

AUTOMATED DOUBLE BLINDING FOR HEARING AID RESEARCH

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INTRODUCTION

Blinding is an experimental technique that has been used to reduce bias during experimental data collection and interpretation. The goal of blinding is to ensure any observed experimental effects result from true differences between the test conditions, and are not due to bias resulting from differences in instructions given to test subjects, expectations related to the anticipated outcomes, or knowledge about the test condition, whether those effects are manifested consciously or unconsciously.

Double blind test design requires two research assistants to be present during subject testing. The second research assistant counterbalances the test conditions and changes the hearing aid settings via the program manager in the hearing aid fitting software. Concerns about the inefficiency of using two testers during a study led to the creation of a custom software program that can switch the hearing aid programs in the hearing aid fitting software in a randomized order without the research assistant's knowledge. The research assistant opens and controls the custom software, but is not aware of the hearing aid settings until after testing is completed. The use of this type of software in the future could be beneficial by allowing double blinded studies to be performed more efficiently with fewer research assistants per study.

SOFTWARE DESIGN

A custom computer program was developed which causes mouse clicks to occur at specific locations on the computer display in order to control program changes in a hearing aid fitting software program and minimize/maximize the program in windows. These clicks occur much more quickly than would be possible by a human (for example, 50 milliseconds).

The software has between two and five buttons (A-E, depending on the number of hearing aid programs being tested), each of which is randomly assigned to a particular program within the hearing aid fitting software. When one of the buttons A, B, etc., is clicked, a program button in the hearing aid fitting software is selected. The custom software does this by clicking the minimized hearing aid fitting software program in the taskbar to maximize it, then clicks on the assigned program button, then minimizes the hearing aid fitting software again. Each mouse click by the double blind software program occurs within 50 milliseconds which prevents the research assistant from being able to visually identify which specific hearing aid program has been assigned to A, B, etc.

SOFTWARE DEVELOPMENT

The amount of time between mouse clicks may be adjusted in the software for more reliability due to the age and speed of a particular computer. In its current form, the double blind program is designed to work with the Widex Compass hearing aid fitting software, but could be modified in the future to other hearing aid fitting software.

GRAPHICAL USER INTERFACE

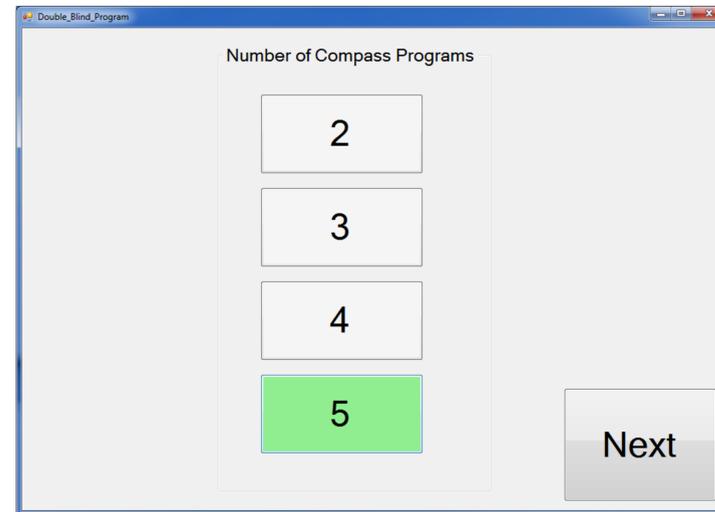


Figure 1. The first screen of the double blinding program allows the experimenter to select how many hearing aid programs are to be used for testing

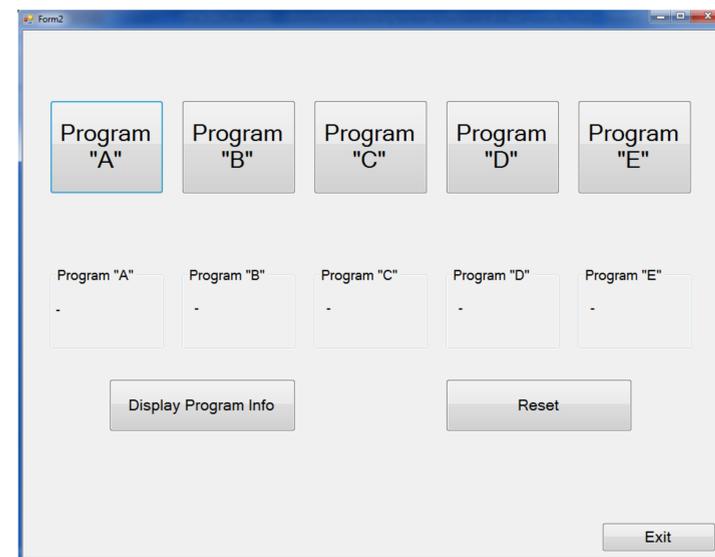


Figure 2. The second screen of the double blinding program allows the experimenter to choose different hearing aid programs while being blinded to the actual hearing aid settings

SOFTWARE DEVELOPMENT

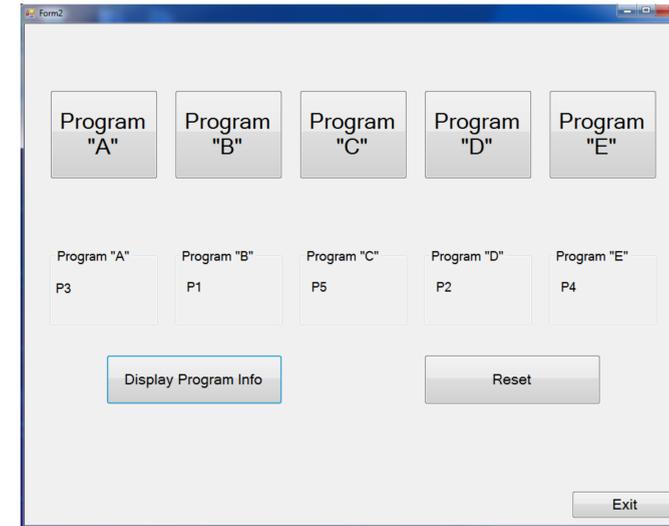


Figure 3. After testing is complete the experimenter can press the "Display Program Info" button to reveal which hearing aid program was assigned to each of the program "A" through "E" buttons.

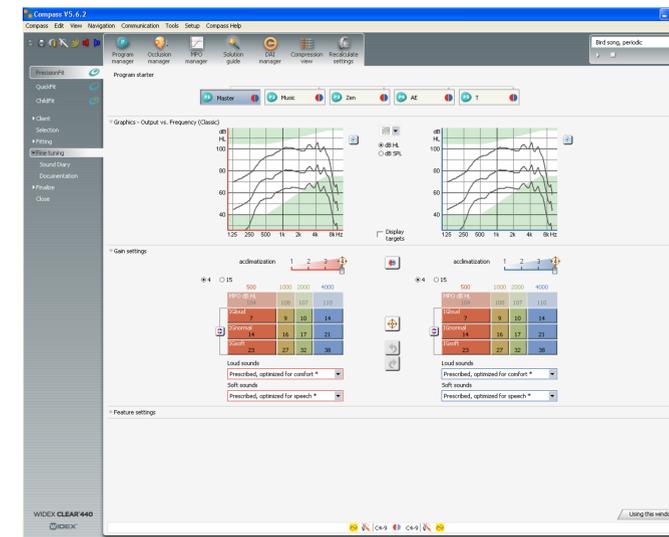


Figure 4. A screenshot from Widex Compass hearing aid fitting software. The double blinding program randomly assigns program buttons "A" through "E" to correspond to the program buttons in the hearing aid fitting software.

METHODS

Five Master programs were created in the Widex Compass hearing aid fitting software. Since NOAH is typically used together with Compass in a clinical research lab setting, Compass was set to be in simulate mode through the NOAH interface. The ORCA-NST testing software was also running on the computer at the same time in order to simulate a typical computational load for a computer in a clinical research lab setting.

METHODS

The custom double blind software was used to change each of the five programs (A-E) in Compass. After each program change in Compass was completed, the program number (1-5) was recorded. The "correct" order of programs as dictated by the custom double blind software, were compared with the order performed by the double blind software.

Two sets of 500 trials were completed. One set used a typical computer mouse as a control device. For the second set of 500 trials a computer touchscreen monitor was used by the test administrator.

The double blind software was exited and restarted after each completion of 100 trials. The order of programs in Compass was changed (re-randomized) after each completion of 100 trials. This was done to ensure these two actions had no negative impact on the accuracy of the software.

RESULTS

Upon completion of the first 500 trials, there was no effect noted for exiting/restarting the software, or for changing the program order in Compass. The use of the touchscreen monitor yielded 100 percent accuracy compared with a 98.6% accuracy when using a mouse. It was hypothesized that use of the mouse, as opposed to the touchscreen, negatively impacted the accuracy of the program due to unintentional mouse movements by the human operator.

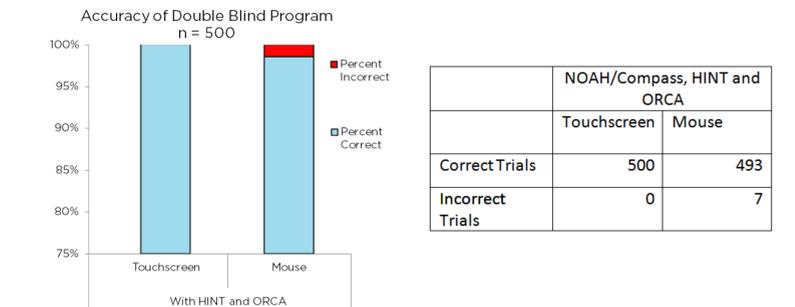


Figure 5. Results from two 500 trial tests of the double blind software. One test used a touchscreen as the computer input device. The second test used a mouse as the computer input device. Percent accuracy [left], raw results [right].

CONCLUSIONS

The double blind software may be useful and accurate when using a touch screen monitor as an input device. The software may be further modified in the future for more reliability with a mouse input device. The software could also possibly be modified for use with other manufacturer fitting software.