User Evaluation: PinThing

Introduction

The user evaluation process is one of the most important steps in user interface design. It is a time where feedback can be given back to the designers by the individuals who will be using the system. For this project and assignment we were unable to perform user tests on our target population, the visually impaired. The population that we had access to was our fellow classmates. There were none is this group that suffered from extreme visual impairment. It is also our assumption that our users will have familiarity with screen reader technology which our classmates to do not. After reading Mortan Heller's "Tactile picture perception in sighted and blind people"\textsuperscript{1}, we discovered that there is little difference between a blindfolded sighted individual's and blind individual's ability of identifying a raised lined image. Thus we determined that a user evaluation that we could perform on the available population would involve variations on the tactile PinThing device. The object of the first user evaluation was to determine the ease of use of the interface and user preference of the interface as well as ask for user suggestions on how to improve the interface. The object of the second user evaluation was to determine if height makes a difference the ability of the user to identify an image and if there is a difference between the ability of users to identify images with curves and straight lines.

(See attached for both evaluation documents.)

Research Design: Participants will have an approximately five minute to ten minute survey and test with the PinThing group members during normal class time. A consent form is not needed for this study as it is in-class work. Individuals always have the option of declining to participate and may stop at anytime. There will be no compensation for participants but it is expected that the PinThing group members will reciprocate and participate in other classmates studies. The first few minutes will be dedicated to a pre-test survey where users will be given a survey ID and asked to complete questions that focus on demographics and previous experience with computers and the internet. Following the pre-test survey the test will be administered (see below for script). In this test, users are asked close their eyes and place their hand on the PinThing prototype and then verbally identify the figure. They will be asked to do this twice. The figures are the two digit numbers, 86 and 47. It was alternated between users which figure was 1\textsuperscript{\textprime} and which figure was ½\textsuperscript{\textprime}. Users will be timed. Lastly, the users will be given a post-test interview that focuses on the user’s perception of how well they could identify the image. (see attached)

Results

I. Behavior Performance

<table>
<thead>
<tr>
<th>no</th>
<th>low_hig</th>
<th>cur_str</th>
<th>Time1</th>
<th>Acc1</th>
<th>low_hig2</th>
<th>cur_str2</th>
<th>Time2</th>
<th>acc2</th>
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<td>2</td>
<td>14</td>
<td>1</td>
</tr>
</tbody>
</table>

Low-hig: Lower or higher pins: 1=lower condition; 2=higher condition

Cur_str: Numbers with curved lines or straight lines: 1="68 or 86"; 2= "47 or 74"

Time: the time spend recognizing the figures (in seconds)

Acc: Accuracy, 1=correct, 0=incorrect

Then, we found:

1. There is a learning effect between the first trial and the second trial. Users usually used less time to recognize the figures.

<table>
<thead>
<tr>
<th>Time (sec)</th>
<th>mean</th>
<th>s.d.</th>
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</thead>
<tbody>
<tr>
<td>First trial</td>
<td>55.25</td>
<td>41.33</td>
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<tr>
<td>Second trial</td>
<td>17.5</td>
<td>6.82</td>
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</table>

Paired t test: t(7)=2.748, p<.05  Significant decrease of the recognizing time

2. There is no difference of the accuracy on the first trial and the second trial. And nearly 80% of the trials were correct. (t(7)=-.55, p=.598)

<table>
<thead>
<tr>
<th>ACC</th>
<th>mean</th>
<th>s.d.</th>
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</thead>
<tbody>
<tr>
<td>First trial</td>
<td>0.75</td>
<td>0.46</td>
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<tr>
<td>Second trial</td>
<td>0.88</td>
<td>0.35</td>
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</table>
3. In our experimental design, we counterbalanced the sequence of the curved or straight stimuli (68 vs. 47) and the height of the pinthing. But we are curious if these two factors will affect the recognition of the figures:

We conduct a 2-way ANOVA here: Dependent variable: Accuracy

Independent variable: Height (low vs. high) X Shape (curve vs. straight)

Then, we found there is no significant main effect or interaction on the accuracy. We can say that the height of the pinthing as well as the shape of the figures won’t influence the accuracy of the figure recognition.

Then, we conduct another 2-way ANOVA: Dependent variable: Recognition time (seconds)

Independent variable: Height (low vs. high) X Shape (Curve vs. straight)

We also found there is no significant main effect or interaction on the recognition time. We can say that the height of the pinthing as well as the shape of the figures won’t influence the figure recognition time.

II. Self-report Performance (from the questionnaire)

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<td>1</td>
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<td>4</td>
<td>4</td>
<td>1</td>
<td>0</td>
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</table>

Sex: 1=male, 2=female ; Edu=education level

Ethnicity: 3= Asian, 6= White or Caucasian, 7= Multiple categories

Pc_exp: the self-report experience with the computer: 7=a lot of use

Then, three questions with the 7-point Likert’s scale

Feel: the degree if the user liked the feel of the plastic pins (7=agree)

High: If the higher was easier to identify

Low: If the lower was easier to identify
Finally, two open questions:

Shape: if the shape influenced their recognition of the figures? 0=no, 1=yes

Height: if the height of the pins influenced their recognition of the figures? 0=no, 1=yes

Preference: which one the user think is easier to identify

Then, we found:

1. The age, education level and the computer experience didn’t influence the figure recognition of our users. (Partly because of the lack of variances in our samples)

2. Most of our users liked the feel of the plastic pins.

3. Combined the results of two preference questions, we found the users think the height of the pins didn’t influence their recognition, or they didn’t figure out there was a height difference in our tasks.

4. 75% of the users think the numbers with curved lines (ex. 68) were easier to identify. Although they performed the same in the tasks.

5. Most of the users think the height of the pins didn’t affect their ability to identify the objects. (Only 2 said this might influence their performance, although their real performance didn’t show this difference.)

**Conclusion**

From the user evaluation, we figured out neither the shape of the stimuli nor the height of the pins will affect the figure recognition. And nearly 80% of the users can identify the figures in our tasks; thus, people can recognize the figures from the pinthing through their fingers. And as long as the stimulus was clearly displayed, people can recognize it regardless of their shapes and their heights.

**Limitations**

We only used the simple figures in this evaluation; thus, the studies with more complex images should be done in future. And, users with visual impaired should be recruited to test the interface.
Interview Questionnaire A

*Based on UIUC IRB Application for Exemption*

http://irb.illinois.edu/files/ExemptFormv1_01.dot

**Project Title:** Pin Thing Renderer

**Investigators:** Jessie Chin, Allison Lacker, Elizabeth German

**Research Summary:**
One of the greatest benefits of the internet has been its potential to increase social inclusion for marginalized and disenfranchised populations. However for the visually impaired, interaction with the web has been limited due to the visual nature of the web. There have been many advances in the way of screen readers and Braille translators which automatically interpret the text on the screen for the user. However, in the case of images there is still a long way to go. Alternative text for images is one option, but there is evidence in the literature that suggests that it is not used often and is inadequate when it is used. Therefore it has become our objective to find a way to covert images on the web to a tactile graphic generation experience.

Our project is going to be a way to convert a 2 dimensional image on a computer screen to a 3 dimensional representation of the image. A computer program will analyze a given image and use edge detection to form a new image. This image that depicts the edges will be output to the device. The device will use electromagnetism to raise and lower pins to display a relief map of the edges.

This research project is to inform how the interface between the user, the screen reader, our software, and the device should operate. In the current project phase, when the screen reader detects an image, the reader is paused and prompt is offered to the user to ask if the user would like to render the image. After the image is rendered the user can push a key to un-pause the screen reader, the screen reader will also become un-paused if the user selects not to render the image. The objective of this project is to (1) determine the ease of use of the interface, (2) user preference of the interface, and (3) user suggestions on how to improve the interface. This is a necessary step in order to insure the most useful tool for our user as possible.

**Participants:**
The participants for the project are individuals whom are blind. Individuals will be recruited through advertisements on the Illinois Radio Reader (a radio station targeted toward blind individuals and those with visual impairments).
**Research Procedures:** Participants will meet for approximately one hour in a lab setting. The first five minutes will explain what the project is and if they assent, sign a consent form. The user study plans to use the Morae Usability software which includes visual and audio recordings. Participants must consent for the use of visual and/or audio recording prior to their use. Users have the option of participating in the study without the use of visual and/or audio recordings. Users then will be given 5 minutes to fill out the pre-questionnaire to gather demographic information (see attached). Users will then be given 30 minutes to interact with the system browsing the internet. The final 20 minutes is an post-test interview (see attached).
Appendix A: Pre-Questionnaire

Subject Id_____

DEMOGRAPHIC INFORMATION

Please answer the following questions:

Date of Birth: ________/ (Month) ________/ (Day) ________ (Year)

Gender: _____Male, _____Female

How many years of education did you complete?  
☐ Less than 8 years: ______ (Yrs)  
☐ 8 years  
☐ Some high school  
☐ Graduated high school  
☐ Some college  
☐ Graduated college  
☐ Advanced degree

Please check one of the following ethnic or racial categories that best describes you.  
☐ Hispanic or Latino  
☐ Native American/Alaska Native  
☐ Asian  
☐ Native Hawaiian or Other Pacific Islander  
☐ Black or African American  
☐ White or Caucasian

How many years did you suffer from the visual impaired? ______ Yrs  
And what is it? __________________

How many years did you have the healthy eyes? ______ Yrs

How often do you read Braille materials? ________ hrs/day

Did you have experience with the screen reader? _____(Y/N)  
How many years did you use the screen reader? ______ Yrs  
How often do you use the screen reader? _____hours/week

What sort of digital devices do you use already to use computers or browse the internet?
What websites do you visit often?

What do you like or dislike from existing screen readers?

How do you feel about internet browsing with a visual impairment?
Do you have any other important health problems? (If yes, what are they?)

How would you rate your overall experience with the computer?

1  2  3  4  5  6  7
Very little use  Average  A lot of use
Appendix B: Post-Test Interview

Thank you for participating in our test. We would like to ask you a few questions about how you felt about interacting with the interface.

Specific Interaction Points

The voice of the software was pleasant

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<th>5</th>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Agree</td>
</tr>
</tbody>
</table>

It was easy to know which button to push

<table>
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<th>4</th>
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<td></td>
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<td></td>
<td>Agree</td>
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</tbody>
</table>

The Pin Thing interfered with my browsing of the internet

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<th>3</th>
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<th>7</th>
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<tbody>
<tr>
<td>Disagree</td>
<td></td>
<td></td>
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<td>Agree</td>
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</table>

How often would you use this interface?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<tbody>
<tr>
<td>Rarely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Everyday</td>
</tr>
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</table>
General Preference:

- What would you say the most challenging thing was with interacting with the Pin Thing? (i.e. moving from pin thing to screen reader, identifying images to render, ect.)

- What did you like about the interface? (i.e. the voice, the button commands, the layout, ect.)

- What would you like to see improved?
Interview Questionnaire B

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http://irb.illinois.edu/files/ExemptFormv1_01.dot

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According to research done by Mortan Heller in "Tactile picture perception in sighted and blind people", we discovered that there is little difference between a blindfolded sighted individual's and blind individual's ability of identifying a raised lined image. Thus we determined that a user evaluation that we could perform on the available population would involve variations on the tactile PinThing device. The object of this evaluation is to determine if height makes a difference the ability of the user to identify an image and if there is a difference between the ability of users to identify images with curves and straight lines.

Participants:
The participants for this project will be sighted individuals and members of CS465. They will be verbally asked to participate in our study during the in class work hour.

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Research Procedures: Participants will have an approximately five minute to ten minute survey and test with the PinThing group members during normal class time. A consent form is not needed for this study as it is in-class work. Individuals always have the option of declining to participate and may stop at anytime. There will be no compensation for participants but it is expected that the PinThing group members will reciprocate and participate in other classmates studies. The first few minutes will be dedicated to a pre-test survey where users will be given a survey ID and asked to complete questions that focus on demographics and previous experience with computers and the internet. Following the pre-test survey the test will be administered (see below for script). In this test, users are asked close their eyes and place their hand on the PinThing prototype and then verbally identify the figure. They will be asked to do this twice. The figures are the two digit numbers, 86 and 47. It was alternated between users which figure was 1” and which figure was ½”. Users will be timed. Lastly, the users will be given a post-test interview that focuses on the user's perception of how well they could identify the image. (see attached)

Script:

Thank you for participating in our survey.

What we are going to ask you to do is that with your eyes closed, place you hand on a device that is about this size (gesture approximant size with hands). Be sure to explore the entire surface of the device in order to feel the whole figure. We're going to ask you to do this two times.

Feel free to talk aloud as you explore and simply verbally tell us what you think the figure is when you're done.
Subject Id____

DEMOGRAPHIC INFORMATION

Please answer the following questions:

Date of Birth: ______/ (Month) ______/ (Day) ________ (Year)

Gender: _____Male, _____Female

How many years of education did you complete?  □ Less than 8 years: ______ (Yrs)
□ 8 years
□ Some high school
□ Graduated high school
□ Some college
□ Graduated college
□ Advanced degree

Please check one of the following ethnic or racial categories that best describes you.
□ Hispanic or Latino
□ Native American/Alaska Native
□ Asian
□ Native Hawaiian or Other Pacific Islander
□ Black or African American
□ White or Caucasian

What websites do you visit often?

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</table>
Do you have any health problems that impact your browsing of the internet? (If yes, what are they?)

How would you rate your overall experience with the computer?

1 2 3 4 5 6 7
Very little use Average A lot of use

Subject Id____

Post Test Questionnaire
Thank you for participating in our test. We would like to ask you a few questions about how you felt about interacting with the interface.

I liked the feel of the plastic pins

The figure that was raised higher was easier for me to identify

The figure that was raised lower was easier for me to identify

There were straight lined numbers and curved numbers. Which was easier for you to identify and why do you think so?

Did you think there was a difference in your ability to indentify the higher raised verse the lower raised pin?