about the current iteration and their opinions on future developments. 60% of users felt that on a page composed of 100 links, the numerical referencing style would be more confusing. The remaining 40% disagreed and felt that link name referencing would be more confusing. For link name referencing, 80% of users prefer saying a specific word in comparison to the remaining 20% whom prefer saying the complete sentence. None of the users preferred saying part of a link as shown in figure 6.

Figure 6: Technique preference for link name referencing

100% of users felt that numerical referencing would only be easier in cases where link names are difficult to pronounce. Users were asked which referencing technique should be applied to a website and only 20% of users prefer numerical referencing whereas 40% would prefer link name referencing to be applied to a website. The remaining 40% of users were unsure as they were unaware of what a website looked liked.

## Iteration 3

A facsimile of a local news website was designed. Two versions of the website were created and the different referencing styles were applied to each website. A total of eight people were tested of which two people were computer literate. No user errors were recorded for either version of the website. For the application errors recorded, 45.23% were recorded for numerical referencing and the remaining 54.76% of errors was recorded for link name referencing. 126 application errors in total were recorded for both websites. This high number of errors may be due to the complexity of the website and the number of computer illiterate users in the group. Between the website versions, 50% of users prefer using numerical referencing and the other 50% of users prefer link name referencing as observed in figure 7.

Figure 7: User preference of referencing techniques for complex websites

Users were questioned on using the application and 87.5% of users felt that website was sufficient in illustrating the differences between the referencing styles. 62.5% of users were happy with the current numerical referencing style. However the remaining 37.5% preferred a different numeric referencing style. Users were questioned about the layout and structure of the web page and 62.5% of users would like different sections of the web page to be annotated using different colours. This would improve the usability of the web page for elderly users.

Only 25% of users felt that the website facsimile was an adequate representation of a news website. The remaining 75% were unaware of news websites which is due to a lack of interaction with computers. 62.5% of users were happy with the current colour of the link when highlighted. The remaining 37.5% prefer a different colour which may be due to varying vision amongst elderly users. 100% of users would like the option to zoom in and out of sections of the webpage. This would improve both the visibility and usability of the web page components.

Users were asked if it was unreasonable to expect elderly users to press a button to activate speech recognition. 50% of users felt that is was unreasonable and the other 50% thought it was an acceptable requirement. This requirement is still debatable. 87.5% of users in the group thought that voice feedback provided adequate user feedback. The remaining 12.5% preferred alternative forms of visual feedback. Users were questioned to ascertain if user confirmation was necessary and 62.5% of users felt that it was not necessary. The remaining 37.5% felt that confirmation was necessary to ensure the application performed as expected. Only 25% of the users tested had an ADSL internet connection. These were the two computer literate users tested. However users were equally divided on whether they preferred a complete application that only ran on a machine and required no internet connection or the current application.

## Analysis

All requirements for the three iterations were sufficiently met and tested. The results were analysed. In total 16 different people were tested and some users were tested on more than one iteration. However, half of the user group was computer literate, i.e. 50% of users tested. User errors were only recorded in iteration one. For following iterations users were explicitly guided which evidently eliminated all user errors.

From figure 8 it is evident that the highest total of application errors was recorded in iteration three. This may be attributed to the fact that iteration three consisted of a more complex website. Errors recorded between iteration one and two slightly decreased after restructuring the first iteration. However between the referencing styles, it was evident that for simple websites numerical referencing resulted in far more errors than link name referencing. This may be due to numbers being short single syllable words. For complex websites link name referencing indicated substantially more errors thank numerical referencing. These errors are the result of complex words, mispronunciations, etc.

Figure 8: Application errors for referencing styles per iteration

As observed in figure 9 it is evident that for simple websites designed in iterations one and two, users preferred numerical referencing. This may be due to the sequential nature and concise vocabulary of numbers. However for complex websites there was no distinct preference between referencing techniques. For complex websites, both techniques appear to be satisfactory.

Figure 9: User preference of referencing techniques per iteration

Although users strongly prefer numerical referencing for simple websites, figure 10 indicates that link name referencing performs significantly better. The performance of these techniques is based on user perception from using the web application. Similar to figure 9, in iteration three there is no distinct difference in performance between the two techniques for complex websites. This implies that both numerical and link name referencing perform equally well and are equally preferred for complex websites.

Figure 10: User perceived technique performance per iteration

## Secondary results

From the results collected additional results were interpreted for interest purposes. The number of application errors between males and females were calculated. For each iteration the number of male and female users tested was recorded. Thereafter for each iteration, the total application errors for each gender was totalled and divided by the number of males and females respectively. From figure 11 it was evident that females experienced substantially more errors than males in all three iterations. This large error rate may also be due to the fact that many of the females users tested were not computer literate and have never used a computer before. Additionally females speak softer and were much more nervous in comparison to the males whilst using the application.

Figure 11: Average application errors recorded between male and females

Tested users were further categorised into age groups. Three age groups were defined: 55-65, 65-75 and 75-85 year olds. Application errors were tallied for each age group and divided by the number of users within that group and within each iteration. From figure 12, it was observed that for the first two iterations a higher number of application errors were recorded for the oldest age group of users tested as expected. However, unexpectedly in the third iteration the middle age group of users performed significantly worse than the eldest age group. This maybe because more users in the second age group were tested and consequently more errors were recorded in comparison to the number of users tested in the third age group.

Figure 12: Average application errors recorded per age group

The affect of a users’ accent on the speech API was investigated. However due to the small sample size of the group, accented users were not encountered.

# CONCLUSION

Each iteration was adequately tested and sufficient data was recorded through the use of surveys. It was concluded that although users prefer numerical referencing for simple websites, link name referencing performs substantially better. On a more complex website there is no distinct preference between numerical and link name referencing. However, there is a slight performance improvement for numerical referencing which indicates that numerical referencing could be used to improve the performance of voice controlled browsing for the elderly on complex websites. For link name referencing users prefer to say a single word in comparison to the part of or the complete link sentence. The current link highlighting and verbal feedback techniques implemented were adequate in providing users with feedback whilst using the application. Additional results observed will be considered for use in future work.