Carbon Footprint System

Final Report

HCDE / INDE 455

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atomiC

Track your carbon production through atomiC and C the results.

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INTRODUCTION

Washington State will be implementing a carbon tax on each household in the year 2020. For this reason, we anticipate a growing demand for the citizens of Washington State to monitor their carbon emissions. In response to this demand, we have created atomiC, an intuitive mobile system that helps users increase awareness of their emissions, and improve their carbon efficiency through tracking and coaching.

THE PROBLEM

At the micro level, we see the problem as being a lack of user awareness of their emissions, a lack of knowledge on how to improve their efficiency, and a general feeling of overwhelm. This feeling of overwhelm is understandable given the gravity of the problem at the macro level: unsustainable consumption practices have led to an increase of life-threatening effects due to climate change, such as high extinction rates, more severe natural disasters, and water shortages. A method for assessing consumption practices is the carbon footprint, which calculates externalities created through consumption, such as carbon emissions. An individual's carbon footprint is determined by the amount of greenhouse gases they produce to directly or indirectly support their lifestyle (Goodier). Carbon footprints account for approximately 60 percent of a person's total ecological footprint, and is often the fastest growing portion. Since 1961, carbon footprints have increased an average of 11-fold (Carbon Footprint). Worldwide, humans now require the resource equivalent of two planets to support us (World Footprint). For these reasons, Washington State's government has identified carbon footprints as a viable leverage point for addressing climate change, and its negative effects on the environment. Our job then, is to help our users learn to live sustainably within their carbon allotment.

COMPETITIVE ANALYSIS

In looking at existing carbon footprint calculators, we were able to identify some design opportunities. For example, current footprint calculations require extensive manual user input, focusing on the following three categories: home energy, transportation, and waste (Goodier). Other factors that determine a user's carbon footprint are location, habits, and personal choices. This leads to our first design opportunity: a carbon footprint is a complex calculation that is challenging to both calculate and communicate effectively

to the user. Existing carbon tracker's estimate the user's carbon footprint level based off of the user's estimated data input. This current method of gathering data raises the design opportunity of estimating a value from estimated user data, which can be inaccurate. Furthermore, because a user's location can account for more than half of their carbon footprints due to factors such as infrastructure, this method can also feel disempowering to the user, leading them to feel as if they have little control over their footprint (Global Footprint Network). This complexity, inaccuracy, and feelings of disempowerment are three opportunities our team addressed in the design of atomiC.

Given the complexity of this problem, we were faced with the following design opportunities:

- How will we collect data on individual's carbon emissions?
- How can we organize our system to make such a complex topic feel intuitive to navigate through?
- How will be present the data in a way that increases awareness and user efficiency without overwhelming them across a diverse spectrum?

THE SOLUTION

In terms of data collection, we made the assumption that the government will be tracking citizen emissions because they need to be able to enforce the tax. To accomplish this, we have assumed individuals will receive a unique Carbon Identification Number that will track their carbon emissions through utility readings and credit card purchases. The latter will function as a tracking mechanism for purchases of food, goods, etc. We assumed that atomiC would be able to partner with the government to access this data, that we would then analyze and visualize for the users. We estimated that the per capita allotment be set at 10 tons of carbon per year.

In terms of organization, we broke down the topic into four subcategories that we felt encompassed the user's carbon footprint: food, goods, transit, and utilities. Food refers to any food items the user may consume. Goods refers to clothing, household items, and other miscellaneous purchases. Transit refers to travel via car, plane, train, or public transit that lead to emissions related to consumption of fossil fuels and infrastructure. Utilities includes consumption of water, electricity, and gas in the home. Consumption in all of these categories lead to different externalities according to the resources consumed and

byproducts produced in manufacturing and distributing. Within these subcategories our system offers individualized, accurate data visualizations, reports for lower level improvements, and themes for higher level improvements. These features focus on users who are intrinsically motivated. For externally motivated users, atomiC offers a social component, wherein users can compare their progress to the average or their friends. With this organization, we hope to increase the user's awareness and improve their carbon efficiency without overwhelming them.

USER RESEARCH

To better understand our user requirements for a system like atomiC, we conducted interviews with potential users. For this research, we were largely centered on gaging user motivations for using a system like atomiC. Our participants ranged in age from 20-57 with an average age of 28. Of the six participants we interviewed, there were 4 men and 2 women. We learned that nearly all of our participants, 5 out of the 6, were supportive of a carbon tax. The most common response for their motivation of why they would track their carbon output was: "I am curious about my ecological footprint and how much carbon I produce" rather than options related to avoiding the tax penalty. This response led us to the conclusion that the best posture for atomiC would be a positive one, as opposed to a negative focus on avoiding the tax. Because this response was paired with a favorable response to the idea of a carbon tax, we inferred there is also an interest in reducing their carbon footprint.

The survey also provided us with information regarding pricing as three of the six people said they would not pay for an application that tracks their carbon output and the maximum amount one of our participants would pay was $50. This information informed the complexity of our application as many tracking technologies, such as the FitBit, are more expensive than this. Participants reported that the most useful features were the credit card tracker that calculated carbon output based on itemized credit statements and notifications about your carbon allotment. The results of the survey led our group to scale down the functionality of our product because of the amount users reported being willing to pay for the system, and because some of the features we previously believed to be important were not considered to be useful to our participants.

FEATURES

Through our competitive analysis and interviews, we were able to identify the following features that would meet the needs of our users:

Accurate and automated data

By utilizing an individual's Carbon Identification Number, atomiC will be able to provide the user with accurate data about their carbon emissions, without the hassle of manual inputs.

Data analysis

Our system will present the user's data to them in a meaningful, digestible way. Users will be able to utilize data visualizations, micro level reports, and macro level themes to learn about their carbon externalities.

A breakdown of carbon externalities

Users will be able to learn about their overall carbon emissions, as well as their emissions within the four categories of food, goods, transit, and utilities. Within these categories, they can also see a breakdown of items within each category, such as gasoline for their personal vehicle.

In-app notifications

Our system provides the user with notifications on how they can reduce their carbon output, as well as notifications for when they are nearing their allotment limit.

Progress tracking

Our system allows users to track their weekly or monthly progress within the data section of atomiC to help increment their goal of reducing carbon emissions, making this daunting task feel manageable.

Improvement coaching

Our system customizes suggestions for how the user can reduce their carbon emissions. Suggests range from the micro to macro level.

Social Media

For externally motivated users, atomiC offers a social media component wherein they can compare their progress and emissions to the average or their friends.

USERS

Our intended users are Washingtonians who do not want to estimate their own carbon usage and want to self-monitor with exact data. Other motivations for our user may include a drive to avoid the carbon tax, gain awareness of their carbon production, and reduce their ecological footprint. We predict that a majority of our users will be left-leaning urbanites, concentrated in the Seattle area, in the middle to upper-class range. This assumption is supported by current data that supports that this group is more concerned with their ecological footprint. Furthermore, middle to upper-class people often have bigger ecological footprints than their lower income counterparts (European Commission), therefore, they are more likely be more concerned with managing their carbon allotments.

Our team sees the carbon tax trends as leading towards carbon taxes as a standard not only at the state level, but at the national level. As a result, we expect this market to expand making this sort of tracking application potentially useful to every US citizen.

PERSONA

To help guide our design, we created a persona to represent our average user. Our persona, Joseph Douglas (Figure 1), is a 28 year old man, lives alone in a small home in Seattle. Joseph was born and raised in Denver, Colorado and attended the University of Colorado where he graduated with a major in marketing. After graduation, Joseph was hired by Microsoft in Seattle and has grown to love the area. Joseph aims to become the VP of Marketing. He's single, and occasionally goes on dates. Joseph also considers his golden retriever, Henry, a member of his family. After taking an environmental science course, Joseph became interested in building his own garden to become more self-sustaining and reduce his ecological footprint. He tends to be more liberal in his beliefs, such as an awareness for the environment and other social issues.

Figure 1. Our persona

Scenario

Joseph wakes up in his two bedroom mid-century home in North Seattle. He enjoys a bagel and french pressed coffee for breakfast. He then takes the bus to the Microsoft campus in Bellevue. After spending the morning studying what other search engines are doing, he walks to Whole Foods to grab lunch. When he returns, Joseph prepares a presentation on Bing's competition, and a pitch for how his team should go about addressing their target audience. Joseph leaves work and takes the bus back home. After hitting up happy hour with some friends, Joseph remembers he needs to pick up some things for breakfast. He opens up atomiC to look at his emission themes for food. atomiC tells Joseph that the top three things he can focus on to reduce emissions are eating beef less (from three times a week to once a week), buying local eggs, and purchasing his produce at a fruit stand where there is less packaging. Joseph goes to a fruit stand where he buys the produce he needs, local eggs, and forgoes on the beef for now. He drives home feeling a sense of empowerment in his choices.

TASKS

During our storyboard phase, the task we focused on involved Joseph importing a shopping list from the notes in his phone before he went grocery shopping. The atomiC application then analyzed the items that Joseph wished to purchase, suggested the most carbon efficient location where he could purchase these goods, and gave him directions on how to get to that store. As Joseph completed his shopping trip, he received a notification with statistics on the items that he purchased and how much of his carbon allotment he had remaining. As he returns home he digs deeper into this data and analyzes ways that he will be able to reduce his carbon footprint in the future.

Through our iterative phases, we realized that the features that our storyboard used were not ideal for this type of interface and application. Our mindset up to the storyboard phase, was that this application would utilize pre-task knowledge, and give feedback regarding the results of the task. After considering the ramifications of this type of system, our group came to the conclusion that this type of interface would be best suited as a post-task evaluation. By supplying the user with their pre-existing data, we are able to offer future advice in a variety of ways such as “shopping at your local farmers market will reduce your carbon footprint by XX%.” While this type of information is very relevant to the user, we felt that the most influential way to impact the habits and actions of the user would be through data presentation. The graphs we chose to display this data include:

- A meter that shows what percentage of the users carbon percentage they have available
- A personal tracker that shows their progress over time
- A breakdown of what items contribute most to that specific category, such as how poultry affects their carbon emissions from food.

By presenting these three types of data, we notify the user of how they are doing in comparison to their carbon allotment, we motivate them to reduce their carbon footprint by displaying their progress, and we inform them of which categories and items compose a majority of their carbon output so that they can work to reduce that specific section.

DESIGN CRITERIA

Our design priorities were to create an interface that had the qualities of a good interface: intuitive, effective, efficient, and likable.

Intuitive

We designed our application to be intuitive so that a person of any age would be able to pick up our application and understand its function and use. Any person who has a basic knowledge of using a smart phone would have an easy time navigating through our application. But this previous knowledge is not necessary as the buttons are straightforward, the labels utilize both words and pictures, and the data is presented in any easily digestible way.

Effective

Our application is effective because of its functionality. By basing the tracker around data presentation, and allowing the user to control the amount and type of notifications that they receive, we are giving them control of how in depth they want to go in reducing or acknowledging their carbon footprint.

Efficient

I would consider our interface to be efficient as we are able to provide the pertinent data of a carbon tracker in a minimal amount of screens and navigational motions. By using the Carbon Identification Number, we are able to minimize the amount of information that the user has to manually input. Additionally, the layout of our application, as seen in the systems map (Figure 2) allows the user to navigate deeply into whatever data they are looking for at a very efficient rate because of the navigation menu.

Likable

We felt that the way our application is organized, it is enjoyable for the user to navigate through. By changing each of the categories to a different color, the user is able to relate this category to a certain color, making it both intuitive and more enjoyable. The purpose of this application is not necessarily meant to be as fun as it is informational and beneficial. That being said, including the progress tracker in the

application will play to the users emotions as reducing your carbon footprint on a weekly or monthly basis could become a sort of competition. We also included a feature where the user is able to link to their Facebook so that they can see how they are doing in comparison to their friends if they so desire.

OUR DESIGN

Our system, atomiC, allows users to track their overall carbon emissions from four categories: foods, goods, transportation, and utilities. This application helps those who would like to track their carbon usages so that they would not go over their allotment, as well as those who are interested in becoming more carbon efficient. atomiC utilizes a clean, simplistic, and modern posture to focus on presenting user data in a clear and intuitive way. To accomplish this, our team focused on functionality that would automatically analyze user data and present it to them in the most useful ways possible, across a spectrum of needs.

Functionality

The main navigation and functionality in atomiC is shown in our systems map on the following page (Figure 2). System functionalities include tracking carbon emissions from foods, goods, transportation, and utilities; viewing data visuals; viewing macro level emissions themes and micro level emissions breakdowns in the form of reports. Within themes and reports, users interested in reducing their carbon footprint are given suggestions on how to lessen their emissions. We consider this the core functionality of our system. For more externally motivated users, our auxiliary functionality includes the ability for the user to compare their emissions data with the average or their friends or connect to Facebook to share their data.

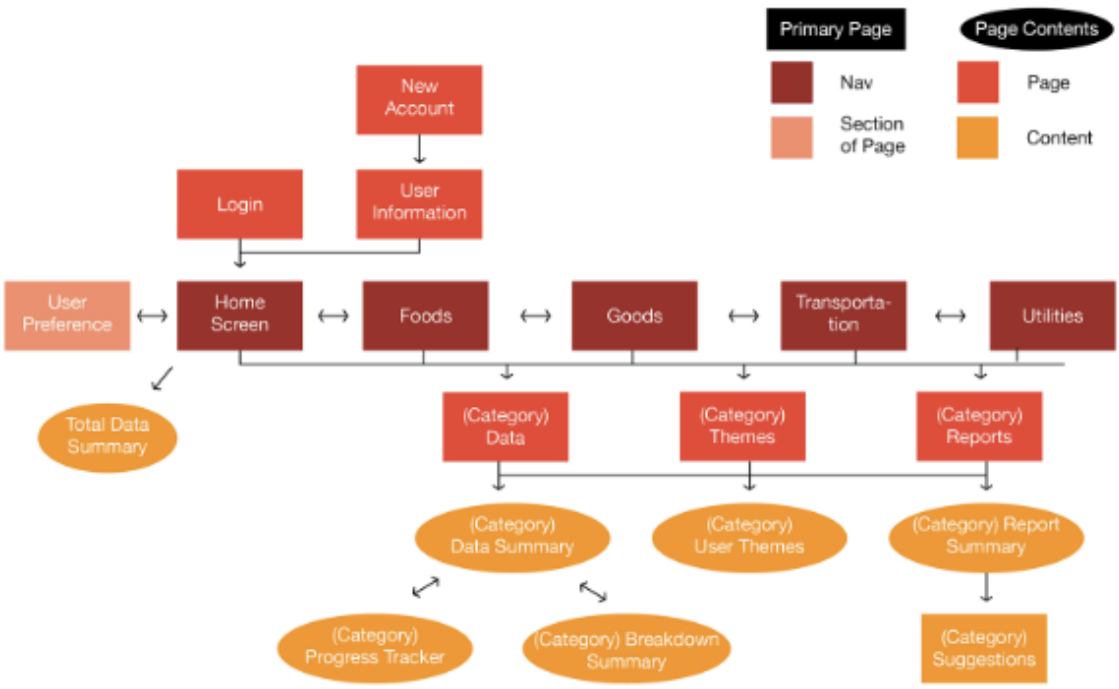

Figure 2. Systems map

Home Screen

The Home Screen page showcases the user's overall total carbon emissions from the four subcategories: food, goods, transit, and utilities. Users are able to navigate down to see more data visualizations or select right to navigate away from data to themes and reports. All four subsections follow this same organization.

Data Visualizations

The first data visualization in all categories displays how much of the user's carbon allotment is still available (Figure 3). The choice to display what percentage is available, as opposed to what percentage has been used, is intended to focus on positive reinforcement to encourage and remind users that they have a certain point before hitting an allotment.

Figure 3. Data visualizations

The second data visualization in all categories is a progress tracker that displays a user's emissions on a weekly or monthly basis to help them identify usage trends. The progress tracker also allows users to compare their emissions to the average or friends. The third data visualization displays a breakdown of the carbon emission usage in each category. This graph helps the user quickly identify areas for improvement. For example, the user may see that a majority of their emissions comes from their consumption of meat, which would provide them with the opportunity to change their eating habits and monitor how their usage responds.

Themes

By swiping or clicking on the arrow keys, users are able to see the macro and micro level of tracking (Figure 4). For the macro level, atomiC analyzes their emissions and presents overall themes as opportunities for improvement. For example, if a user has a tendency to shop at big box stores, which tend to use a lot of packaging, atomiC will advise them that they can reduce their emissions by buying produce from fruit stands where packaging is less prevalent.

Reports

For the micro level, users can utilize reports to see specific feedback on specific purchases. For example, within the food subcategory, a user can select a specific shopping trip and atomiC will identify the top three items that contributed to the emissions. If the user selects one of these items, atomiC summarizes the externalities associated with the item and gives a suggestion on on alternative purchase. All suggestions are intended to be incremental to aid the user in gaining empowerment in their choices without getting overwhelmed.

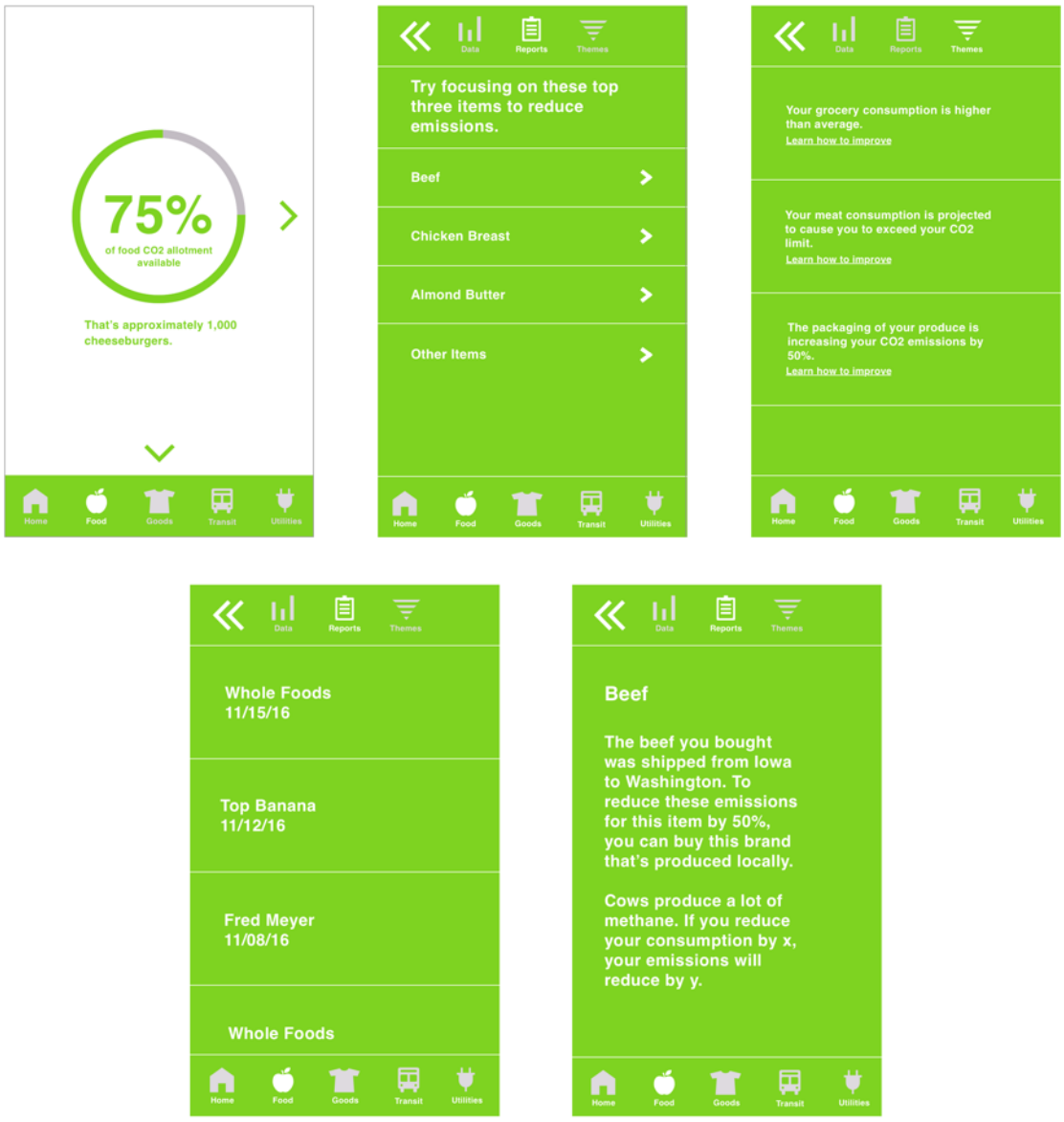

Figure 4. Food subcategory: data, themes, and reports

Organization

atomiC focuses on clean and simplistic design, as well as consistency of navigation. By utilizing common UX idioms and designing our interactions to be repetitive, our system can be quickly learned by the user. As the systems map illustrates, each subsection of atomiC has the same functionality, and this functionality is navigated through the same interaction flows. For example, the home data screen and the

food data screen feature the same visual layout and respond the same to user input, creating predictable feedback.

TESTING

Overview

To test our design we executed two iterations of usability testing: one with a paper prototype (Appendix A) and one with a digital prototype. The paper prototype was a binder of printouts of the screens that were specific to the tasks that were tested listed later in this section. We asked users to interact with the paper as if they were interacting with an app on their phone. When the user would press a button indicating a screen change one of our teammates would flip to the correct page the button corresponded to. The digital prototype was created by our lead designers on Marvel which could be viewed and interacted with on a desktop computer or mobile device.

Since our criteria for our design revolved around the intuition, effectiveness, efficiency, and likability of the design we based our tests around these criteria. For both tests we gathered 6 participants to evaluate three tasks within our design. These tasks are listed below:

1. After hearing from coworkers and friends about the new carbon emissions tracking application, you decided that you also want to keep track of your carbon emissions. You decide to download the application and that you would want to hear about your progress each week. Create an account and change your preferences so that you will hear about your progress each week.
2. After creating an account with atomiC, you realized that you need to go grocery shopping to prepare meals for the week. Find your current emission total for this category.
3. You are curious to see how the beef you purchased may have had an effect on your overall total. Find how your recent grocery store trip affected your carbon emissions for the week from the beef you purchased.

These tasks represent a majority of the data analysis functions and notifications functions that are essential to our design. We were primarily concerned with the speed that our users were able to conduct these operations because this design is an application that we expect to be most used on the go. If it took

too long for the users to complete the task then it could mean the design is inefficient or unintuitive. Due to this concern, we timed each of the tasks that the users completed. We also recorded the number of mistakes that each user made to further test the intuitiveness of the design. If the user navigated to the incorrect page or got stuck and couldn't find the correct button we recorded that as a mistake. The last element of our quantitative analysis was a ranking scale for both likability and usability. This was given to us on a scale from 1–10, where 1 would be poor and 10 would be excellent. This gave us a numerical data point that would indicate whether the design was enjoyable to use and intuitive, respectively. Our qualitative data included comments from the user and targeted questions that we would ask after the completion of the tasks about new functions we implemented into the design.

Results

Paper Prototype

Table 1 below visualizes the quantitative findings from each participant in the first iteration of our usability testing of the paper prototype. Here you can see that the task time varied on average from 31.5 seconds to 53 second and had a fairly significant variation on the tasks times especially in tasks two. The variation can, in part, be attributed to the time that it took to turn the page for the user. However, our qualitative findings showed us that the users were unclear on some of the language that was being used which contributed to the variation. The average mistakes were about 2.2 mistakes and mostly occurred in the food category's menu screen. Our usability and likability ratings were fairly low as well so we turned to the qualitative findings to indicate improvements that could be made to increase these scores.

Table 1. Paper Prototype Results

Participant	Time Task 1 (sec)	Time Task 2 (sec)	Time Task 3 (sec)	Usability 1-10	Likability 1-10	Mistakes
1	47	50	36	6	7	3
2	49	26	37	7	4	1
3	47	62	15	8	8	2
4	66	35	30	7	6	1
5	46	45	32	4	7	2

Participant	Time Task 1 (sec)	Time Task 2 (sec)	Time Task 3 (sec)	Usability 1-10	Likability 1-10	Mistakes
6	63	21	39	7	3	4
Average	53.0 +/- 9.0	39.8 +/- 15.4	31.5 +/- 8.7	6.5 +/- 1.4	5.8 +/- 1.9	2.2 +/- 1.2

Some of the positive feedback that we got in our qualitative findings included:

- Easy to use design due to the simplicity of the screen design.
- Covers all the basic features needed for the example problem.
- Both micro level and macro level of analysis of emissions are included to see what is causing any changes in your carbon emission usage.

These results revealed that the effectiveness of our product was where it needed to be since it was able to complete all of the tasks needed for our problem. Taking a look at some criticisms we found that:

- The language was unclear at times especially on the food menu page (themes vs. data vs. reports and the difference between food and goods).
- Implementing different colors for each category may be beneficial for ease of navigation.
- Better graphical representations of the data are needed to get a clearer understanding of the carbon usage.
- Additional features are desired beyond those given to make the application more enjoyable such as a progress tracker, goal setting, or reward system.

Having completed the first iteration of usability testing we took this feedback and made several revisions. One of the major revisions we made involved changing the format of our application. We changed the food subcategory menu so that when users clicked on the navigation bar to go to the food category it would immediately show the user a summary of their carbon emissions related to food products. From there the user could swipe left to view themes and then left again to see reports. This change intended to eliminate an unnecessary menu and address feedback about confusing language within the removed menu with the addition of images to aid in visually communicating to the user. We also implemented additional data visualizations for our data sections, which addressed some additional features that the

users wanted including a progress tracker that indicated a weekly or monthly overview of the user's carbon emissions so that they could self monitor and reflect, and a bar graph to break down the user's emissions into smaller categories to help them quickly identify areas of opportunity for improvement. Some smaller aesthetic design changes were implemented including changes in color and verbiage in several descriptions that can be seen in the final product.

Digital Prototype

Table 2 below displays the quantitative findings of our second iteration of usability testing. You can see here that our task times are between 6.2 seconds and 28.5 second on average which is more typical for a mobile application. Our usability and likability rankings are between 8.8 and 9.2 on average and our mistakes are at 0.2 on average. A comparison to the first iteration of usability testing are shown below where you can see a significant drop in average task time and mistakes along with a significant increase in usability and likability rankings.

Table 2. Digital Prototype Results

Participant	Time Task 1 (sec)	Time Task 2 (sec)	Time Task 3 (sec)	Usability 1-10	Likability 1-10	Mistakes
1	29	7	39	10	10	0
2	27	5	22	10	10	0
3	36	13	16	8	8	1
4	21	3	31	9	9	0
5	31	4	18	9	8	0
6	27	5	24	9	8	0
Average	28.5 +/- 5.0	6.2 +/- 3.6	25.0 +/- 8.6	9.2 +/- 0.8	8.8 +/- 1.0	0.2 +/- 0.4

We saw a significant drop in both average times, time variance, and mistakes. This means that the efficiency of our product increased significantly and consistently among all participants. We also saw a significant growth in ratings for usability and likability. This shows that users found our interface more

intuitive and enjoyable after the revisions made in the first iteration of testing. Please see Appendix B for box plot visualizations.

We were able to get some more qualitative feedback as well and found that there were only a few minor points in our designs that needed to be improved. The feedback was as follows:

- A better indication of the swiping function on the data summary pages
- A second navigation bar that indicates where the user is in the subsections of each category
- A numerical equivalent to represent what the percentage means
- A preference of an in-app notification in addition to the email and text preference settings

These revisions can be seen in the final design of our product except for the swiping function since we concluded it would be more intuitive if it was a button instead.

CONCLUSION

Our team is happy with what we were able to accomplish given the time constraints of the quarter and the complexity of our problem. If we had more time, we would have liked to have tested a reward system for the user that would further positively reinforce emissions efficiency. To accomplish this, we would want to partner with the companies that we recommend to our users for more carbon efficient purchases. We see this as a way to both reinforce positive changes in the user, but also influence positive changes within industry. For example, if industries knew that consumers were opting to purchase produce at fruit stands instead of box stores because users are learning to understand the carbon externalities of the packaging box stores tend to use, those box stores might change their packaging practices. As this would be an exponential change, this could have huge positive implications for the environment. Even short of this, we feel that our system has accomplished the goal of increasing user awareness and carbon efficiency at the micro level. On a more idealistic scale, we see this system as an effective tool for people to learn to live within Earth's ecosystem.

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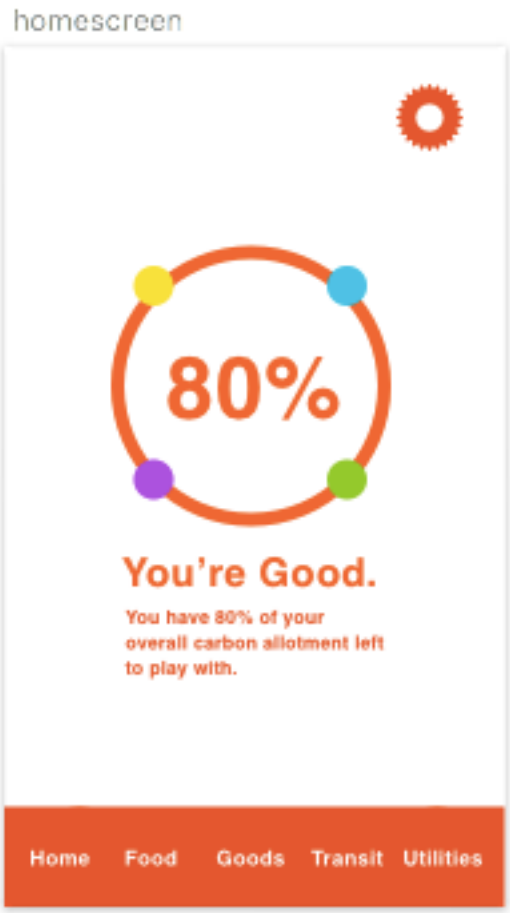
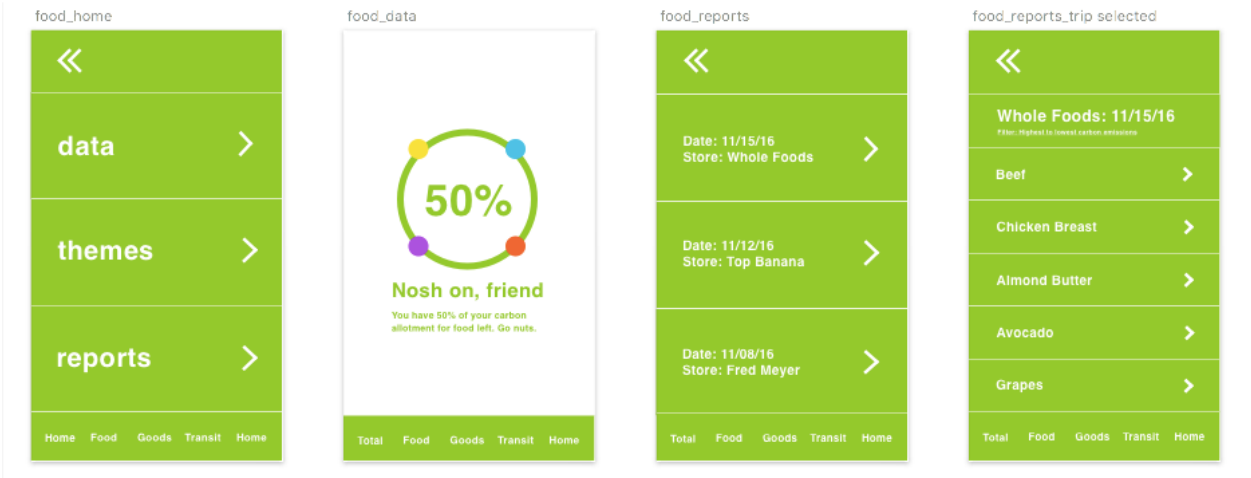
APPENDIX A

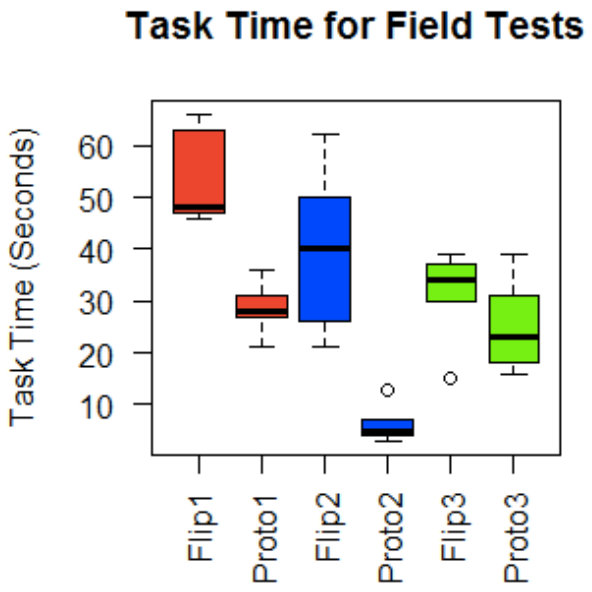
Paper Prototype Screens



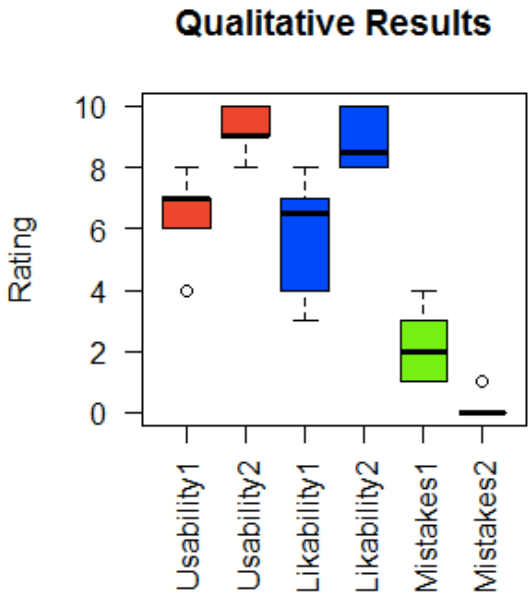


APPENDIX B

Box Plots for Field Test Results



The box plot label above titled “Flip” shows the data from the first iteration with our paper prototype and the label titled “Proto” shows the data for the second iteration of testing.



The figure above shows the rankings of usability and likability, as well as mistakes. The box plots whose label ends in a “1” indicate the data from the first iteration of testing and the box plots with a “2” in the name indicate the second iteration of testing.

APPENDIX C

Group Reflections

Shelley Eang

This project has opened my eyes to tracking my carbon emissions usage. I learned what could be tracked for carbon emissions total and how ones daily lifestyle can accumulate a lot. For example, meat and dairy is one of the biggest factors for having a large carbon footprint compared to produce. I also learned that there are alternative eco-friendly public transportation options. By knowing these alternatives, this makes me realize that simple switches can lower my carbon emissions.

This project was very interesting topic wise, and very fun because of my group members. My group and I communicated our ideas and were consistent in how we communicated and how often we met as a group. While I enjoyed working with my team, I also enjoyed the fact that I was learning on ways to better the environment by taking small steps and also practicing on my user experience design and visual design skills. The structure of this class and project allowed for many iterations and going through the design process. As a senior graduating this year, I enjoyed this class for a good refresher on the user experience design process and also as a practice before entering the industry.

Although I enjoyed learning about carbon, working with my team members, and practicing my skills, there were a few downsides to this quarter. I enjoy iteration and I believe one can grow extensively just from it. I also am a firm believer that feedback should be part of the iteration process. Our team did receive feedback for our assignments; however, I felt that the feedback given wasn’t as helpful for improving our work or to help our team in the next assignment. I also did not enjoy the deadlines of the project assignments. Despite warning the class about the high turn around rate after thanksgiving break, I still felt that the heavy load of assignments near the quarter could have been dispersed a bit more evenly.

Working together in my group was a great experience. My group was consistent in communication and how often we met. Dispersing working between our group members was also fairly consistently and everyone tried their best to make it evenly as possible. I enjoyed my team members and I am very grateful for their hard work and great attitudes towards the project.

I hope to use these techniques in the future, as I am an aspiring User Experience Designer and I very much enjoy the process. I think it would be great if in the future job I get in the industry uses these same techniques since I am learning them in class and I have been practicing them in different courses.

If I could have changed something about this project, I would choose to be given more time to focus on the design and overall end product. I enjoyed the assignments that lead up to designing the interface, however I also think it would be great to practice designing it. In terms of what I would keep the same, I enjoyed the iterations and having the assignments lead up to the final project. I believe this is a good lesson and goes with the flow of the design process.

Our group's process was meeting consistently every week and having the assignment done a few days earlier before the actual deadline to allow time to finalize the assignment and to get a jump-start on the next assignment. This was very helpful for me because I felt that we kept a good consistent rate and always tried to keep each other focused. Although it worked well in the beginning, I believe it didn't work out quite well near the end of the quarter due to heavy loads of assignments and the quick due date turn around.

Some improvements on the course would be to use class time for more hands on activities such as creating paper prototypes and testing in class and presenting more on how it relates to the industry. I would have enjoyed coming out of class with more experience and more "real world" knowledge.

Sean Hoon

Having completed our final project I have a lot to take away from the experience. First and foremost, I have a firmer understanding of the course material including the design process, the difference between an interface and a tool, and proper mechanics of usability testing. I also have learned a lot about the HCDE major as I worked with Lacey and Shelley who are in the major. Lastly, I further developed my understanding of group dynamics and how to operate in a group setting.

Coming into this class I was very confused about the difference between an interface and a tool. However, on completing this assignment I believe I have a better understanding of the difference. A tool is the technology used to aid a person in performing a task. The interface is the connection that the person has in operating the tool and the interactions that they will go through in this operation. For example in our project we developed a carbon footprint tracker. The tool in this case is the application and the conversion of raw data into an understandable format for the user. The interface was the presentation of this newly formatted data and the different kind of interactions the user could have with this data. Most of the time we spent wasn't on the programming of how to convert the data or the kind of mechanics the program would need to operate, but rather what kind of interactions the user would have with the data once it was already gathered. We spent the most time trying to figure out what the user would see on the screens of our application and what kind of functions the application would provide. I was amazed by the amount of time we spent on trying to figure out if the application would have more buttons or a swiping function and didn't realize how crucial that was to the interaction of the data points the user wanted to see. I also gained a lot from the thinking hats that Prof. Furness taught us in class. I had heard of this before, but had never put it to much use until this project. Not being from a design background it took me a little while to understand that users who had nothing to do with the design of the product didn't understand some of the functions that we put into it without having any explanation from us as designers. Once I implemented the thinking hats, especially the black hat, it became much more apparent to me. I am an archery coach and so explaining my thought process to students comes very natural to me. However, that made usability testing difficult for me at first. It was hard to sit there and let people struggle on the use of our application rather than just explaining how I intended it to work. Going through this process made me realize that design and teaching were not as related as I initially thought. I will be able to use this new

understanding of usability testing in my work at Prof. Linda Boyle's Human Factors Lab over the course of the next year.

My time working with Lacey and Shelley also taught me a lot as well. I am very grateful that there was an eclectic range of majors in this class because without it I don't know that I would ever have truly understood what HCDE majors do. I have now come to realize the amount of time and work that it takes for HCDE majors to develop and design a screen on an application. I was able to discuss and participate in the thought process that we all went through in choosing how users would navigate through different pages of our application and came to realize that it took a lot of forethought to make that design something that is easy and intuitive. I have a new found respect for the students in HCDE and have confirmed that it would not be something I am very good at. However, there was a lot of areas in the project that I was able to contribute to with my education. I spent a lot of time in looking at the systems map and in thinking about how the flow from one screen to the next and the overall organization of the application may have an effect on the user. I was able to really implement this in our first round of revisions after the first set of usability testing when users were getting stuck on the menu before they were able to see the food carbon emission summary. I worked on rerouting the user by breaking the menu up and removing non value added elements from the systems map to make navigation on a broad spectrum more easy and intuitive.

I feel that I have a strong element of leadership when working with groups. Initially with this group it was not the case since I didn't have a whole lot of background knowledge in the specific example problem as some of our other group members. However, as we continued to work together I found that I had a much stronger role in the presentation of our findings. Michael and I proved to be more comfortable in our oral presentation skills. Because of this I presented all of the findings that we gathered on our usability test and did the majority of the talking with Michael in our final presentation. The most difficult part for our group was I think understanding the roles that each person played in the beginning. I see how it would be beneficial to identify the skills that everyone has at the beginning of the design process, but it was difficult assigning everyone a job title since we were unfamiliar with what each other's majors entailed. We had several conversations later on describing what industrial and systems engineering and human centered design engineering were. At that point we had a firmer grasp that an HCDE student would be stronger in

designing the screens of the product and making design decisions based on user intuition and the ISE majors would be stronger with usability testing and systems mapping.

believe that I will be using a lot of these techniques again in my working career. I may not be developing applications, but I will probably be designing machining processes and workspaces for manufacturing and hospital environments that will require a lot of the techniques used in this project. I will definitely hold onto the general etiquettes of usability testing as I go about conducting time and motion studies on assembly lines and make sure to have minimal impact on the users in order to identify their capabilities more efficiently rather than my own understanding. I thoroughly enjoyed working with Lacey, Shelley, and Michael and hope that we will be staying in touch as we each advance through our career paths. I could not have asked for a better group on this project and our skills seemed to really complement each other well. Thank you for this opportunity to develop an interface and further my education in design and group dynamics.

Michael Kozlowski

Working on this type of project has been an eye opening experience for a variety of reasons. I not only learned more about how to create an interface designed for a specific problem, I learned a lot about our specific task and how what kind of interface our government/private company will need to create for our citizens to monitor and reduce their carbon footprints in the future. Throughout this project I enjoyed the iterations we went through to create, refine, and finalize the features of our product. These iterations forced our group to consider what features were necessary to the user, and what would be considered a distraction or unnecessary. This presented us with the decision on what kind of feel we wanted our application to have whether it be a control system that the user can shut off utilities to reduce emissions, or the data presentation and coaching strategy that we used so that the user can see what areas have the most emissions and follow our suggestions on how to reduce those. I enjoyed making these decisions and deeply thinking through the problem.

However some of the things that I did not enjoy about the project was how the timelines became closer together towards the end of the quarter. I understand why this was done, so that we fully understand the needs of our user and the full extent of the problem, but having the bulk of the design work at the end of the quarter along with the report made for several very stressful nights.

Working in a group was a great experience, especially considering our group worked together really effectively. We were able to meet on a regular basis to discuss the details of our project and divide up the work, which everyone completed in a timely manner. I was very happy with how our group cooperated and worked together as we have all had experiences where groups do not work well together or someone does not complete their parts of the assignment.

I will definitely be using these techniques again, specifically the thinking hats as I move forward in my life and career and encounter complex problems. By breaking down a problem into the certain mindsets (thinking hats), we are able to think of creative solutions, eliminate the ones that don't work, and then analyze whether one of the solutions would be an effective solution to the problem.

Looking back on our project, one thought that comes to mind is whether this topic should be assigned again next year. When we were presented with the problem, the implementation of a carbon tax, the first

thing that popped into my mind was a mobile application. Hearing about everyone else's VR and AR projects made me wonder our interface was too simple. Our group pondered this point for quite some time and we struggled to think of a solution to this problem that did not use a mobile application as its interface and would utilize some sort of advanced technology. While we still had many points to consider regarding the features and design of the product, I feel that the other groups futuristic problems made ours seem very simple.

The process we used to come to our finalized product was iterating our ideas every single week, often more than once, so that we could collectively determine what features worked, and what features we did not want to include. The most effective use of our time was the group meetings we had, and I am concerned that if other groups did not work well together like we had, their progress was likely slower and more tedious than ours. Another thing that worked well in our process was the survey section. We were able to survey quite a few participants, and although we were only asked to gain certain information, by having extensive conversations with these participants we were able to learn what they were expecting, and what kind of features they would want to have included if this type of application became a reality because of the carbon tax.

Overall I really enjoyed the course. I learned a lot, not only about the design process, but also about how many steps are required to make a thought a reality. The only thing that I think could be improved is the relationship between the project and the lecture classes. It seemed like the class had two different parts, one being the regular class and the other being the group project. While the things we were discussing in class related to the projects that we were working on, having some examples of how these practices can be applied to our specific projects would have been really valuable information as well.

Overall, I enjoyed the class and will be able to apply the things that I learned in my future career, specifically the strategies on problem solving and making sure I design to the commandments.

Lacey Peil

To be honest, I did not learn much in this class. The course subject matter was familiar to me, as I am a senior in human centered design and the process was very similar to what we did in 318. Furthermore, the topic we were assigned, the carbon tracker, was also familiar to me because I am doing a minor in environmental studies and work with Carbon Washington doing graphic design.

What this class did offer, however, was the opportunity to practice what I already knew about visual communication, UX design, and usability testing, as well as build new relationships with my team members. I enjoyed getting to know my team members and thinking about how our skill sets could be best applied to the various assignments we had. Outside of the group assignments, I enjoyed the individual assignments. They were helpful in helping me refine my ideas about good and bad interfaces. The only individual assignment I didn't find useful was the arcade critique assignment. I think I needed more scaffolding for applying this critique to broader user interface principles.

Reviewing and practicing is always valuable in my opinion, however, I wish I could have learned how to improve my UX design practices. Instead of feeling as if I was improving, I felt like I was guessing what would be the best approach for each assignment based on prior knowledge. This is not a new feeling to me in HCDE, and I am aware that design is difficult to teach. But usually this feeling is mitigated through critique and general feedback on assignments. I was disappointed by how limited the feedback was in all facets of this course: in lecture, live after presentations, and on our assignments.

I, of course, will continue to utilize these techniques as I am a human centered design major. But even if I wasn't in the field, these techniques and practices can be applied and valuable in all fields. I hope to go to grad school where I wish to incorporate human centered design practices, urban studies, and social justice. An example of this would be developing qualitative research practices to extract user requirements discoveries to inform policy.

I don't know that there's anything I would do differently next time, but I do feel like the design process in courses is always unfortunately abbreviated by time constraints that would not be less severe in a professional setting. It's difficult to work in a group when everyone is taking three or more classes and working one or more jobs, for example. This is the type of project I would feel better about working on in a more full-time capacity to properly address the problem's complexity in a meaningful way.

What worked in our group's process was having weekly meetings in which we would try to get ahead of the next assignment. This was helpful because it's easy to underestimate the work required in design

assignments, and we more often than not needed more time to pull assignments together than we originally anticipated. I would definitely do this the same next time.

There are a few things I would like to suggest to improve the course. First, let students select their projects or make the projects more level. For instance, the carbon tracker was far less enticing of an assignment than the holocell. Second, I'd like for class time to be utilized in a more meaningful way. For example, from a student perspective it is difficult to see how watching 17 presentations on the same thing is useful. I would rather five people be selected either as good or bad examples and those people be critiqued. This would help the students learn from critique, learn to be critiqued, learn to critique, and would motivate group members to do a good job to avoid being shamed in front of the class. Third, the design process is so condensed that it's difficult to be thoughtful. I would recommend giving students predetermined, relevant research to base their designs off of and start from there. This would allow more time for thoughtful design, testing and iterations, and would more effectively model the professional field.

Thank you for your time and interest in my feedback.