

Megan Dinh, Brendan Jew, Tatum Maston, Aaron Truong

ECO-TRACKER USER TESTING + ANALYSIS

User Testing Protocol:

Add goal:

1. Open app and log in
2. Navigate to goals page
3. Scroll to the bottom of the page
4. Add goal category and description
5. Press save

Log data:

1. Open app and log in
2. Navigate to add page
3. Add any method of commute and any distance
4. Add any data for food
5. Add any data for waste
6. Check summary page to see your daily progress
7. Go to the tips page
8. Copy a link for one of the tips

Testing with Alex:

Justification of the user:

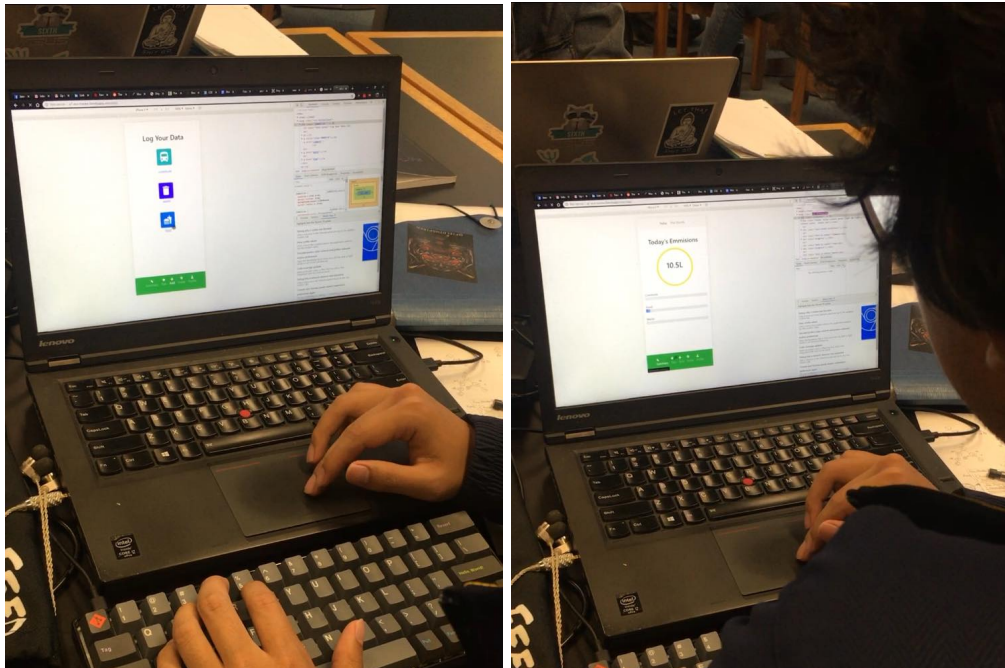
Alex is a fourth year student at UC San Diego. He is justified to user test the application for a few reasons. First off, he has experience with coding in html, css, and JavaScript, which helped him to assess our application on the technical level. He also has taken COGS 120 before and was able to give good design insight to our application. Additionally, he is not someone who uses data tracking apps. This makes him a justified tester because it helps us to understand how we might design the app experience to cater towards users that are new to data tracking.

Recording Notes:

Alex started off by logging into the system, and when asked to add a goal, he went to the add page, resulting in a mistake. He noted that using "add" in the navigation bar language led him to think that he would be able to add a goal from that page. When logging in data towards his summary, he said that he was confused by the numbers and the information displayed on the page. He was unsure about the "L" by the number, and after finding out it stood for liters, he wondered, "liters of what".

Findings:

One of the main findings from user testing with Alex is that the experience is not rewarding enough to encourage continued use, and there needs to be a way to build empathy when the user is not doing the best in terms of their emissions. He suggested that we add context to the numbers to show exactly what they mean and how the user might compare to the average user. We also found that the language we use, specifically “L” for liters on the summary page and “add” for one of the navbar items, does not create the clearest mental model for the user, causing them to perform mistakes when using the app.



Left - Alex accidentally goes to the add page to add a goal rather than going to the goal page. This is a mistake and a clear mental model was not conveyed.

Right - Alex sees that the circle has changed colors to indicate that his emissions are high. However, he does not feel bad about it and does not feel any urge to fix this score.

Testing with Kela:

Justification of the user:

Kela is a second year student at UC San Diego. She is justified to user test the application because she is familiar with using data tracking apps, such as MyFitnessPal and iPhone Health. Her experience with data tracking would provide us with insight as to how well our application motivates the user to track their data. Furthermore, she has some interest in reducing her carbon footprint, which is evident in her conscious effort

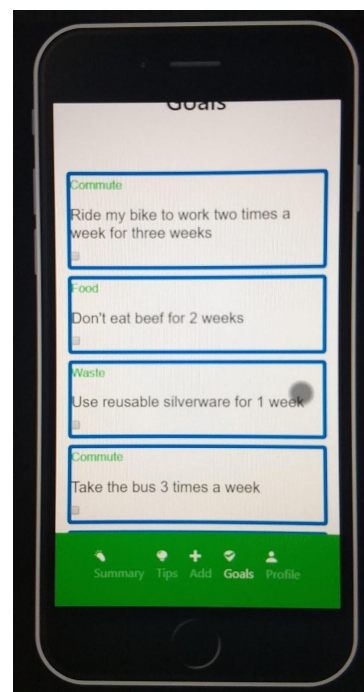
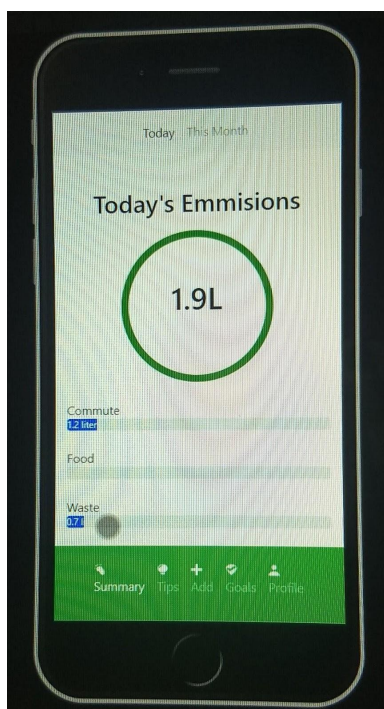
to eat less meat and use a reusable water bottle. Naturally, our targeted user base would include people who have some interest in eco-friendly goals and habits.

Recording Notes:

After Kela added her waste data (2 single-plastic uses), she noticed that the amount of liters emitted was cut off by the small progress bar. Furthermore, when looking at her daily summary, she did not understand what the “L” means next to her numeric score. “Does this mean liters of carbon?” She realized that the “L” stands for liters based off of looking at the progress bars, but otherwise, she would not have known what “L” meant. After Kela completed all of the tasks, she noted how there seems to be preset goals on the goals page already, which does not support customization. She would prefer these to be suggestions rather than hard goals that the user should also complete.

Findings:

After debriefing as a team, the main finding from Kela’s user testing is that there should be more user freedom as well as help and documentation. There should be more consistency in the system image - if there is no data in the summary page, there should also be none or few goals on the goals page. With the layout of the goals page, Kela felt confused by how many goals she already had despite opening the app for the first time. We concluded that we need to make the system image more consistent and not assume what the user knows. In this case, we should not assume that the user would know that the “L” represents liters of carbon emissions. In regards to the progress bars on the summary page, we need to find another way to present this information in the event that the progress bar is too small to contain that information.



Left: Kela is confused by the ambiguous “L” next to her overall score. Furthermore, her actual progress does not show completely if the individual score exceeds the length of the progress bar (See “0.7 l”). Right: Beginning users start with no data (a score of 0L), but the goals page seems to be pre-populated with goals that the user did not choose. This can seem to reduce customizability and user freedom.

Testing with Ashley:

Justification of the user:

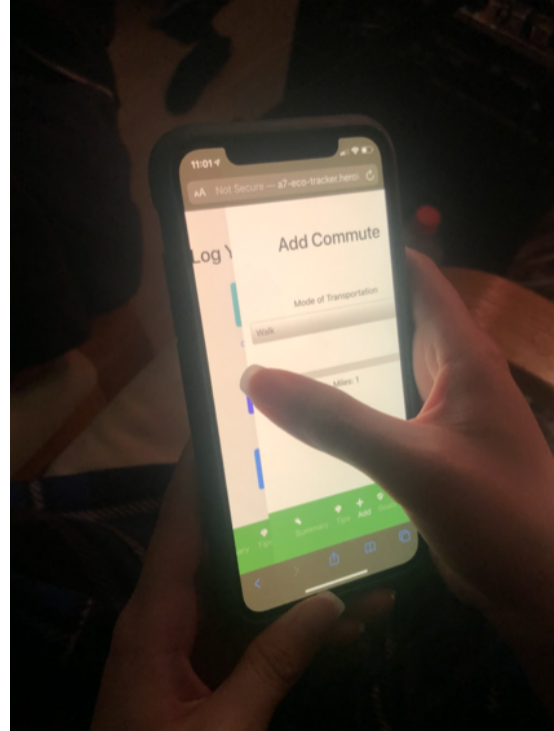
Ashley is a third year student at UCSD. She has some experience with mobile design from her DSGN 100 class, but not too much outside of that. We decided to pick her as a user to test with due to her personal views of mitigating her environmental impact and carbon footprint, in addition to her knowledge of some design principles and critique. She was a natural candidate for testing since she would ideally be part of our main user database—those who are concerned about the environment and willing to make changes.

Recording Notes:

Ashley was able to accomplish all the tasks without needing to ask questions or for clarification. In her own words, it was quite simple to recognize what she needed to do. However, she had an issue with the sliding feature under the Commute logging page. When she initially reached for the slider button, she grabbed part of the margin which resulted in her moving the entire page (much to her annoyance). Another small heuristic error occurred when she was prompted to “copy a link to one of the tips to share”. She incorrectly clicked on the text box, thinking it was to copy and then click the share button. It didn’t fit her mental model that the share button would both copy the link and share it.

Findings:

The main findings after going reviewing the testing notes and observations from Ashley’s session revealed the need for accessible design. Our group needed to be aware of how margins and padding could affect a user on mobile due to the differences in precision between touch screens and using a mouse on a computer. Additionally, we should streamline our UX writing to be simple—to the point, in order to avoid user confusion. Her comments about the profile page, along with others, also made us realize how odd the page was in its set-up and its irrelevance. As a result, we removed it.



Left: Ashley questioned why we even had a homepage and that the way it was presented made no sense. Why would the user have the profile others would see instead of an editable one? Right: The slider was too close to the left side of the page. As a result, even someone with small fingers like Ashley could have the interaction of moving the page backwards on accident.

Testing with John:

Justification of the user:

John is a second year mechanical engineering student with not much experience with mobile design outside of the few apps on his phone. We decided to pick a user with very base level knowledge to hone in on aspects of confusion that an average user may experience when testing. John is also part of our target group because he is interested in the eco-friendly trend and concerned about his footprint, and also is mildly knowledgeable in this topic. By choosing John, we are hoping to see if the app is user friendly and intuitive enough to accommodate the user, while actually seeing if they find the app practical enough to actually use.

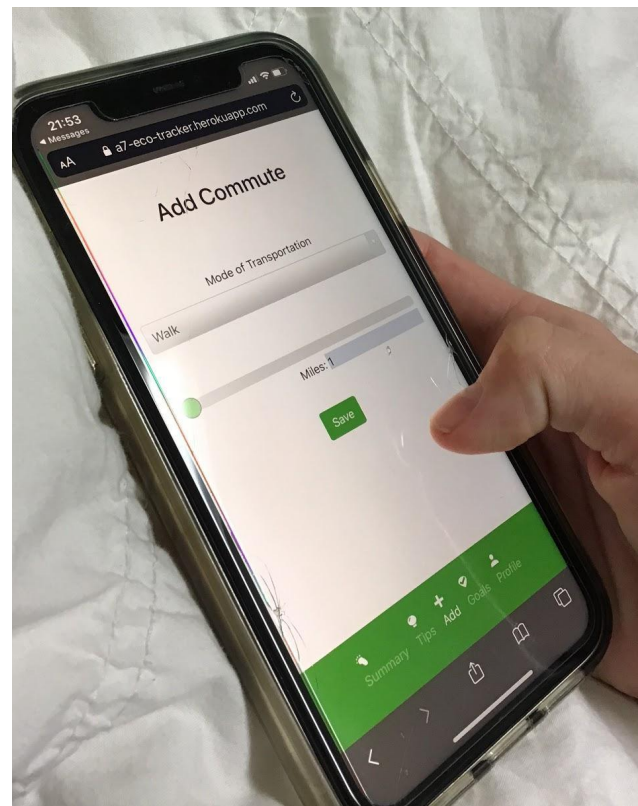
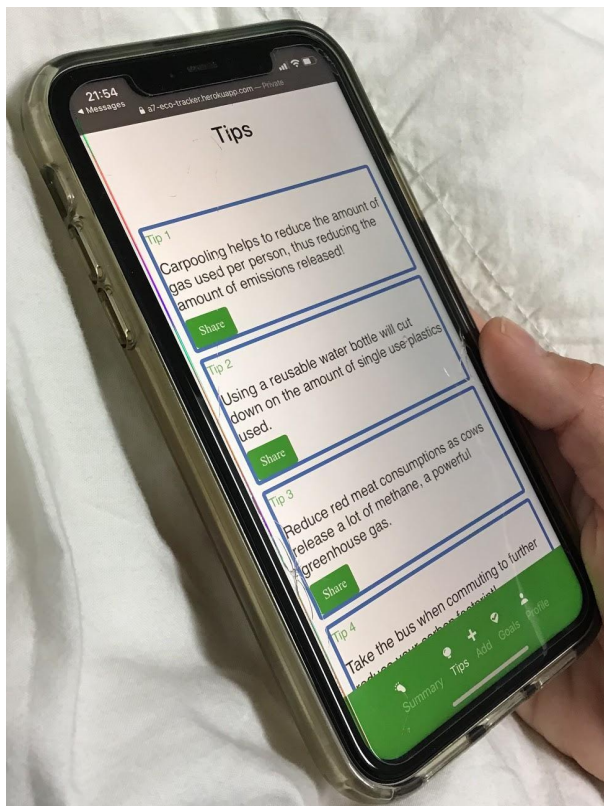
Recording Notes:

The first problem that John encountered was that he was unable to see the whole page on the tips page without holding his finger in the scroll bar. The next part was when we told him to add a commute and he accidentally pressed the food icon instead, taking him to the food addition page. This then confused him as he tried to

get back to the previous page by sliding his finger to the right across the page since he didn't see a back button. After no success, he figured out that he must press the nav bar item again to take him back to that page. The last major issue encountered was the amount of liters of Co2 that our app calculated by the daily input. John questioned whether this data was accurate, knowing somewhat about carbon footprints. He said he would like to maybe read or see what exactly the conversions are for each activity logged.

Findings:

The main usability issue encountered here dealt with the scrolling aspect of a few pages and the users ability to recover from error when going through the app's functions. After discussing with the team, we also decided to add a little information section to the summary page so users can see exactly how we are using their inputted data to calculate their daily score. This means that we can have information they can read about normal daily activities and their byproducts. This creates more repubility with our methods so users don't need to question where we got our numbers.



Left: Here is the tips screen after attempting to scroll down to the bottom. Without placing and holding your finger down on the page, you are unable to see the rest of the elements on the bottom of the page. Right: Here John is sliding his finger from left to right across the page in order to recover from the mistake he made when pressing

the incorrect icon. Because there is no obvious back button, he spent some time confused on how to return to the add page.

Consent Forms:

Consent to Participate in Research

You are being asked to participate in a research study.

Before you agree, the investigator must tell you about (i) the purposes, procedures, and duration of the research; (ii) any procedures which are experimental; (iii) any reasonably foreseeable risks, discomforts, and benefits of the research; (iv) any potentially beneficial alternative procedures or treatments; and (v) how confidentiality will be maintained.

Where applicable, the investigator must also tell you about (i) any available compensation or medical treatment if injury occurs; (ii) the possibility of unforeseeable risks; (iii) circumstances when the investigator may halt your participation; (iv) any added costs to you; (v) what happens if you decide to stop participating; (vi) when you will be told about new findings which may affect your willingness to participate; and (vii) how many people will be in the study.

If you agree to participate, you must be given a signed copy of this document and a written summary of the research.

You may contact Megan Dinh phone number (909) 747-2450 any time you have questions about the research.

You may contact Megan Dinh phone number (909) 747-2450 if you have questions about your rights as a research subject or what to do if you are injured.

Your participation in this research is voluntary, and you will not be penalized or lose benefits if you refuse to participate or decide to stop.

Signing this document means that the research study, including the above information, has been described to you orally, and that you voluntarily agree to participate.


Signature of participant

2/23/20
date


Signature of witness

2/23/20
date

Consent to Participate in Research

You are being asked to participate in a research study.

Before you agree, the investigator must tell you about (i) the purposes, procedures, and duration of the research; (ii) any procedures which are experimental; (iii) any reasonably foreseeable risks, discomforts, and benefits of the research; (iv) any potentially beneficial alternative procedures or treatments; and (v) how confidentiality will be maintained.

Where applicable, the investigator must also tell you about (i) any available compensation or medical treatment if injury occurs; (ii) the possibility of unforeseeable risks; (iii) circumstances when the investigator may halt your participation; (iv) any added costs to you; (v) what happens if you decide to stop participating; (vi) when you will be told about new findings which may affect your willingness to participate; and (vii) how many people will be in the study.

If you agree to participate, you must be given a signed copy of this document and a written summary of the research.

You may contact Aaron Truong phone number 714-203-4363
any time you have questions about the research.

You may contact Aaron Truong phone number 714-203-4363
if you have questions about your rights as a research subject or what to do if you are injured.

Your participation in this research is voluntary, and you will not be penalized or lose benefits if you refuse to participate or decide to stop.

Signing this document means that the research study, including the above information, has been described to you orally, and that you voluntarily agree to participate.

Ashley
Signature of participant

02/25/20
date

[Signature]
Signature of witness

02/25/20
date

Consent to Participate in Research

You are being asked to participate in a research study.

Before you agree, the investigator must tell you about (i) the purposes, procedures, and duration of the research; (ii) any procedures which are experimental; (iii) any reasonably foreseeable risks, discomforts, and benefits of the research; (iv) any potentially beneficial alternative procedures or treatments; and (v) how confidentiality will be maintained.

Where applicable, the investigator must also tell you about (i) any available compensation or medical treatment if injury occurs; (ii) the possibility of unforeseeable risks; (iii) circumstances when the investigator may halt your participation; (iv) any added costs to you; (v) what happens if you decide to stop participating; (vi) when you will be told about new findings which may affect your willingness to participate; and (vii) how many people will be in the study.

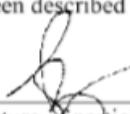
If you agree to participate, you must be given a signed copy of this document and a written summary of the research.

You may contact Brendan Jew phone number (408)-722-6862 any time you have questions about the research.

You may contact Brendan Jew phone number (408)-722-6862 if you have questions about your rights as a research subject or what to do if you are injured.

Your participation in this research is voluntary, and you will not be penalized or lose benefits if you refuse to participate or decide to stop.

Signing this document means that the research study, including the above information, has been described to you orally, and that you voluntarily agree to participate.



Signature of participant

2/24/2020
date



Signature of witness

2/24/2020
date

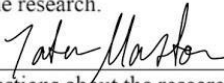
Consent to Participate in Research

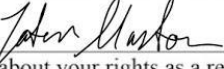
You are being asked to participate in a research study.

Before you agree, the investigator must tell you about (i) the purposes, procedures, and duration of the research; (ii) any procedures which are experimental; (iii) any reasonably foreseeable risks, discomforts, and benefits of the research; (iv) any potentially beneficial alternative procedures or treatments; and (v) how confidentiality will be maintained.

Where applicable, the investigator must also tell you about (i) any available compensation or medical treatment if injury occurs; (ii) the possibility of unforeseeable risks; (iii) circumstances when the investigator may halt your participation; (iv) any added costs to you; (v) what happens if you decide to stop participating; (vi) when you will be told about new findings which may affect your willingness to participate; and (vii) how many people will be in the study.

If you agree to participate, you must be given a signed copy of this document and a written summary of the research.

You may contact  phone number 760-717-0188
any time you have questions about the research.

You may contact  phone number 760-717-0188
if you have questions about your rights as a research subject or what to do if you are injured.

Your participation in this research is voluntary, and you will not be penalized or lose benefits if you refuse to participate or decide to stop.

Signing this document means that the research study, including the above information, has been described to you orally, and that you voluntarily agree to participate.


Signature of participant

2.22.20
date


Signature of witness

2.22.20
date

Summary of Findings and List of Changes Post-Testing

Findings:

Overall, we found that our app did not create the clearest mental model. Many users questioned what the “L” meant on the summary page, meaning we have to modify our design to better explain this measurement. Another finding was that users did not always go to the right section and also got confused with how numbers on the summary page were calculated. This is the case in which help and documentation would aid the app and alleviate some of the stress put on users to figure out what the numbers mean on their own. We should also be using clearer language that helps the user accomplish their intended action. Additionally, there were many layout issues found through user testing, and many people had trouble viewing all of the content on a given page, meaning we need to update our styling to ensure that everything is viewable when users scroll down on a page.

List of Changes:

- Creating navbar component (responsive)
- Add page cleanup (back buttons, confirmation, numeric input)
- Help and documentation on the summary page (how things calculate)
- Stretch goal: tutorial
- Stretch goal: styling app
- Daily tip (randomized from set)
- “Add” changed to “log/track”
- Confirm log data modal
- How people compare to average on summary page
- Change from liters to pounds of CO₂

Three General Patterns

1. The user could not identify the markers and identifiers used in our app, specifically the “L” on the summary page and the “Add” on the navbar.
 - a. There is very little information on the summary page, or even the app in general, about what each element means. As a result, the users’ mental model clashed with the conceptual model, so users did not know what to do with the information presented with them.
2. The user did not feel extremely motivated by the numbers on the summary page
 - a. There is not a lot of context on this page, and the user is not quite sure how their number compares with others. This causes them to feel distant and they don’t feel any empathy since the numbers seem arbitrary to them.

3. The user was confused whenever they were confronted with errors and could not recover from them.
 - a. This is seen when the user accidentally clicks on a button and has no way of returning to the previous page. Furthermore, the slider on the add commute page does not consider the spatial layout of elements in relation to the user's gestures. This error is not prevented by the system image, so the user feels frustrated when an error occurs at the fault of the app.

A/B Testing

The Component We Are Testing:

For our A/B testing, we wanted to test out different interfaces on the log commute data page. We are not sure whether having a manual numerical input or using a slider would be better for logging data. One issue with the slider is that it does not allow for an infinite range of numerical input. However, the advantage to a slider over a manual typing in of the number is that it is easier and allows for more efficiency of use. There is no clear winner in terms of design decision so we would like to test this aspect in A/B testing since each has good reasons for being effective.

How it is justified:

This component is justified to test because, as mentioned before, there is good reasoning for why each of the options would work. Having a slider makes for an easier and more efficient input as the user does not need to type anything, however the numerical keyboard input lets the user have an infinite range to input for their commute data. The two different designs are different enough because they are core components to our main task, which is to log data. It is not something superficial such as changing the text of a certain button, but rather changing how data is input into our app.

How we will track the data:

The results of these changes will be listened to by Google Analytics, and we will track when the amount of times the button to save the data is clicked, as well as how long people are spending on the add page. This will allow us to see which one is more efficient, as the page with less time spent on it will likely be quicker and more efficient for the user to log data. This form of tracking allows us to use a chi-squared test because our null hypothesis would be that the amount of time spent on each page would be the same, and the button clicks would also be the same. When getting the data from Google Analytics, we will be able to use our data to compare to the expected and compute its chi-squared value.

Why each design might work better than the other:

Design A, the slider bar, might work better because it might lead to a quicker interaction to log data. The design of the slider bar allows the user to quickly slide and input their commute mileage. It also gives a better visualization of how much mileage they are tracking, allowing them to better gauge from a high-level how much they are inputting.

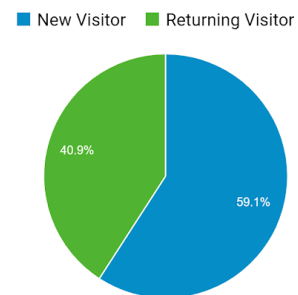
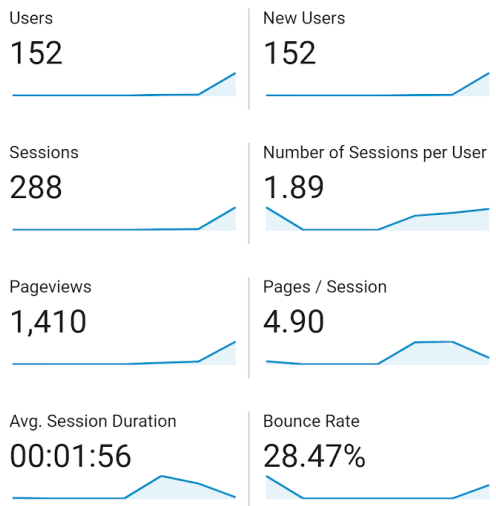
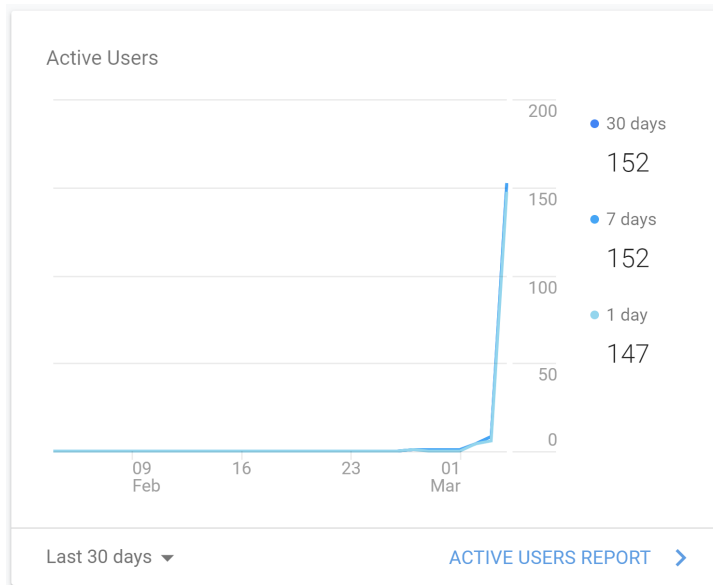
However, Design B might work better than Design A because it allows people to put in any amount of miles they want to since the input range is not limited. It also might be faster since the user would not have to slide slowly to get the exact mileage on the slider bar. Rather, they can just type in the exact number.

TEST ver on Heroku: <https://a8-eco-tracker.herokuapp.com/>

GitHub: <https://github.com/brendcrumb/eco-tracker-ixd>

A/B Testing BELOW

Screenshots of Google Analytics



During our testing period, we had a total of 152 unique users and 288 sessions, with the average session time being just under 2 minutes and users visiting an average of almost 5 pages per session.

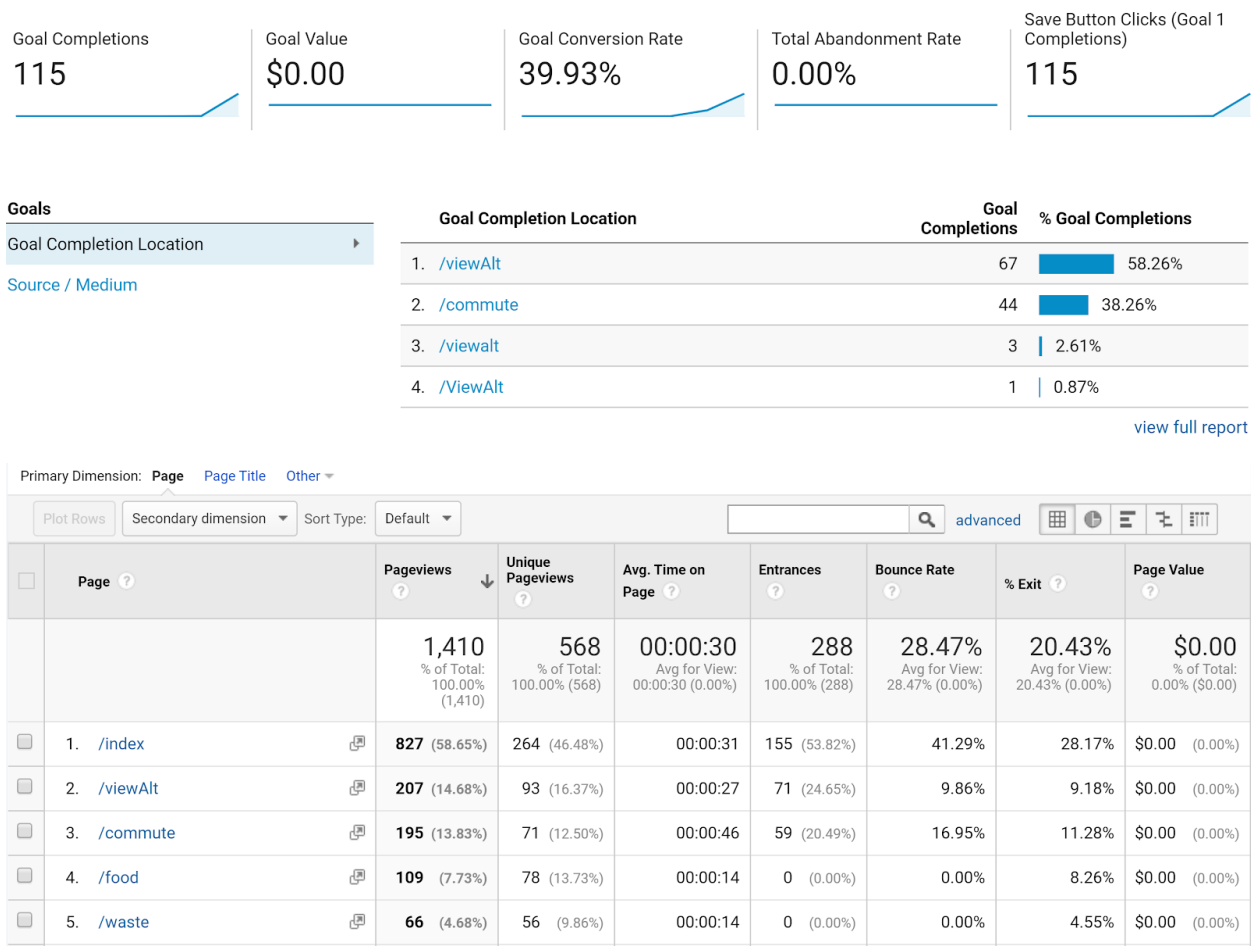
Recruitment Process

_____ We recruited UCSD students from DSGN 1 to test our app because they are a part of our targeted demographic, which includes students who may or may not be familiar with carbon footprints and/or tracking apps. We also believed that DSGN 1 students would provide insightful feedback because they could elaborate on

human-centered design principles to explain how the system image succeeded or failed in bridging their gulf of execution.

Data & Tables

Below are tables and graphs of the amount of tracked events (clicking the save data button) and the average time spent on each page.



Looking at the data above, we can see that Version B (text input, *right*) of our commute data tracking page was more successful than our Version A (slider bar, *left*). Of the 288 sessions, 115 events of people saving their commute data were tracked. There were 67 save button clicks recorded on Version B, and 44 from Version A. The average time spent with textual input was 27 seconds, while it took users on average 46 seconds to log their commute data using the slider bar. This is conveyed in the table below.

User/Condition	Expected Average Time	Observed Average Time
----------------	-----------------------	-----------------------

Version A (slider bar)	30 seconds	46 seconds
Version B (text field)	30 seconds	27 seconds

Add Commute

Mode of Transportation

Walk

Miles: 34

Save

Cancel

Version A

Add Commute

Mode of Transportation

Walk

Miles

34

Save

Cancel

Version B

Chi-Squared Statistic

chi squared test

	observed			Expected	
	Version A	Version B	total	Version A	Version B
save	44	67	111	53.843	57.157
didn't save	151	140	291	141.157	149.843
total	195	207	402	195	207

Chi-squared test

save (A)	$\frac{(44 - 53.843)^2}{53.843} = 1.799$	didn't save (A)	$\frac{(151 - 141.157)^2}{141.157} = 0.666$
save (B)	$\frac{(67 - 57.157)^2}{57.157} = 1.695$	didn't save (B)	$\frac{(140 - 149.843)^2}{149.843} = 0.647$

$\Sigma = 4.827 \rightarrow \chi^2 \text{ value}$
 degrees of freedom = 1 $\rightarrow$ critical value of ~ 0.025

odds of observed behavior happening and null hypothesis being true: 2.5%
 $\rightarrow$ not likely results are due to underlying distribution

From the chi-squared test, our chi-squared value was 4.827. With a degree of freedom of 1, our critical value was a little more than 0.025. This means that there is a little more than a 2.5% chance that our results are due to an underlying distribution.

Summary of Feedback

Version A produced 44 page clicks with an average time of 46 seconds while Version B boasted 67 page clicks with an average time of 27 seconds. Other feedback from users was a bit of frustration around the slider bar in Version A, since the screen often did not recognize the user was trying to move the pointer along the bar, and the whole screen was pushed to the side.

Interpret and Implement

Interpret Results of Analysis

The two versions only had a slight difference regarding the method the user uses to input the number of miles they traveled. As seen above, Version A's page had a significantly longer average time spent on the page, where the task was to input data related to the length of your daily commute. Version A also received only 44 recorded button clicks while Version B had 67. From this, data we can see how Version B was both faster for users to use and more successful in getting users to complete their given task.

This could be due to the imprecision of the sliding bar, as the slightest of movement or "slide" resulted in about a 4 miles increase or decrease in either

direction. For this reason, users may have had to spend more time to accurately slide the pointer into the correct position to count the precise amount of miles driven.

Describe Internal and External Validity

Our experiment has internal validity for a few reasons. First, study was done using random assignment, thus ruling out any systematic bias for how each group of participants were formed. Additionally, we conducted an intervention and manipulated an independent variable (which screen the user was presented to log their commute data) to see how the dependent variable (time spent on the page) was affected, allowing us to see specific effects of each condition. Furthermore, we practiced blinding in which the randomized page generation of either Version A or B did not allow participants to know which version they were receiving, or how the versions differ from one another.

We believe our experiment has external validity as well due to the fact that the study was conducted with people we believe to belong to our target population. As stated before, the DSGN 1 students belong to our target population of students who may or may not be familiar with data tracking apps or ways to be more eco-friendly.

Delineate the changes (to be) made and Justify with Test

For the “Log Commute” page, we intend to use the text field for inputting miles traveled because there is more user freedom, as opposed to using a slider with a limited set of values. As seen with our A/B testing, users spent more time on the page with the slider bar. This can be a result of users having to manually drag the slider to a specific number and spending a couple extra seconds adjusting the slider to fall directly on their desired input.

Furthermore, we will implement error recovery into our “Goals” page, where users can edit their goals and remove them if desired. We decided to include this change because we noticed that the goals added by one user can be seen by anyone with the link to our app. As a result, the option to remove a goal may be useful to users in this case.

Another change that will be made is adding help and documentation to the summary page to help users understand what their daily emission score means within the context of their logged data as well as within the context of the emissions of the average person.

What was learned from A/B testing and Google Analytics

Performing A/B testing and analyzing the results through Google Analytics proved very helpful in the development in our app. Previously to having done the AB

testing, our group was certain that our slide bar method would be best for this function because it was both intuitive and used advanced css. However, after analyzing both the click and time data through Google Analytics, we saw that we were greatly overestimating the usability of the sliding bar. Google Analysis allowed us to quantify this difference enough to confirm that the sliding bar was much more inefficient than the other tested version.