



## Low-Fidelity Prototyping and Usability Testing

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## Introduction and Mission Statement

Is the item you're ready to dispose recyclable? With so many rules, restrictions, and guidelines, this question is becoming harder and harder to answer. Finding such information is not easy and often times a person places more value on saving time by throwing items in the trash than upon researching the correct disposal method. For the same reason, most people do not keep track of their personal consumption habits and do not think about the environmental impact of the materials they purchase. A mobile application that connects users to their consumption statistics and shares proper recycling information will allow people to realize and ultimately improve their consumption habits.

Consumester's mission is to reduce the environmental impact of individuals by improving personal consumption habits.

## Prototype

Consumester's interface utilizes many of the iPhone's native utilities such as attribute-value buttons (Figure 1). Upon clicking one of these buttons, a list page is shown with a check by the current value. Users can select a new item in the list (which will become checked) and the attribute-value button is updated with the new value (Figure 2.3) after hitting "Back" to return to the previous page.

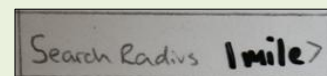
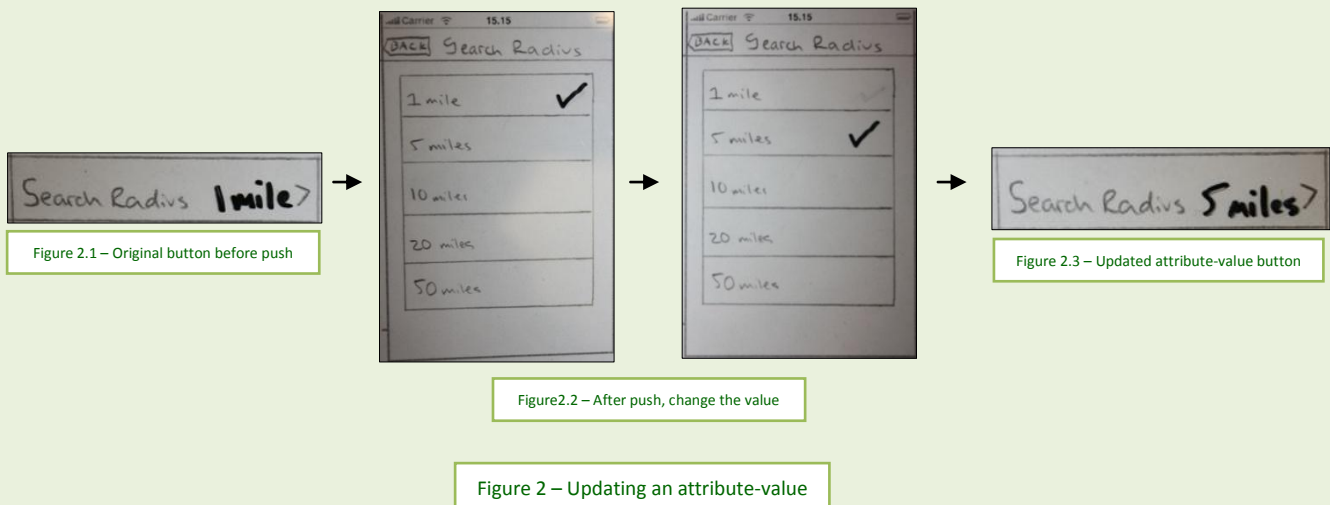


Figure 1 – Attribute-value button



These UI tools are already familiar to iPhone users and are easy for new users to learn. Additionally, Consumester's interface follows many of the native iPhone interface styles such as consistent "Back" button placement (Figure 3) across all pages and oversized buttons to signify a significant action (Figure 4).

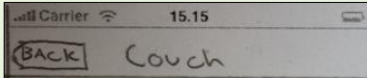


Figure 3 – "Back" button

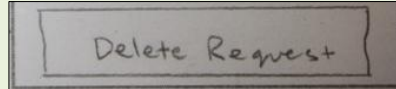


Figure 4 – Buttons with significant effect are sized to span the width of the page

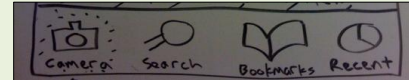


Figure 5 – Icon-assisted tabs

Consumester also utilizes icon-assisted tabs (Figure 5) to allow additional functionality for a feature without having to switch to a new page, such as our four methods of item search: image capture, textual search, bookmarks, and recent items. The selected tab is highlighted to notify the user of the mode they are in.

One of the most important methods we will use in our low-fidelity prototype testing is the usage of transparencies to display dynamic content. For example, while our test participant changes the value of an attribute-value button, a checkmark on our transparency will move to their selected value. Once they hit "Back" and go to the previous page, the attribute-value button will display the new value, which we will write elsewhere on the transparency and slide into place.

## Consumption Tracking

Consumester's consumption tracking functionality allows people to view their recorded

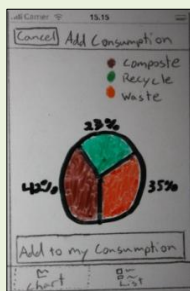


Figure 6 - Pie graph

consumption in a given a date range from the past. The default date range is the previous month. This information, which can be viewed as a line graph or as a pie graph showing the totals, comes from taking pictures of receipts that are then saved automatically in the history. The add button on the graph display page allows people to enter a new receipt via image capture. Once a receipt image is captured, the receipt information is displayed in a pie graph (Figure 6) but can also be displayed as a list of each item

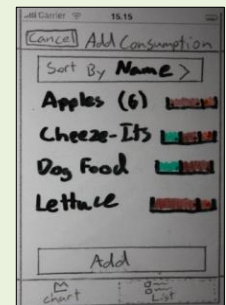


Figure 7 - List View

(Figure 7). The list can then be sorted by name, % recyclable, % compostable, or % trash, allowing users to view their data sorted by multiple characteristics.

## Give/Find Item

This section of Consumester allows users to handle the transfer of free, usable items in their local area. The basic functions are the ability to give away or find local items. Giving away an item is as simple as providing basic information about the item and clicking post. Finding an

item is more flexible, as you can either look at what items are available locally (Figure 8) or request an alert when a specific item becomes available (Figure 9). Additionally, there is a page to add, update, or delete current requests and posts.

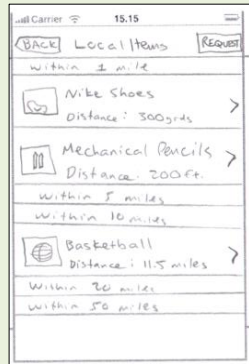


Figure 8 – Local items

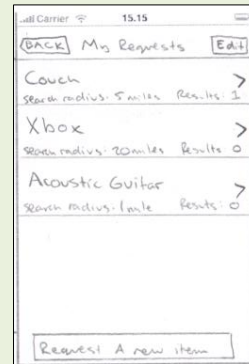


Figure 9 – Requests

### Item Lookup

Item lookup is a core function for the entire application. The primary method is picture recognition; however, there is a search function for lookup in the event it does not work (see [Figure 5](#)). Once an image of an item has been captured, an item details page is displayed (Figure 10) with a description and picture, as well as buttons to add that item to consumption, give it away, or request that item. Further information can be accessed regarding the item through the recycling tab (Figure 11). This displays information about specific material breakdown, as well as recycling information for those materials. This page is complete with a link to a local recycling map (when applicable) for each specific recycling method.



Figure 10 – Item Details Page

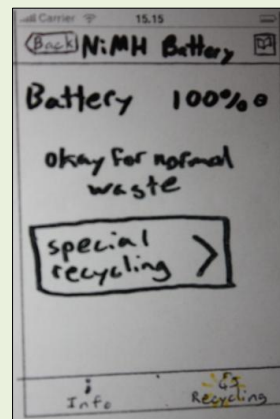


Figure 11 – Recycling Information

## Entire Low-Fidelity Prototype

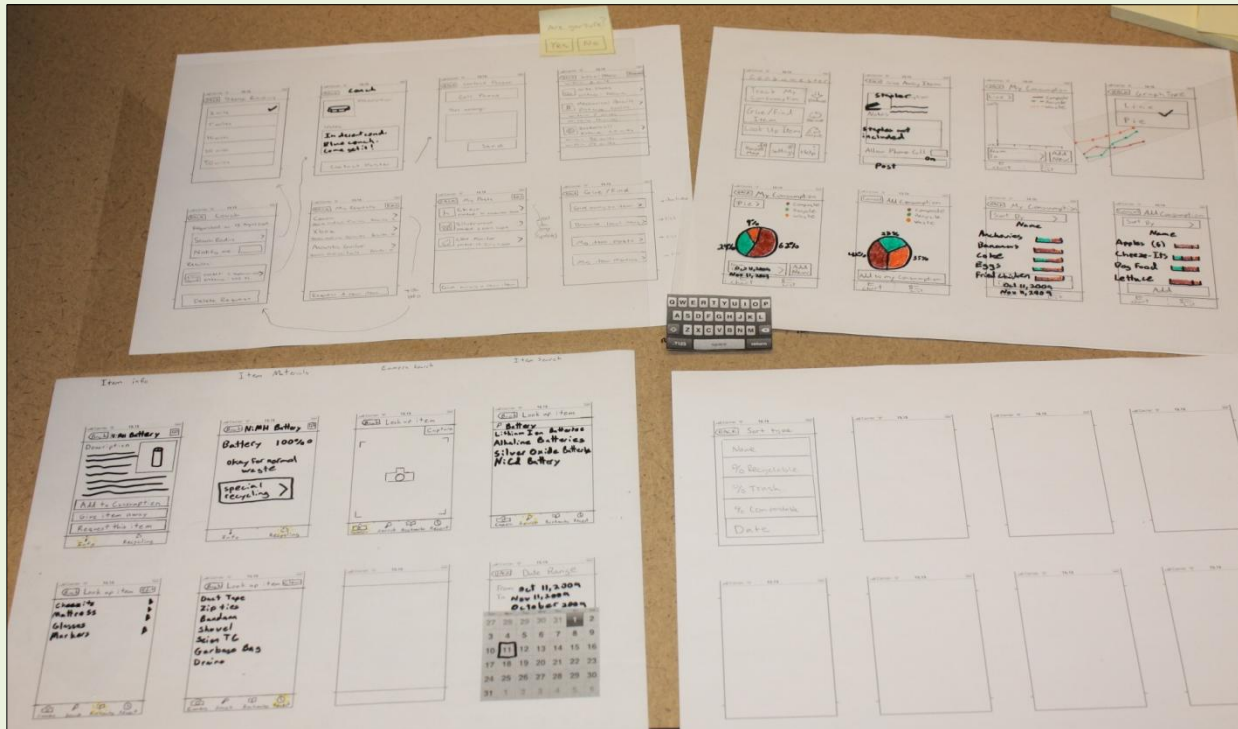


Figure 12 – Entire paper prototype

## Method

### Participants

Our application may be used by anyone who uses a Smartphone (such as an iPhone) and anyone who has to make decisions regarding the disposal of items. Because of the broad potential audience, we did not need to target a very specific group of individuals. We chose the convenience of other University of Washington students, as they are included in the population of people that uses or might use a Smartphone. Further, UW students are faced with recycling decisions on a daily basis.

Chris is a sophomore pre-engineering major. He tries to recycle but is willing to throw things away if it is the only available option. He does not know how to properly recycle a computer and has not used an iPhone before.

Frances is a freshman biology major. She recycles when she can, but not if she has to go significantly out of her way. Though Frances has never needed to go to a specialized recycling center, she is aware they exist and that specialized recycling centers would be the best way to recycle a computer.

Grace is a sophomore and has not yet chosen a major. She recycles passively (when an

opportunity exists) and only when it is convenient. She does not know how to properly recycle a computer, and she has used an iPhone previously.

Before starting the usability test, we asked a few questions that revolved around the participants' current recycling knowledge and previous iPhone usage. We also had them sign a consent form (see [Appendix 1](#)) before starting the tests.

### Environment

Our user testing took place in a McCarty dormitory study room. We simply asked other students in the area if they would be willing to help us with our testing. We had a video camera set up to capture only the prototype manipulations (Figure 13).



Figure 13 – Camera setup

### Tasks

#### Task 1 (easy) [See [Appendix 2.1](#)]: *Recycling a rechargeable battery*

The task is to determine if the batteries are recyclable and if so, how to recycle them. The steps necessary to complete this task begin with pressing “Look Up Item”. Participants should first take a picture of the item. Once the item is recognized and the item information page populates, the participant should click on the recycling tab. The proper recycling information is displayed and if a recycling option is available, a button will appear that leads to a map with nearby applicable recycling locations.

#### Task 2 (medium) [See [Appendix 2.2](#)]: *Giving away an unwanted couch*

The task is to advertise a couch using our give-away feature, making sure to specify its condition and how the participant wants to be contacted. This task begins with pressing “Give/Find an Item” button on the home screen, and then the participant must select “Give away item” on the following sub-menu (Figure 14). From there, the participant should take a picture of the item to be given away, which will populate the give-away item page with the picture and a short description of the item. Our participants will then need to click on the notes box and enter information about the condition of the couch and click on “Contact Preferences” and specify how they wish to be contacted. The last step is to click “Post”.



Figure 14 – Give/Find menu

#### Task 3 (hard) [See [Appendix 2.3](#)]: *Reducing consumption over time*

The task begins with checking current waste/recycling consumption statistics. Pushing “Track My Consumption” from the home screen brings the participant to the consumption data page, which displays the current levels of waste and recycling consumption. After noticing unsatisfying data about their consumption habits, our participants will use this information to

make less-wasteful purchases over a period of time. We will simulate their purchases by providing receipts for participants to enter into our application. Clicking “Add new” on the current screen loads the image capture page where the participant can take a picture of the receipt. A pie graph containing information about the receipt will then be displayed (Figure 15), and participants should press “Add to my consumption” and press “Yes” in the confirmation pop-up. After doing this for an imaginary week, participants will recheck their waste/recycling consumption to see if they notice a difference. Pressing “Track My Consumption” from the home screen leads to the updated consumption graph with recent data. Finally, participants will compare the change in consumption levels to the values from the previous week.

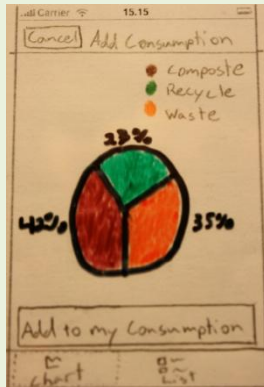


Figure 15 –  
Receipt pie graph

### Procedure

During our usability tests, Cullen acted as the computer. Cullen's job was to prepare all the screens of our interface for interactivity with the participant (Figure 16). To handle participant input, Cullen prepared hand-written content on clear transparencies. After a test participant typed something into our prototype, Cullen wrote their input on a transparency and then overlaid the transparency on top of the prototype. Additionally, Cullen handled more subtle interface actions such as pop-up dialogues. Cullen's preparation and awareness was vital to the success of our usability testing because he had to be able to react to any action our participants might take.



Figure 16 – Multiple slides  
and transparencies

Michael was the participant facilitator and interacted with each student, introducing the project and general background information about its mission and functionality. Following our testing procedure script (See [Appendix 4](#)), he introduced our project to the participants and gave them some general background information about its mission and functionality. For example, Michael explained to our participants that our application has image-recognition capabilities. Then Michael showed the participants a sample iPhone screen with buttons and tabs to explain to them how the prototype would work. Michael explained that their participation was entirely voluntarily and emphasized that we were testing our interface and not them.

After having the participants sign a voluntary consent form (See [Appendix 1](#)), Michael gave each participant the tasks one by one. Michael answered the participants' questions about our interface as best as he could throughout their tasks without telling them how to complete the tasks. After each task, Michael debriefed the participants for relevant information such as usability problems.

Patrick was the observer during usability testing. He took notes of all activity he noticed (See [Appendix 5](#)), both positive and negative observations. After completion of the tasks, Patrick shared and verified his observations with the participants. This gave the entire group a chance to dive into deeper evaluation of the observations and receive meaningful input from our test participants.

### Test Measures

During the testing we placed a large emphasis on participant understanding and ease of use. We wanted to find out what was confusing about our application and when participants took incorrect steps. The process data we searched for was general trends in task completion. We documented anytime participants strayed from the exact path necessary to complete the tasks and, more importantly, why they ended up in these situations. Further, we documented when participants were unsure about what to do or needed guidance in their actions. This may not have been incorrect steps but rather stalling due to lack of confidence in the next necessary action. Concentrating on this data allowed us to pinpoint confusing elements of our application.

### Results

*Please note: Participant names have purposely been kept anonymous from all data presented*

Participant 1 (who we will refer to as "he") was initially confused. He was not sure what pressing "Track My Consumption" or other buttons would do and was intrigued, wanting to explore the application. In task 1, he liked the image recognition functionality. However, shortly after that he hit some speed bumps. He could not locate where to go to find recycling information on the general item information page. He clicked on some buttons that took him further away from finding this, and eventually we had to guide him in the right direction. In task 2, he was mostly successful without too many issues. He was able to navigate through screens to take a picture of an item he wanted to give away. The main error came when he input information to give-away an item because he initially wanted to post the item right away. After considering adding notes, he was not sure what kind of notes to enter, and considered entering contact information notes despite the contact preferences button. Task 3 went smoothly; he was able to take pictures of receipts and input them, as well as take note of various graphs and their meaning.

Participant 2 (who we will refer to as "he") was a lot more concerned with our technological assumptions than usability issues, although he still did run into some usability problems. In task 1, he expected to see some sort of search option regarding items rather than a camera. Once it was established that image recognition could provide the same functionality, he became very concerned with the specifics of this technology. He was also curious about adding a price for the couch in task 2 and whether or not items were always supposed to be free. He also was not aware of how we were dealing with people contacting each other regarding posted items, and

the privacy features associated with this interaction. For example, he was unaware of our anonymous calling feature.

Participant 3 (who we will refer to as "he") had the most success when completing our 3 tasks. He executed task 1 with few issues; he clicked on the correct buttons and took the correct steps to complete the task. The only possible issue he had with our interface was that he found some of the buttons confusing. In task 2, he was able to navigate to the item give-away page fairly effortlessly. The only issue arose on the actual item give-away page when he was not exactly sure what the notes field was supposed to be used for; he thought it seemed a little ambiguous given there was already an item description. In task 3 he was able to complete everything successfully but pointed out a few confusing elements of the prototype. First, the "Add new" button on the graph page was ambiguous. Was it supposed to add a new graph? And second, the date field for the graphs did not look like a button, and consequently he was unsure how he would go about changing the date range on the displayed graph.

## Discussion

From this testing we learned a lot about our prototype. We were able to narrow down several confusing and misleading elements that we had not initially thought were confusing. One major issue with task 1 screens was the inability to quickly find recycling information. This was due to our use of tabs to get to the recycling page instead of a more visible and immediately recognizable button (Figure 17).

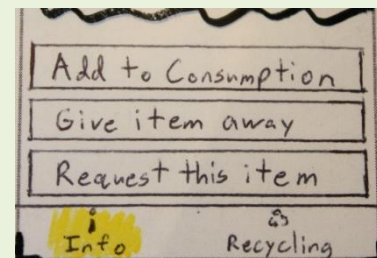


Figure 17 – Recycling tab is too small, not prominent

Another major issue was related to the pick-up location when giving away an item. Since Consumester is a mobile application, we assumed it should be able to use the current GPS location to give something away on the go, and therefore the first version relied solely upon the phone's location when posting an item. However, we realized people might not always carry the item with them at all times. Due to the feature of location-based give-away, we realized we need some way to specify where the item would be given away. For example, people are not going to carry large items such as a couch around all the time, so there needs to be a give-away location option. We propose allowing the user to specify a static location for item pickup or a "with me" feature that will use the phone's location as the pickup point.

Participants also were confused about how monetary transactions would be handled by the give-away feature of our application. Are people supposed to list a price they want in the notes field or are items supposed to be given away for free? We intend to fix this by suggesting that all items posted on Consumester should be given away for free, but ultimately it is up to the consumers to decide and negotiate if money becomes an issue. We arrived at this decision because Consumester's goal is to promote reuse of items instead of throwing them away, and



not about facilitating the sale of items.

Poor button placement, unclear text, or lack of visibility also added to confusion. For instance, we realized the "Add New" button on the My Consumption graph page was unclear (Figure 18).

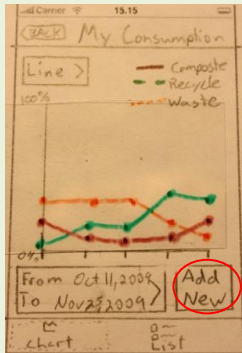


Figure 18 – "Add new" button is ambiguous

It appeared to one of our participants that the button meant add a new graph, when its purpose is actually to add a new consumption point by taking a picture of a receipt. We plan to fix this, as well as other similar issues, by changing the button text. We will change "Add new" to "Add New Consumption", for example. Another example of these types of errors was the lack of awareness that contact preferences were editable on the give-away item page. There is a button for this purpose, and our fix is simply to move this button above the notes field to make sure it is seen before notes are entered. We believe this will reduce the user's instinct to enter contact information into the "Notes" field.

Another goal we formulated from our usability testing experience is our desire to make Consumester more friendly and interactive. The main feature needing a boost in user friendliness is consumption tracking. As of now we rely on voluntary user input of consumption (e.g. taking a picture of a receipt), so we need to make their actions more rewarding. We are exploring ideas like graphical icons which visually represent the state of your consumption, such as an Earth with a face on it that changes colors. We believe this approach will be more inviting to users than simply showing a line graph.

Overall we realized a few major issues with our application's interface usability. For the most part the feedback we received was largely smaller confusion-based issues with easy fixes such as moving, resizing, or changing text in order to be in order to make important buttons more prominent.

## Appendix

### 1. Consent Form

The Consumester application is being produced as part of the coursework for the University of Washington Computer Science course "CSE 440: Introduction to Human-Computer Interaction". Participants in experimental evaluation of the application provide data that is used to evaluate and modify the interface of Consumester. Data will be collected by interview, observation, and questionnaire.

Participation in this experiment is voluntary. Participants may withdraw themselves and their data at any time without fear of consequences. Concerns about the experiment may be discussed with the researchers (Cullen Walsh, Michael Abel, and Patrick Healy) or with Professor James Fogarty, the instructor of CSE 440:

James A. Fogarty  
Computer Science & Engineering  
University of Washington  
206-685-8081  
jfogarty at cs.washington.edu

Participant anonymity will be provided by the separate storage of names from data. Data will only be identified by participant number. No identifying information about the participants will be available to anyone except the researchers and their supervisors.

I hereby acknowledge that I have been given an opportunity to ask questions about the nature of the experiment and my participation in it. I give my consent to have data collected on my usage and opinions in relation to the Consumester experiment. I understand I may withdraw my permission at any time.

Name \_\_\_\_\_

Date \_\_\_\_\_

Signature \_\_\_\_\_

Witness name \_\_\_\_\_

Witness signature \_\_\_\_\_

### 2. Tasks

#### 2.1: Task 1 (easy): *Recycling a rechargeable battery*

The batteries in your calculator have run out of power. Use Consumester to determine if they are recyclable, and if so, how to recycle them.

## 2.2: Task 2 (medium): *Giving away an unwanted couch*

You have just purchased a new couch and need to get rid of your old one to make room. It is in pretty good condition. Use Consumester to advertise that you are giving the old couch away, specifying what condition it is in and how you wish to be contacted.

## 2.3: Task 3 (hard): *Reducing consumption over time*

You notice you are producing a lot of trash and little recycling. You have been using Consumester to track your purchases for awhile. Check your waste/recycling ratio over the past month. After going to the store, input what you purchased into Consumester using the receipt. You do this for the next month, and then see how your recycling habits changed.

## 3. Critical Incidents

### 1. [Task 1](#)

- a. Home screen confusing: Severity 2
  - i. Issue: Not sure what buttons mean, some ambiguity between "lookup an item" and "find an item"
  - ii. Solution: change "lookup an item" to "recycle an item"
- b. Did not find recycling tab on general info page: Severity 3
  - i. Issue: One of our main features is to provide recycling and this prevented/slowed them from getting to that information
  - ii. Solution: Make it a button and put it above the other buttons so it is the first button they see.
- c. Add to my consumption button confusing: Severity 2
  - i. Issue: Not sure what adding to consumption means
  - ii. Solution: Elaborate in "are you sure" prompt about what is going on
- d. Wanted to throw away battery: Severity 0
- e. Lookup confusing: Severity 1
  - i. Issue: expected some sort of search function, not camera
  - ii. Solution: Text in camera window about what is happening

### 2. [Task 2](#)

- a. Description/notes same size: Severity 0
- b. Typed contact info in notes: Severity 2
  - i. Solution: move contact preferences button up on page
- c. "Notes:" prompt too vague: Severity 3
  - i. Solution: faded initial text in notes box explaining notes
- d. Wanted monetary info about giving away items: Severity 3
  - i. Solution: "all items posted should be free"
- e. Wasn't aware of "local" when posting an item: Severity 3

- i. Solution: Need to specify pickup location
  - f. Multiple pictures: Severity 1
    - i. Solution: Add more pictures functionality to input. Click on picture to view multiple in find item
  - g. Wanted email in contact preferences: Severity 1
    - i. Solution: Add email option, change from checklist to combo box
  - h. Wasn't aware of anonymous phone number feature: Severity 2
    - i. Solution: Explain in a line of text
- 3. [Task 3](#)
  - a. Not confident that voluntary input would work: Severity 0
    - i. Solution: Home screen more welcoming. Consumption tracking more welcoming. More interesting/fun feedback
  - b. Not sure if "add new" means add new graph: Severity 2
    - i. Solution: wider button, change text to "Add new consumption"
  - c. Did not know you could change graph type: Severity 1
    - i. Solution: Change to "Chart type"
  - d. Did not know date button was a button: Severity 0
  - e. Line graph cumulative or specific to a date?: Severity 2
    - i. Cumulative approach: we will need to clearly define this as we move forward
  - f. Past purchases similar or same item?: Severity 1
    - i. Solution: View past purchases
  - g. When adding an item to consumption, is there a quantity?: Severity 3
    - i. Solution: attribute value that is quantity purchased. If item is a receipt, populated by receipt data.

#### 4. Procedure Script

1. Introduce ourselves, our application
2. Ask simple background-information questions:
  - a. Do you actively or passively recycle?
  - b. Do you know the proper way to dispose of a computer?
3. Demonstrate sample iPhone screens, showing button interaction and dynamic-content updating via transparencies
4. Explain to participant the voluntary nature of the experiment
  - a. we are testing the interface, not them
  - b. sign [consent form](#) -- we will not release their data or data collected of them
5. Explain to participant our roles (Patrick - observer, Michael - facilitator, Cullen - computer)
6. Present [task 1](#)
  - a. when task 1 completed, debrief

7. Present [task 2](#)
  - a. when task 2 completed, debrief
8. Present [task 3](#)
  - a. when task 3 completed, debrief
9. Debrief of overall interaction
  - a. ask questions / probe for deeper understanding
  - b. share Patrick's observations
  - c. confirm
  - d. ask for suggestions
  - e. thanks participant for their time

## 5. Raw Data

### Participant #1

- [Task 1](#)
  - Home screen confusing. What is "track my consumption?". Clicked it before anything else, she wanted to explore.
  - Liked picture taking feature
  - Look up item ok
  - Doesn't tell her if she can recycle at all
  - Didn't find recycling info on general info page
  - clicked "give away" then clicked back right away
    - Did not see recycling tab
    - Clicked add to my consumption, are you sure->No
    - Once we informed her about tabs, ok
- [Task 2](#)
  - Home -> pushed give/find -> pushed give ->Looked up using image capture. Executed perfectly
  - Give away item page populated
  - Description/Notes should be same size
  - Did not add notes
    - Wanted to post right away
  - Typed contact info in notes when suggested she should add notes.
- [Task 3](#)
  - Worked fine: add new, receipt image capture, add to my consumption, track my consumption
  - Not confident in voluntary use of this feature. Emphasized convenience for her and others.

## Participant #2

- [Task 1](#)
  - Lookup and picture taking worked fine
  - Buttons were confusing on item detail
    - Add to my consumption = put in trash?
  - Wanted to explore what the buttons did
  - The recycling tab was too small, took her awhile to find it.
- [Task 2](#)
  - Give/find -> give away item -> image capture, executed perfectly.
  - Save button for contact preferences?
  - "Notes" too vague: what would she say? Maybe change name of field to "condition" instead of "notes"?
  - Wanted to add monetary info
  - Multiple pictures
- [Task 3](#)
  - Reluctant to press "Add New". Does this mean add new graph?
  - Image capture worked fine
  - Did not know you could change chart type. Attempted to click chart tab (which she was already on)
  - Did not know date button was a button (doesn't look like a button)
  - Was not sure about clicking "add to my consumption"

## Participant #3

- [Task 1](#)
  - Clicked recycling tab at bottom of item info page
  - Wanted to throw battery away
  - Does picture recognition recognize wear on items? example: leaking battery
  - Some buttons confusion/ambiguity
    - Lookup item -> expects search not camera
  - Focused a lot on image recognition issues
    - What happens if image recognition doesn't work?
- [Task 2](#)
  - Wanted multiple pictures
  - Understood notes section and input item specific information
  - Wanted to enter item selling price -- did not know that everything was presumably free
  - Wasn't aware that when you post something, the location was significant of locality feature when posting an item
  - Thinks people would use notes for price

- Unclear about how contact between two people might work when giving/finding an item.
- Wanted email contact capability
- Wasn't aware of anonymous phone # feature when posting
- [Task 3](#)
  - Line graph cumulative or specific to a date?
  - Accumulation of items over time?
  - Past purchases of similar or same items?
  - How to specify # of items to add when consuming a specific item
    - Worried about capability of receipt recognition