Gogglefox *Tree Tap* Usability Test Report

Brandon S. Perelman

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Final Design Documents

- Final Design Prototype
- White Paper
- Team Gogglefox Website
- Author's Website
Introduction

This manuscript describes a usability test of, and design recommendations for, Tree Tap, an android application created by Team Gogglefox at Michigan Technological University. The purpose of Tree Tap is to support the hobby of amateur maple syrup production by (1) providing literature to new hobbyists with little prior knowledge of amateur maple syrup production, and (2) facilitating the tree tapping process with useful tools and a database by which amateur maple syrup enthusiasts can log information critical to amateur maple syrup production.

We conducted a usability test of Tree Tap to ensure the application’s utility for achieving the aforementioned objectives. To these ends, our usability test consisted of (1) a test of the application’s Tree Tapping Guide created to aid new hobbyists in tapping a tree and producing sap for the first time, (2) a traditional usability test of the application itself in which participants were provided with a list of information to log into the application and then view, and (3) an evaluation of the help documentation associated with the application. As a consultant for Gogglefox, my role in this usability test was to conduct a traditional application usability test.

The usability test consisted of a live test by each participant in which they were asked to log information from five trees into the application, then test that the information had successfully saved. The application was evaluated according to quantitative and qualitative measures of usability. Specifically, participants provided quantitative feedback on their interest in the hobby, importance of an application to the hobby, and their interest in citizen science, as well as ratings of the application’s intuitiveness, aesthetics, legibility, simplicity, ease of use, reusability, and overall enjoyment. Second, we asked participants to respond with short answers to questions regarding the design’s structure, usability, data logging and data display components, and efficiency.
Test Plans

- **Test Scenario 1:** Enter data into the application for the first time and check to verify that it has saved.

**Scenario 1 Test Goals**
- Determine intuitiveness of the design.
  - Can participants enter data for a single tree without accessing the tutorial?
- Determine effectiveness of the tutorial instructions.
  - Does the tutorial provide sufficient information? Is more / different information required?
- Determine suitability of data inputs.
  - Do participants know what information to enter into the fields? Do they understand the scale / units involved?
  - Is data entry efficient?
- Determine quality of the data display
  - Once entered, is the data easily understandable?
- Determine quality of “soft” design features.
  - Responsiveness
  - Aesthetics
  - Engagement
  - Legibility and accessibility

**Scenario 1 Quantitative Measurements**
- Time to complete (how long does it take the participant to complete the task?)
- Non-fatal errors (how many times does the participant make an error from which they can recover?)
- Fatal errors (how many times does the participant make an error from which they must ask the experimenter’s help to recover?)
- References to tutorial (how many times does the participant reference the tutorial?)
- Help requests (how many times does the participant ask for help?)

**Scenario 1 Qualitative Measurements**
- On what screens did the participant appear frustrated or confused?
- On what screens / in what situations did the participant have to ask for help from the experimenter?
- What is the participant’s demeanor while using the application? Does he or she appear to be engaged? Frustrated? Confused?

**Scenario 1 Task List**
- If necessary, access the tutorial to acquaint yourself with the application.
- Enter all pertinent data from your plot into the application.
- Check the records to ensure that all of the data you have entered is accurate, and is saved into the application.
- **Scenario 1 Description:**

In this test, you will assume the role of an amateur maple syrup enthusiast. Your goal in this scenario is to enter data into the application as if you were using it for the first time. Your plot of land contains the following trees:

- Sugar Maple tree, 34” in diameter, with one tap in it. So far this year it has produced 30 gallons of sap.
- Sugar Maple tree, 65” in diameter, with two taps in it. So far this year it has produced 64 gallons of sap.
- Sugar Maple tree, 96” in diameter, with three taps in it. So far this year it has produced 83 gallons of sap.
- Black Maple tree, 40” in diameter, with one tap in it. So far this year it has not produced any sap.
- Black Maple tree, 40” in diameter, with one tap in it. So far this year it has not produced any sap.

Once you have entered this information into the app, check to ensure that it has all been correctly saved.
• **Scenario 1 Post-Scenario Interview Questions**

• Please provide feedback on the basic structure of the application. Do the screens logically transition one to the other? ____________________________

• Please provide feedback on the usability of the interface. Are the buttons appropriately sized? Is the font sufficiently large? ____________________________

• Please provide feedback on the data logging process. Is it clear to you what you are supposed to enter into each field? ____________________________

• Please provide feedback on the data display. Is it clear to you what data you have logged, and is it easy for you to view the data? ____________________________

• Please provide feedback on the efficiency of the design. Are there any areas where you found yourself working less efficiently than possible? ____________________________

• How many years of experience do you have with amateur maple syrup production? If you have no experience, put “0”. ____________________________

• Rate your interest in the hobby of amateur maple syrup production (circle one).
  
  1  2  3  4  5  6  7

• If you were to start amateur maple syrup production as a hobby, how important to you is having an app to track your production (circle one)?
  
  1  2  3  4  5  6  7

• Rate your interest in grass roots-style citizen science ventures (circle one).
  
  1  2  3  4  5  6  7

• Please rate the design in terms of its (circle one)…
  
  • Intuitiveness (is it easy to use?)
    
    1  2  3  4  5  6  7
  
  • Aesthetics (does it look nice?)
    
    1  2  3  4  5  6  7
  
  • Legibility (is all of the text easy to read?)
    
    1  2  3  4  5  6  7
  
  • Simplicity (do the screens contain only the necessary information or is there extraneous information?)
• Please indicate your level of agreement with the following statement: Overall this android application was easy to use to perform the task
  1. Strongly Agree
  2. Agree
  3. Neutral
  4. Disagree
  5. Strongly Disagree
• Please indicate your level of agreement with the following statement: I would use this android application again
  1. Strongly Agree
  2. Agree
  3. Neutral
  4. Disagree
  5. Strongly Disagree
• Please indicate your level of agreement with the following statement: I enjoyed using this android application
  1. Very much
  2. A little bit
  3. Neutral
  4. Not very much
  5. Not at all
• **Test Scenario 2:** Use the tapping guide to tap a tree for the first time. The participant will read through the tapping guide, then describe, step by step, the process required to tap a tree. Quality of the guide will be determined by the correctness of this step by step description.

• **Scenario 2 Test Goals**
  - Determine intuitiveness of the design.
    - Can participants access the tapping guide easily?
  - Determine effectiveness of the tapping guide.
    - Does the tapping guide provide sufficient information? Is more / different information required?
  - Determine quality of the guide display
    - Is the tapping guide easily understandable?
  - Determine quality of “soft” design features.
    - Responsiveness
    - Aesthetics
    - Engagement
    - Legibility and accessibility

• **Scenario 2 Quantitative Measurements**
  - Time to complete (how long does it take the participant to complete the task?)
  - Non-fatal errors (how many times does the participant make an error from which they can recover?)
  - Fatal errors (how many times does the participant make an error from which they must ask the experimenter’s help to recover?)
  - Help requests (how many times does the participant ask for help?)
  - Errors in the step-by-step description
  - Correct points in the step-by-step description

• **Scenario 2 Qualitative Measurements**
  - On what screens did the participant appear frustrated or confused?
  - On what screens / in what situations did the participant have to ask for help from the experimenter?
  - What is the participant’s demeanor while using the application? Does he or she appear to be engaged? Frustrated? Confused?

• **Scenario 2 Task List**
  - Access the tapping guide.
  - Read through the step-by-step tapping instructions.
  - Reproduce, in your own words, the process you would go through to tap a tree.
**Scenario 2 Description:**

In this test, you will assume the role of someone who wants to learn how to tap trees to produce maple syrup. Your goal in this scenario is to read the Tree Tapping Guide, and produce a step-by-step explanation of how to tap a tree in order to demonstrate your competency. First, access the Tree Tapping Guide, then use the guide to produce step-by-step instructions.
- **Scenario 2 Post-Scenario Interview Questions**

- Please provide feedback on the basic structure of the guide. Do the instructions logically transition one to the other? ________________________________

- Please provide feedback on the usability of the guide. Are the buttons appropriately sized? Is the font sufficiently large? ________________________________

- Please provide feedback on the description of the tree tapping guide. Is it clear to you what you are supposed to do at each step? ________________________________

- Please provide feedback on the efficiency of the guide. Are there any instructions that you felt could be worded more efficiently? ________________________________

- If you were to start amateur maple syrup production as a hobby, how important to you is having a guide available on your phone to describe the process (circle one)?
  1  2  3  4  5  6  7

- Please rate the guide in terms of its (circle one)…
  - Intuitiveness (is it easy to use?)
    1  2  3  4  5  6  7
  - Aesthetics (does it look nice?)
    1  2  3  4  5  6  7
  - Legibility (is all of the text easy to read?)
    1  2  3  4  5  6  7
  - Simplicity (does the guide contain only the necessary information or is there extraneous information?)
    1  2  3  4  5  6  7

- Please indicate your level of agreement with the following statement: Overall this android application was easy to use to perform the task
  6. Strongly Agree
  7. Agree
  8. Neutral
  9. Disagree
  10. Strongly Disagree

- Please indicate your level of agreement with the following statement: I would use this android application again
  1. Strongly Agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree

- Please indicate your level of agreement with the following statement: I enjoyed using this android application
  1. Very much
  2. A little bit
  3. Neutral
  4. Not very much
  5. Not at all
Pre-Usability Test Questionnaire

- For how many years have you used a smart phone? _____________________

- Please indicate your level of agreement with the following statement: I am very interested in testing this android application
  1. Strongly Agree
  2. Agree
  3. Neutral
  4. Disagree
  5. Strongly Disagree
Results

For the usability test, we recruited participants \((n = 7, \) four men and three women) from the Michigan Technological University undergraduate subject pool. Our sample was comprised of relatively inexperienced smart phone users \((M \text{ experience} = 1.2 \text{ years, } \text{Range} = 0 \text{ to } 2 \text{ years}).\)

The subjects reported a moderate interest in participating in the usability test \((M = 2.5 \text{ of a } 5\)-point Likert scale in which 1 indicated “most interested” and 5 “not interested at all.” None of the subjects had any subjective experience with the amateur maple syrup production hobby.

The usability tests were conducted in a classroom at Michigan Technological University. Upon arriving at the test site, subjects provided informed consent, then completed a pre-test questionnaire, the usability test scenarios, and then received a debriefing. The usability test scenarios consisted of (1) a qualitative test of the tree tapping guide, in which subjects read the guide and reproduced it in their own words, (2) a general usability test of the application requiring participants to save plot data, and (3) an evaluation of the help documentation associated with the application. The results of the first two usability test scenarios to follow will be discussed in terms of qualitative and quantitative results.

Quantitative Results

During the usability test, we collected observational data regarding participants’ timing and errors. Fatal errors were operationalized as errors in which the subject could not recover, while non-fatal errors were defined as errors from which the participant recovered to complete the task. Across all participants, errors were generally very low (see Table 1). On average, participants took 6.7 minutes \((SD = 2.02)\) to complete the general usability test, which involved...
entering data into the application and checking it, and 9.3 minutes \((SD = 2.99)\) to complete the tapping guide evaluation task.

*Table 1.* Error and help request frequencies across all participants.

<table>
<thead>
<tr>
<th>Error Type</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal Errors</td>
<td>0.2</td>
<td>0.44</td>
</tr>
<tr>
<td>Non-Fatal Errors</td>
<td>0.2</td>
<td>0.44</td>
</tr>
<tr>
<td>Help Requests</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Participant responses to the questionnaire items are available in Table 2. Generally, participants reported neutral attitudes toward the amateur maple syrup production hobby and Citizen Science projects. Importantly, however, many participants indicated a relatively high interest in using such an application to support their hobby. It is important to exercise caution in interpreting these results, however, as our sample of undergraduate students may be more open to incorporating technology into their hobbies than the target users of the present application.

Regarding the application itself, the subject pool generally rated the application neutrally in terms of intuitiveness, aesthetics, legibility, simplicity, usability, reusability and enjoyment.

*Table 2.* Subject responses to questionnaire items (7-point Likert scales)

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hobby Interest</td>
<td>4.00</td>
<td>2.37</td>
</tr>
<tr>
<td>Use application to support hobby?</td>
<td>5.50</td>
<td>1.64</td>
</tr>
<tr>
<td>Citizen Science project interest</td>
<td>4.17</td>
<td>1.94</td>
</tr>
<tr>
<td>Intuitiveness</td>
<td>4.33</td>
<td>1.37</td>
</tr>
<tr>
<td>Aesthetics</td>
<td>4</td>
<td>2.37</td>
</tr>
<tr>
<td>Legibility</td>
<td>5</td>
<td>2.10</td>
</tr>
<tr>
<td>Simplicity</td>
<td>4.33</td>
<td>1.86</td>
</tr>
</tbody>
</table>
Usability* 4.67 0.82
Would you use the app again?* 4.5 1.38
Enjoyment* 4.17 1.33

Note: reverse-scored items, indicated with *, have been recoded.

**Qualitative Results**

The bulk of actionable data was revealed during the quantitative analysis. Subjects reported no significant issues with the basic structure of the application. Regarding the interface, reviews were mixed. While participants found the font on the buttons legible, and the buttons themselves large enough for easy use, the font was universally regarded as too small in all areas of the application, and the data entry field size was insufficient.

All subjects reported dissatisfaction with the data logging process, though their reasons differed. First, there was universal confusion regarding (1) the process for entering single vs. multiple trees and when each button would be appropriate (see below), and (2) the units of measurement for sap yield. In terms of sap yield, one participant remarked that the Sap Yield label was confusing (i.e., the participant was not familiar with the term sap yield).

Subjects remarked that there was no field available to enter tree diameter. Subjects noted that the instructions for what to enter into the Plot Name button, and what constitutes a specific “plot,” were not clear. In terms of Plot Location, subjects were not sure if they were to enter GPS coordinates or otherwise describe the location. Furthermore, one of the subjects suggested that the application should include functionality to automatically fill the Plot Location based on the user’s current location using the phone’s GPS.

The present sample expressed the greatest degree of frustration with the option to enter multiple trees. In the scenario, of the five trees that participants were asked to log in the
application, two were the same (i.e., same type of tree, trunk diameter, and sap yield). The scenario was designed this way to test whether participants would intuitively understand that the ability to add Multiple Trees was intended to allow participants to streamline the data entry process. Of the seven subjects, none used the button in this way. Qualitatively, subject strategies for data entry may be characterized in one of two ways: inefficient or imprecise. Four of the participants adopted an inefficient strategy whereby they entered data tree by tree, failing to use the Multiple Trees button to add the duplicate trees. Three of the participants used an imprecise strategy which involved aggregating the trees and, in the process, losing information. For example, participants using this strategy entered the majority tree type (sugar maple) into the Tree Type field, and chose to enter either the mean sap yield or net sap yield into the Sap yield field. While a system of this kind may work for an individual, since the eventual goal is to inform the United States Department of Agriculture, standardization is required.

Finally, subjects were unable to view data once it had been entered because the View Records button was not functional at the time of the usability test. This is a serious concern, as data representation is a serious concern in such an app. In lieu of a usable View Records screen, we asked participants to describe to us the features they would like for this section. One participant suggested that all trees should be entered and viewed individually, and that aggregation of trees into distinct plots should be implemented in the View Records screen. Another suggested that the database should be set up similarly to a spreadsheet; in this way, each plot would have an associated spreadsheet that could be edited as desired. These possible changes, as well as others, are discussed below.
Conclusions and Recommendations for Design

Generally, according to usability test subjects the application requires significant refinement, and is worth pursuing as it would be useful to amateur maple syrup enthusiasts. As a result of the above usability test, I make recommendations changes generally and as they pertain specifically to the Enter Data and View Records screens of the application. Generally, the usability test results suggest increasing default font size and usable data entry field size across the entire application. Given the age differences between subjects and primary users, we should expect that dissatisfaction expressed by subjects in this regard would be amplified in practice.

Regarding the Enter Data and View Records screens, I make the following recommendations, including removing the ability to add multiple trees,

1. Change Enter Data on main screen to Add New Tree.
2. On the View Records screen, display each tree individually.
3. When viewing a specific tree on the View Records subscreen, include functionality permitting the user to duplicate a given tree. This will allow the user to duplicate trees then subsequently edit information in the event that the two trees differ in some small way.
4. When viewing a specific tree on the View Records subscreen, include a field listing Date Last Modified, and permit users to update information such as sap yield.
5. Add Tree Diameter (inches) to the Tap Entry screen.
6. On the Tap Entry screen, modify Sap Yield to include a unit of measurement.
7. On the Tap Entry screen, change Plot Location to Tree Location.
8. On the Tap Entry screen, include functionality to automatically fill Tree Location using the phone’s GPS.

The above recommendations focus mainly on the Tap Entry and View Records screens.

At the time of the usability test, the application was not fully implemented. As data representation is critical in this application. Therefore, I recommend that the application be evaluated in a subsequent round of usability testing before release.
## Appendix A: Undergraduate Group Member Attendance

<table>
<thead>
<tr>
<th>Date</th>
<th>Time Slot</th>
<th>Location</th>
<th>Undergraduate Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/14/14</td>
<td>2 – 3</td>
<td>Rekhi 118</td>
<td>Estefania Borns  Travis Foster</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>David Nyakundi  Quincy Howe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Theresa Tran</td>
</tr>
<tr>
<td></td>
<td>3:30 – 4:30</td>
<td>Rekhi 118</td>
<td>Estefania Borns  Travis Foster</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>David Nyakundi  Quincy Howe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Theresa Tran</td>
</tr>
<tr>
<td>4/15/14</td>
<td>11 – 12</td>
<td>Rekhi 118</td>
<td>Ann Dahlquist</td>
</tr>
<tr>
<td>4/17/14</td>
<td>11 – 12</td>
<td>Rekhi 118</td>
<td>Ann Dahlquist</td>
</tr>
<tr>
<td></td>
<td>1 – 2</td>
<td>Rekhi 118</td>
<td>Estefania Borns  Thomas Black</td>
</tr>
<tr>
<td></td>
<td>3-4</td>
<td>Rekhi 118</td>
<td>Ann Dahlquist</td>
</tr>
<tr>
<td></td>
<td>1 – 2</td>
<td>Rekhi 118</td>
<td>Estefania Borns  Thomas Black</td>
</tr>
</tbody>
</table>
Appendix B: Bug Report Forms

Bug Report Form

Experimenter Name: Brandon
Date: 4/14/14

Bug Number: 2
Bug Name: Diameter
Bug Location: Enter Data
Bug Description: No field for tree diameter

Procedure for Replicating the Problem: Enter Data screen - missing content
Bug Report Form

Experimenter Name: [Handwritten]
Date: 04/15/2001

Bug Number: 3
Bug Name: Crash to Desktop
Bug Location: Enter Data
Bug Description: When pressing submit, it crashes.

Procedure for Replicating the Problem: Enter # trees, # cars, date, gallons?