



Sustainability at Cornell

HUMAN-COMPUTER INTERACTION

Cornell University

Professor François Guimbretière

Ph.D., Computer Science, Stanford University

CONCEPT STATEMENT

The current waste sorting system provided in Cornell A La Carte dining facilities is inefficient and needs to be replaced or significantly improved. Most students are either too confused or too lazy to properly sort their food waste and distinguish between the three bin-options provided: trash, compost, and recycling.

This is because the current system does not offer sufficient information required to appropriately and effortlessly sort waste. Pictures mapping each item to its respective bin are cluttered and fail to include every possible item students wish to dispose. It is clear that this is a prevalent problem because within each trash bin there is no organization and it seems that the same types of waste are put into all three.

THE PROBLEM

The three-bin system here is direct, yet still does not encompass all types of products that can be purchased at Cascadeli. Also, the system does not provide any reasoning as to why certain items belong in each bin.



In Mann, the three bins are not clearly labeled, are not differentiated by color, and the trash bags obscure the labels. There is only an image to clarify what goes into the Compost bin, but no instruction is provided for the Trash or Recycle bins.



THE PROBLEM (CONTINUED)

In Mattins, there are four bins present in this picture yet only three descriptive photos. The arrows in the photos overlap bins that they point to and the descriptive pictures seem unorganized.



This system provided at Goldies lacks instruction and direction for the users in all aspects. It is assumed that the users are informed and will know in which bin to dispose of their waste. Of course, this is not always the case.



DISCOVERY

USER RESEARCH

We decided on this project of improving the sustainability initiative at Cornell University because of the high interest in the subject on campus and the immense impact it could have on our community. There already exist many sustainability interest groups on campus, but there are also many people who are not very knowledgeable on the subject. We noticed that it was a common theme throughout campus to see the three-bin system of Compost, Recycling, and Landfill always cluttered and causing confusion. Thus, this particular initiative on campus and understanding how students feel about and interact with the current system became the focus of our project.

USER SURVEYS

We conducted our interviews in the dining areas that have the original versions of the three-bin system. When students were finishing up their food and preparing to dispose of their waste we approached them and asked if they were willing to participate in our survey.

A. Discovery Questions

a. Demographics Questions

- i. What is your name?
 - ii. How old are you?
 - iii. What is your school and major?
 - iv. Where are you from (hometown)?
- b. Where do you spend most of your time on campus?
 - c. Do you eat at dining halls or at A La Carte cafeterias?
 - d. How often do you eat at _____?
 - e. How long do you normally have to eat lunch?
 - f. At what times/what meals do you come here for?
 - g. What did you order?
 - h. Do you recycle or compost (in general)?
 - i. Did you recycle or compost here today?

B. In Depth Questions

- a. What composting is?
- b. What items are compostable?
- c. What items are recyclable?
- d. What is the differences between composting and recycling?
- e. Why do you/why don't you recycle/compost?
- f. Do you care about the issue? Why/why not?
 - i. Parents/Friends do or do not recycle?
- g. What is your reaction when you see the current waste-disposal bins?
- h. How do you decipher which bin your waste should go in?
 - i. Do you tend to look inside a bin to try and figure out how to sort your items?
 1. How does that go for you?
- i. Do you use the images provided as examples in helping you decide?
 - i. What do you like/not like about the current images?
 - ii. Are they clear? Too general?
 - iii. How could they be changed to make them better aids?

C. Wrap Up Questions

- a. What inconveniences/issues with the current system prevent you from recycling/composting?
- b. What improvements would make it easier accomplish?

SURVEY RESULTS

The misunderstanding of the Cornell Composting, Recycling, and Landfill system is in part because the current front-end of the system is confusing and all-around not user friendly.

Ethnographic observations revealed the majority of dining hall visitors draw a blank when they arrived at the three bins and saw the scattered photos above them.

Most people took a brief moment to pause and look at the pictures, but ultimately gave up on trying to figure it out and threw all of their waste into a single bin.

Many users are not knowledgeable about what is compostable, how it is processed, and how it benefits us in the end, so they don't care whether it gets done right or not.

PERSONAS

Sally

Interested, just doesn't have the time



Sally is a busy Cornell student: she is taking 18 credits this semester, is a member of a sorority on campus, and is treasurer of the Film Club.

Sally cares about the environment and is willing to do her part in terms of composting and recycling, but she is not well informed on how to do so.

She has a general idea about what composting is and how it works, but she is not knowledgeable enough to easily and efficiently make decisions in the stressful atmosphere of dining/a la carte areas, especially when pressed for time or in a rush to get to her next class.

Age: 20

Gender: Female

College: College of Agricultural and Life Sciences

Major: Communication

Year: Junior

Hometown: Palm Beach, Florida

User Goals:

Have an easy and quick experience

Sally's most important goal is to put in as little effort as possible into the system. She wants to be able to recycle and compost without having to work hard or waste a lot of time.

Feel altruistic and competent

Sally wants to feel good about helping the environment. Doing her part and having knowledge about sustainability will make Sally feel accomplished and positive about her experience.

Better the environment through sustainability

Sally knows that composting and recycling is good for the environment and ideally, she would like to know that she took part in making the world more sustainable and eco-friendly.

PERSONAS

Amber

The Sustainable Guru



Amber is currently in the middle of her senior year at Cornell University. She lives off-campus in college town.

Amber is adamant about both composting and recycling. She always does her part after she finishes her meals, but becomes very frustrated with the difficulty and inconsistency of the system.

Although she understands the processes and helps out by using the systems that are provided, sustainability is not her primary passion. Her greatest incentive to compost and recycle is because many of her friends are passionate about 'going green'.

Age: **21**

Gender: **Female**

College: **College of Human Ecology**

Major: **Human Biology Health and Society**

Year: **Senior**

Hometown: **Smallwood, New York**

User Goals:

Have an organized and uniform experience

The primary goal of Amber is to have a uniform system across all locations and dining areas at Cornell to make it easy for her to do her part.

Feel responsible and respectful to others

Amber wants to be able to respect her friends who are passionate about composting. She always puts out the extra effort to support them and their passion for sustainability.

Recycle and compost availability off-campus

Amber has really made Recycling and Composting part of her regular routine when she is on-campus. She wants to be able to apply her knowledge whenever she is off-campus.

PERSONAS

Peter

Means well, but has no clue



Peter is currently a sophomore undergraduate at Cornell University and is majoring in AEM.

At home, Peter successfully distinguishes between the trash and recycling bins, but doesn't compost because there is no designated bin, and he simply doesn't know what to do for that.

When Peter is on campus, he's usually rushing between class, work, and any other commitments he has to meet, so he does not have time to sort through all his items and place them each in the appropriate bin. He tries, but the confusion, stress, and rush overcome him and he will just throw everything in the trash.

Age: **20**

Gender: **Male**

College: **College of Agricultural and Life Sciences**

Major: **AEM**

Year: **Sophomore**

Hometown: **NYC**

User Goals:

A well-structured and consistent system

Peter wants to be environmentally friendly and do his part in being green, but the chaotic and inconsistent systems used throughout campus make it hard to properly dispose his waste.

Obtain knowledge on the matter at hand

Peter wants to be able to successfully play his part in being environmentally friendly, but he simply lacks the knowledge to effectively do so, and the systems do not provide a learning curve.

Improve sustainability and proper waste disposal

Peter wishes to make proper waste disposal more common for himself and other students. He knows the importance of doing it, is barely able to do it right.

SYNTHESIS

From user research, we were able to extract the main needs of the users that interact with the current system.

Such necessities and improvements will affect the users by giving them a more positive and fulfilling experience with the disposal system, which will encourage them to properly sort their waste.

Intuitive and Efficient Interface

The system must take into account that each user will not necessarily have a lot of time to spend. Thus, with a very visual, speedy interface, the system can be implemented to be much more successful than the current.

Specific to Each Dining Facility

The system should include which specific materials can be disposed in which bin, but in a more organized and specialized manner. It is required that the system be flexible and easily adapted to a particular environment.

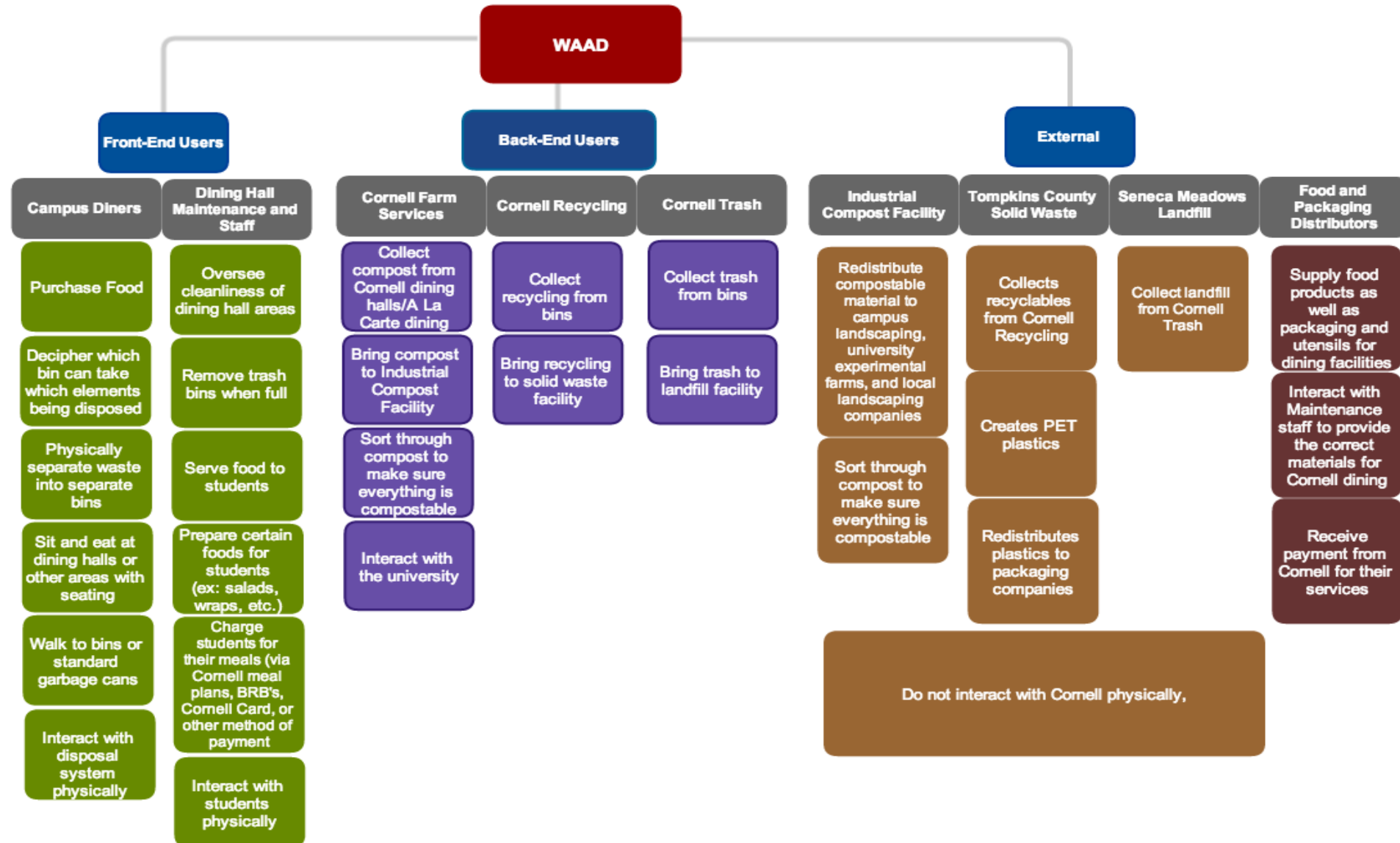
Development of Knowledge

The system would need to be informative. Composting and recycling require the users to have some knowledge in order to correctly sort their waste into the respective bins.

Reliable Sorting for Collection

The ability for the system to inform users will benefit each user in the long run, and also the back-end users who collect the trash. This will make the system more reliable by encouraging correct disposal of waste.

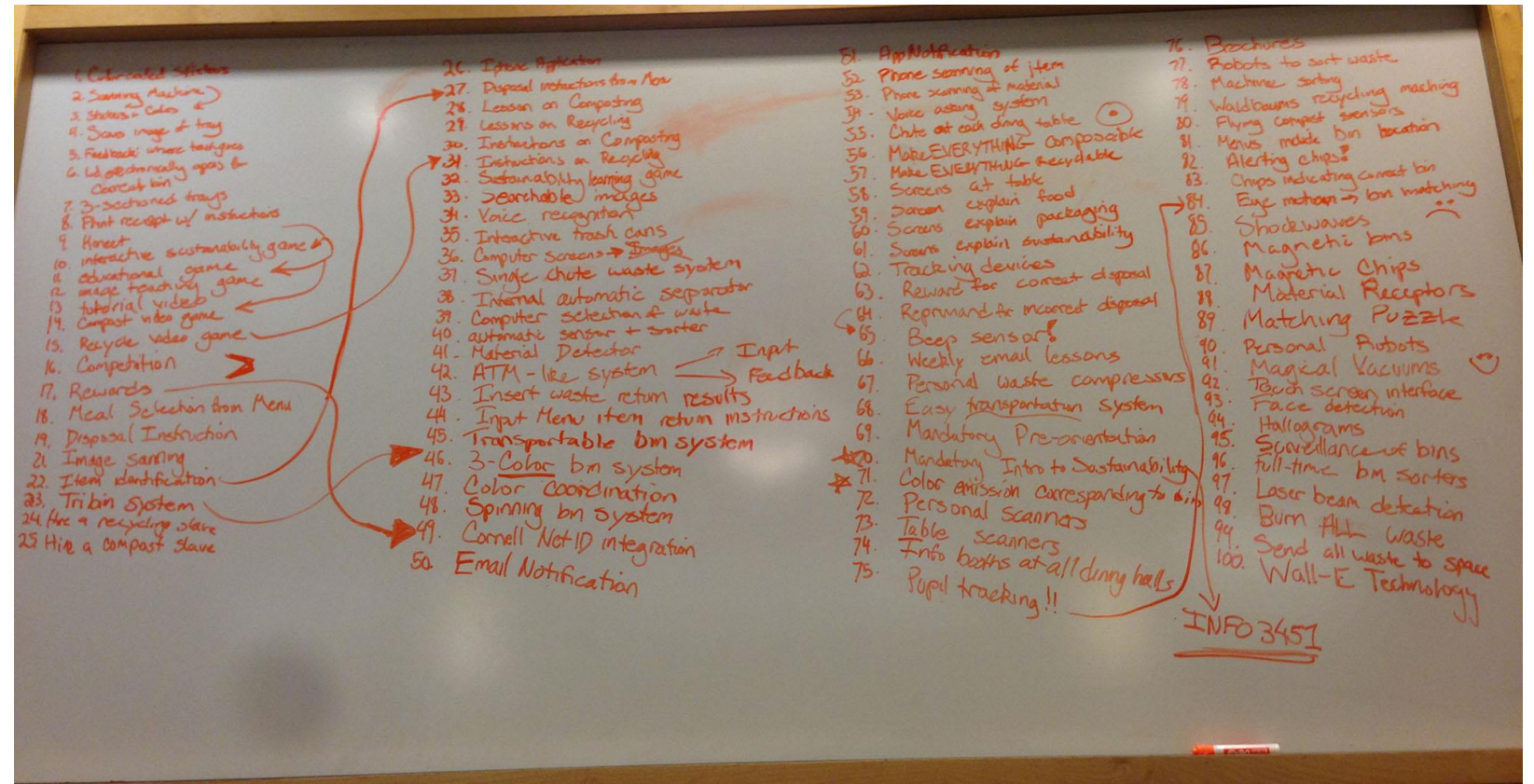
WORK ACTIVITY AFFINITY DIAGRAM



IDEATION

BRAINSTORMING

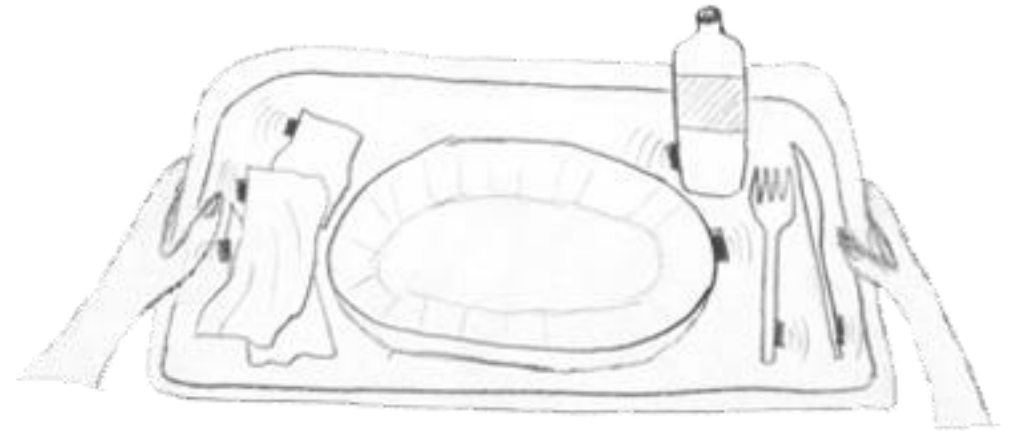
After our initial interview processes, we got a better understanding and insight into how students interact with the current system, the challenges they face with it, and ideas about redesigning, leading us to brainstorm a list of possible solutions.



PROPOSED CONCEPT

A chip will be placed on each item in every dining hall to be detected by a Kinect system. Chips are specific for each item they are placed on. For example, there may be multiple types of plates used in a dining facility. However, for each different type of plate, there is a specific chip for that specific type. This is intended to decrease confusion and ambiguity for similar items.

Each chip will include the information of the item it was placed on, including the item itself, a picture of it, the material it is made out of, its size and weight, and the proper bin in which it should be disposed in. This was the way that our system would be able to detect and recognize the items users were carrying as they approached the bins to dispose of their waste.



PROPOSED CONCEPT (CONTINUED)

When you approach the bin interactive system, and are within a 5 foot range, the system will detect the chips on every item you are carrying. The system that will detect the chip will be similar to Kinect technology. There will also be a camera detecting the user's movement.

At first, each item will appear in no particular order on the screen. Right after, they will move around the screen and sort themselves into the appropriate bins. The user will recognize his or her item on the screen and will simply dispose of each item where the display indicates one to.

Following disposal, the screen will display a message thanking the user for sorting his or her items. It will also display statistics about sustainability at Cornell.



IMPLEMENTATION

PAPER PROTOTYPE

Initial Interface State



Expected Final Interface State



USER TESTING

Testing Technique

We collected our data through a think-aloud data collection method. This means that the participants were expected to talk while they worked and while they thought. Ultimately, this means that our participants shared their thoughts with us by verbalizing them as they come to into their heads, giving us access to an understanding of how each participant is responding to the tasks provided and in what way he or she is interpreting our system's design.

We were mainly looking for the participants to express the descriptions of their intentions, what actions they were taking or what actions they were trying to take, their motivations, the reasoning behind their actions, and any other train of thought relating to the tasks they were going to be performing.

USER TESTING

Task 1

Goal:

Sort waste correctly.

Task:

Use the system to throw away a banana peel (compostable), a water bottle (recyclable), and a chip wrapper (landfill).

Context:

The most important goal that we have come across by the primary users is to be able to sort waste into the correct bins. When users approach the system, they can clearly see which bin is which in addition to exactly which bin the specific items they are holding belong.

USER TESTING

Task 2

Goal:

Sort waste quickly.

Task:

Throw away an empty soda cup (landfill) and compostable fork while someone else is throwing away a Snapple bottle.

Context:

Regardless of how many people are using the system, all of the items detected within range will be displayed on the screen, and under the correct bin. This specificity is the key to what expedites the process that users must undergo in order to separate their waste and complete the task at hand. The images of exactly what the users are holding appear in the correct column of the screen to lead the user through a quick process of sorting, no matter how many other people or items are present.

USER TESTING

Task 3

Goal:

Sort waste correctly.

Task:

Throw away a water bottle (recycle) and apple (compost) brought from home in the correct bins. These are a real water bottle and apple (not cardboard pieces from the prototype).

Context:

Since the primary goal the system addresses is to be able to sort into the correct bins, we wanted to address an instance that may trigger error-prevention among our system. If you are going to throw out an item you did not purchase at a Cornell dining facility, it won't have chip on it. This is compensated for by the Kinect feature. This feature will detect and recognize a visible item, and will display it on the screen, under its appropriate bin.

USER TESTING

Questionnaire

Before we asked the participant to complete the three tasks, we asked a few questions about their daily routine involving on campus eateries as well as their experience with the current disposal system.

1. Approximately how many days per week do you eat meals on campus?
 - a. What are those meals (breakfast, lunch, dinner, or snack), and which dining areas do you frequent?
2. What do you know about sustainability?
 - a. More specifically, what do you know about composting? Recycling?
3. What aspects, if any, do you like about the current disposal system at Cornell.
4. What aspects, if any, do you dislike about the current disposal system at Cornell.
5. Do you compost and recycle when eating on campus?
 - a. If so, why do you compost? Is there anything that you would change about the current system?
 - b. If not, why? What would persuade you start recycling or composting?

USER TESTING

Debriefing

After completing the three tasks, participants were asked to fill out a short survey about their experience.

1. Describe any confusion you had when beginning the task.
2. Were you easily able to understand how the system worked?
3. Did you make any error in assigning items to bins?
 - a. If so, how did you know you were making an error?
 - b. How did you decide where to put the item after realizing you had made the error?
4. Did you notice the tons count under each waste category?
 - a. If so, did you find the information useful or interesting? Explain why or why not.
5. How did you feel after completing the task?
6. Are there any suggestions you have in improving the interface or design?
7. Were there any specific problems you have with the interface or design?
8. Are there any questions you have about the prototype or this evaluation?

USER TESTING

Key Findings

Problem 1:

Visual design for error catching and prevention.

Description:

Some users were not immediately able to identify an error they had made or how to fix it.

Solution:

We implemented a lid that serves as an error detection screen on our revised prototype, where each lid is a display screen that changes based on the item that approaches its bin. When a user goes to put an item in a bin it doesn't belong in, the screen will change to a red background. In addition, the item that was going into the incorrect bin will light up on the screen to remind the user of which bin it should be disposed into.

USER TESTING

Key Findings

Problem 2:

Visual design of initial and final states of the display.

Description:

Some users were not sure what they should be doing when first approaching the bins or what they needed to do in order to get it started.

Solution:

We added an additional display message to our standing screen that reads “Approach bins to sort items.” As long as nobody is within the 5-foot detection range, this will be the resting state of the system. Our hope is that users will understand that walking towards the system will provide further direction regarding disposal, therefore preventing any initial confusion regarding a lack of instruction.

REITERATION

Storyboard



The user approaches the system after they have finished eating her meal.



Once the user gets close enough, her items appear neatly in their respective columns on the screen.



Quickly and easily, the user sees which items she is holding go into which bin. You can see here she was able to separate the items on her tray just as they are on the screen.



As she goes to put her items in the respective bins, the lids open automatically. Here, she places her banana peel and fork in the compost.



Next, she tosses her water bottle and Snapple toward the recycling bin, which opens automatically as the items near.



In just a few seconds and after very little confusion or thought, the user is on her way to her next class!

REITERATION

Storyboard



The user approaches the screen but does not take notice of the distribution of items that it displays. She is carrying a banana peel and Pepsi cup.



The user dumps both the banana peel and Pepsi cup on the Landfill bin.



The Landfill bin lid does not open because the user has not properly place her items.



Because the Pepsi cup is properly places and the banana peel is not, the screen displays an error over the banana peel.



The user is indifferent to the entire experience and chooses to simply walk away instead of fix the change.



The system senses the user has left the area and allows for the waste to be disposed, even with the mistake.

REITERATION

Storyboard



The user attempts to throw away his water bottle in the Landfill bin.



The Kinect system registers the water bottle being placed in the incorrect bin. The Landfill bin lid does not automatically open for the user



The user notices this block and looks up, confused and wondering why he can't throw the bottle away!



The screen now shows the water bottle with an alert around it in the Recycling column. This is where the bottle should go!



The user realizes the mistake and moves the bottle to the correct bin, Recycling.



The Recycling bin lid automatically opens to receive the bottle.

FINAL DESIGN

INTERACTIVE DEMO

To view the Final Design as an Interactive Demo Presentation, please download the Prototype presentation and launch the slideshow.



Thank You!