

# OnePaceAway: Pedestrian Navigation for OneBusAway

## Team Members/Role:

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## Problem and Solution Overview

OneBusAway is a useful application providing real-time bus transit information. It can display bus stops on a map, approximate bus arrival times for a given stop, and display a full schedule for specific routes. Users can also choose the nearest bus stop on the desired route and find out when their bus is coming. Although this application does a great job giving transit information to users, it does not actually help users to know whether or not they can catch their bus. OnePaceAway, an addition to OneBusAway, is a solution that provides real-time estimates of how long it would take for users to travel to a bus stop from a location as well as how fast they must travel in order to stay on schedule - a navigation aid for pedestrian riders.

## Paper Prototype Description

We created our paper prototype using 3x5 index cards that each represented a touchscreen on a smart-phone. Smaller menus were made of trimmed index cards, and the “phone” of the interface was printed out on a sheet of 8.5”x11” paper. On screens that contained variable fields and user-adjustable values, we used sticky notes for easy adjustments to the boilerplate interface. Our prototype is specifically designed for an Android interface.

### *Map screens:*

These index cards are the maps from the OneBusAway application showing major roads and bus stop locations. Below are the maps for our three tasks. When users look at their pedestrian navigation on OnePaceAway, this map screen will also mark and display the shortest path from user’s current position to his/her bus stop. This path is calculated automatically, so even if a user strays from the original walking route, it will recalculate from the new position. Selecting a stop on the map will bring up the pop-up depicted in Figure 5-1a.

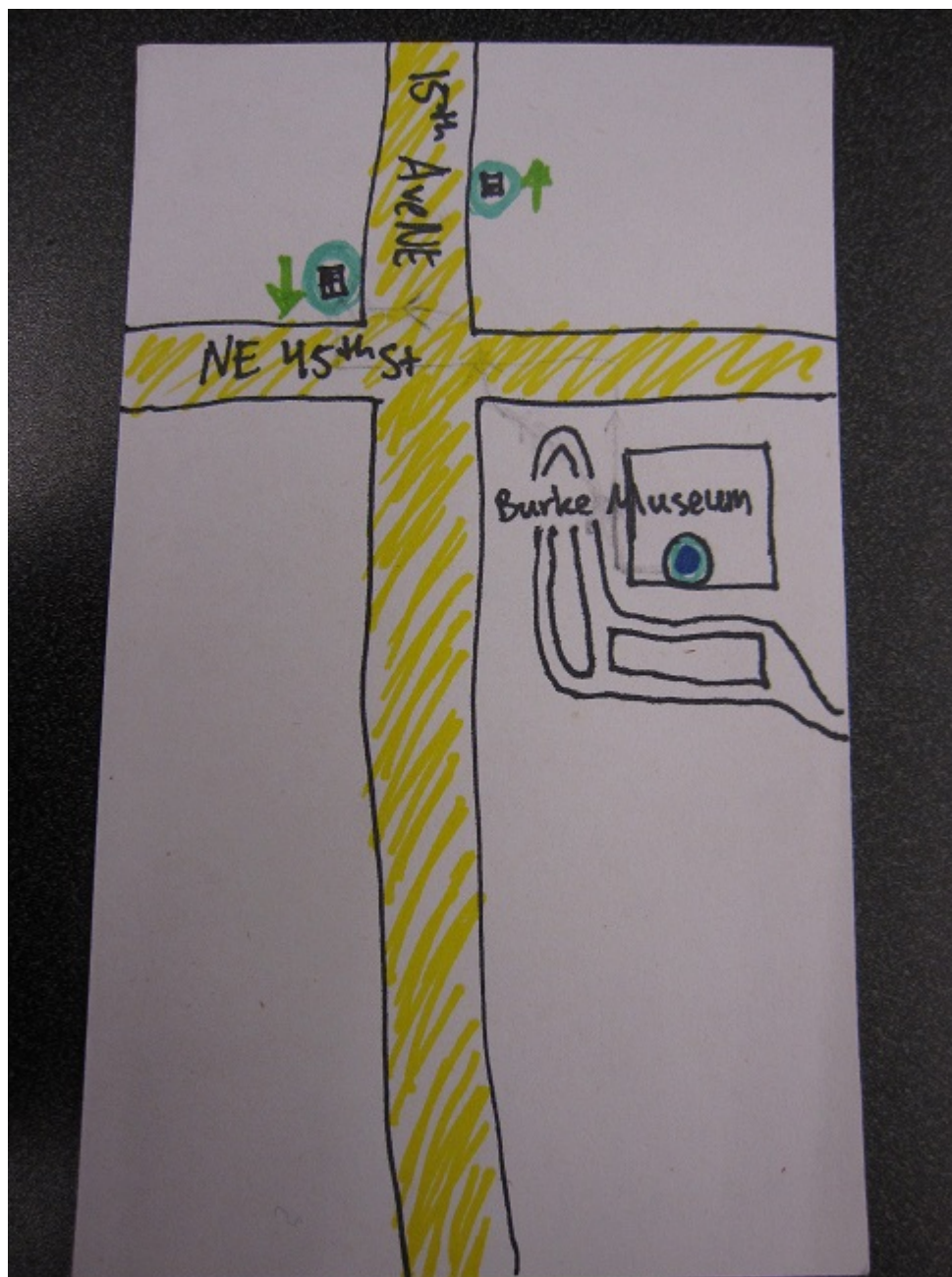


Figure 1-1, the map for task 1



Figure 1-2, map for task 2

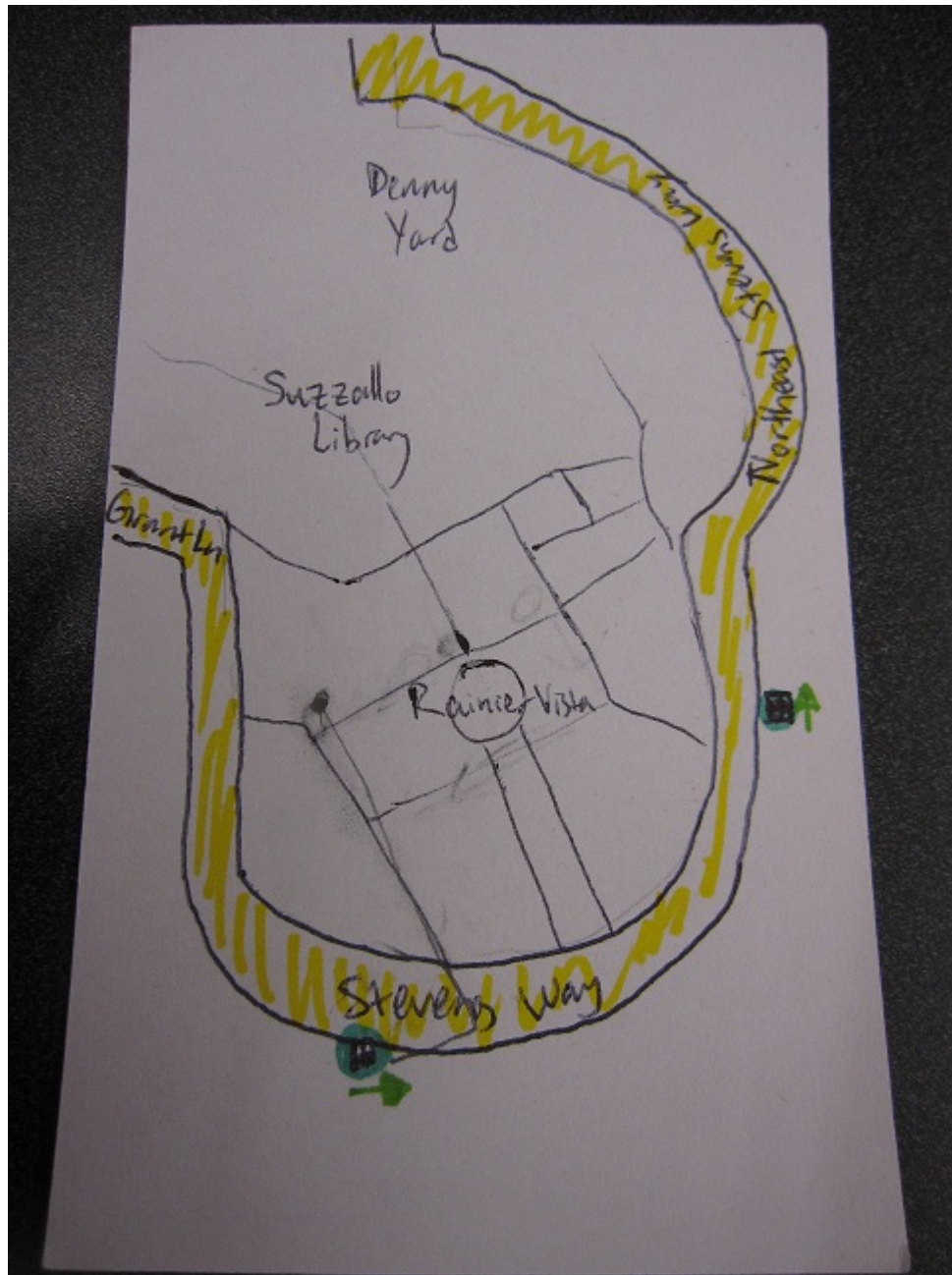


Figure 1-3, map for task 3

### ***Bus Route Screens:***

These show bus routes for each specific bus stop and are directly from the OneBusAway application. Each screen shows bus stop location and direction on the top and lists all the buses coming to the bus stop. For each bus, it shows the bus route number, the destination of the bus, and its estimated arriving time to the stop (in minutes). The bus arriving time is shown in different colors based on if it is arriving earlier (red), on time (green) or late (blue). Generally OneBusAway only shows the buses arriving to a bus stop in about 30 minutes. Selecting a certain route will bring up the menu depicted in Figure 5-1a.



★ Stevens Way & Okanagan Ln Eastbound		
372E	Kenmore P&R Lake City	-2
75	Ballard Northgate	-2
65	Lake City Wedgwood	NOW
68	Northgate University Village	3
372E	Woodinville Lake City	8
75	Ballard Northgate	23
65	Lake City Wedgwood	24
372E	Kenmore P&R Lake City	32

Figure 2-1, a bus arrival screen for task 2

#### *Pace Screens:*

These index cards show pacing information for the selected bus stop and bus route. Each screen displays the currently selected bus stop, distance and estimated walk time on the top. As the user walks, their pace information changes dynamically. In Figure (3-2) you can see the user is on schedule so Pace Needed is less than or equal to their current pace. Distance remaining and time remaining will be updated as the user walks. In Figure (3-1) the user has fallen behind. The Pace Needed exceeds their Current Pace so the screen has updated with the message "Behind Schedule" and the stick figure has gone from a normal walk to a run indicating the user needs to speed up. The final option for this screen is Figure (3-3). The user is ahead

of schedule so the message "Ahead of Schedule" is present and the stick figure is walking at a leisurely pace indicating the user can slow down if desired. While on this screen there is also the option to press the menu key on the android. This will bring up the menu displayed on Figure (5-1c) which allows the user to switch to the OnePaceAway Setting Screen or choose to catch a later bus.

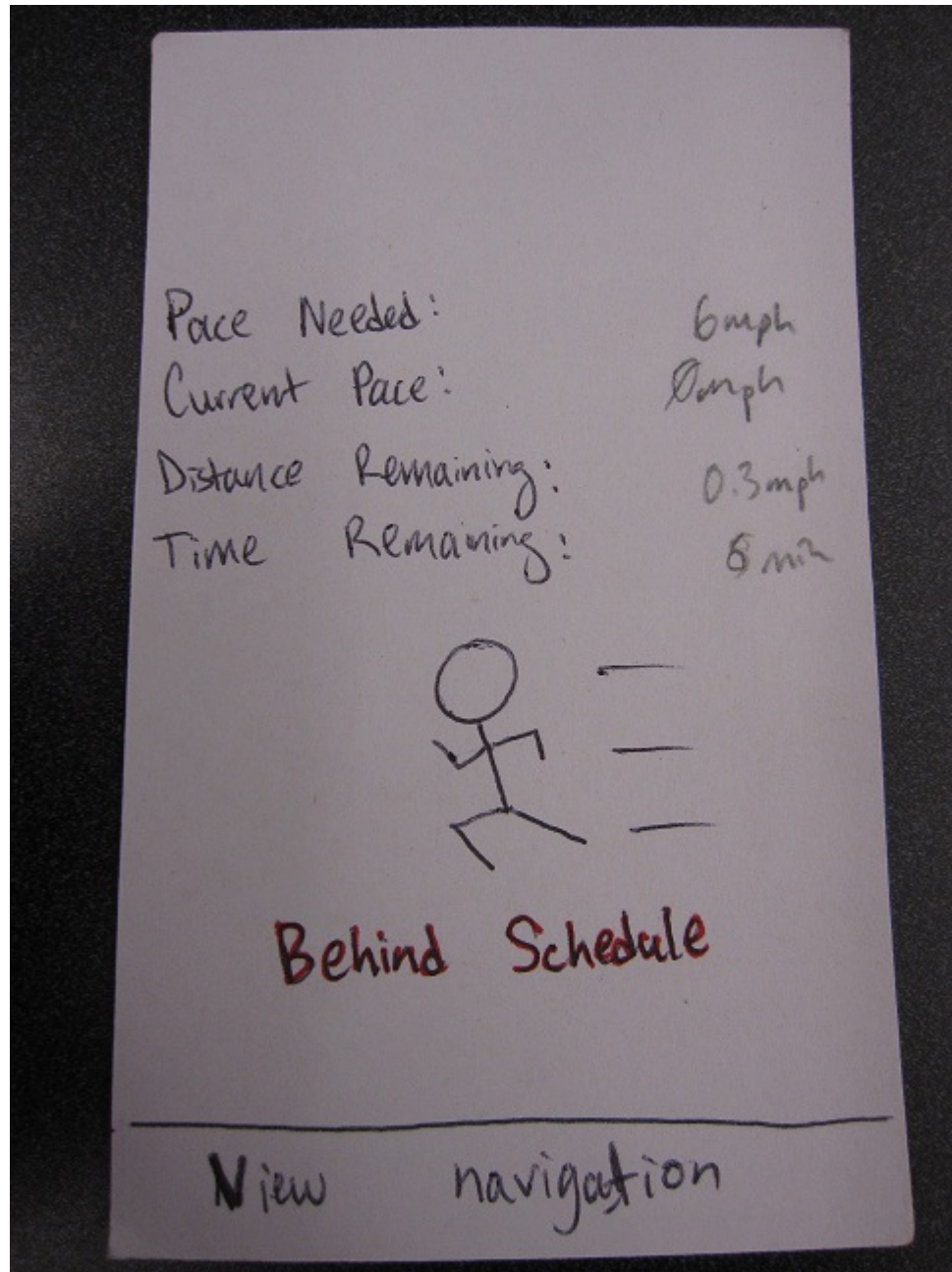


Figure 3-1, pace page, shows the user that they are behind schedule since they are traveling at 0 mph and need to travel at 6 mph

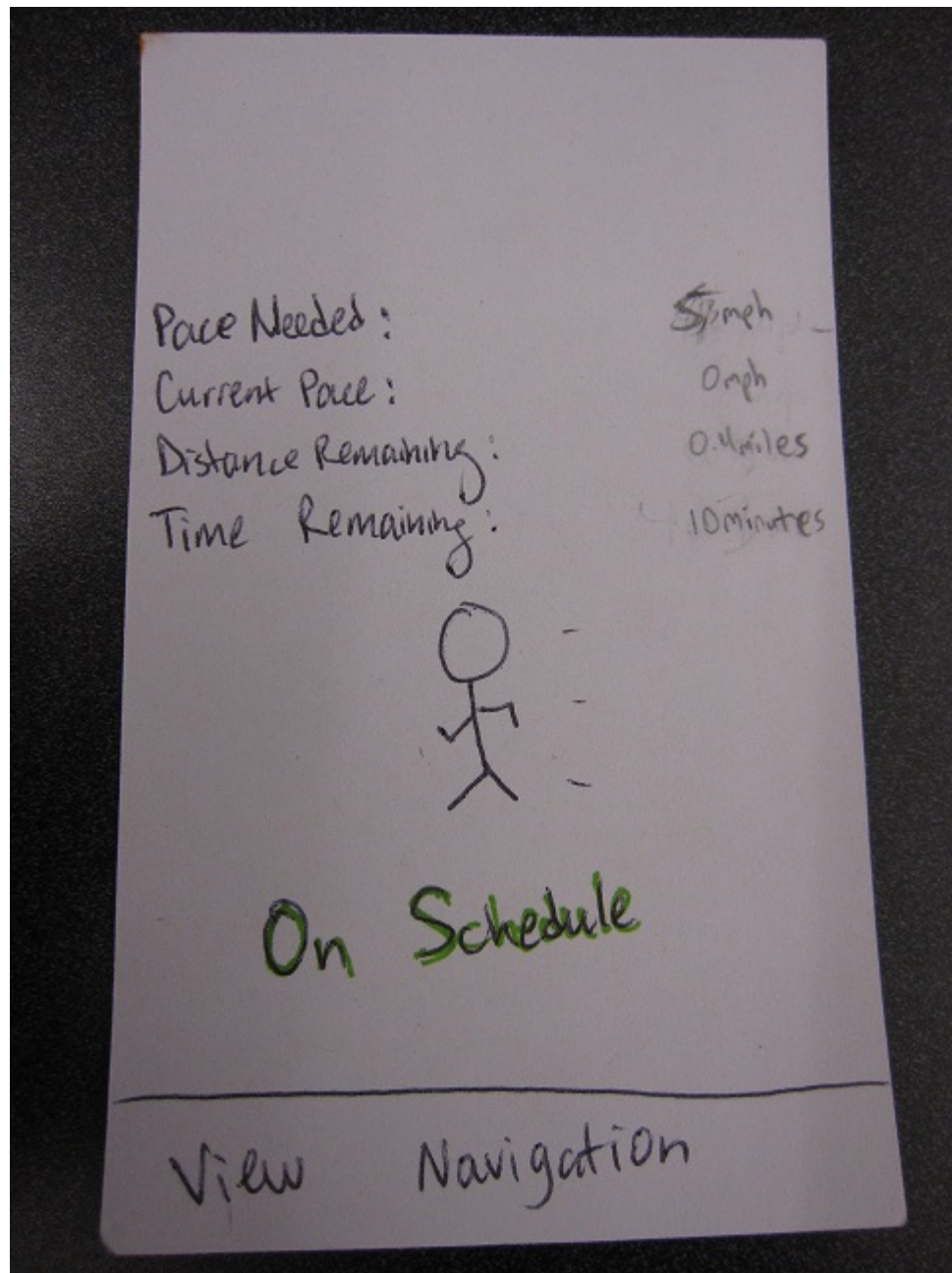


Figure 3-2, pace screen for On schedule. The interface gives the user some time to catch back up to the needed pace before it tells them they are behind schedule.



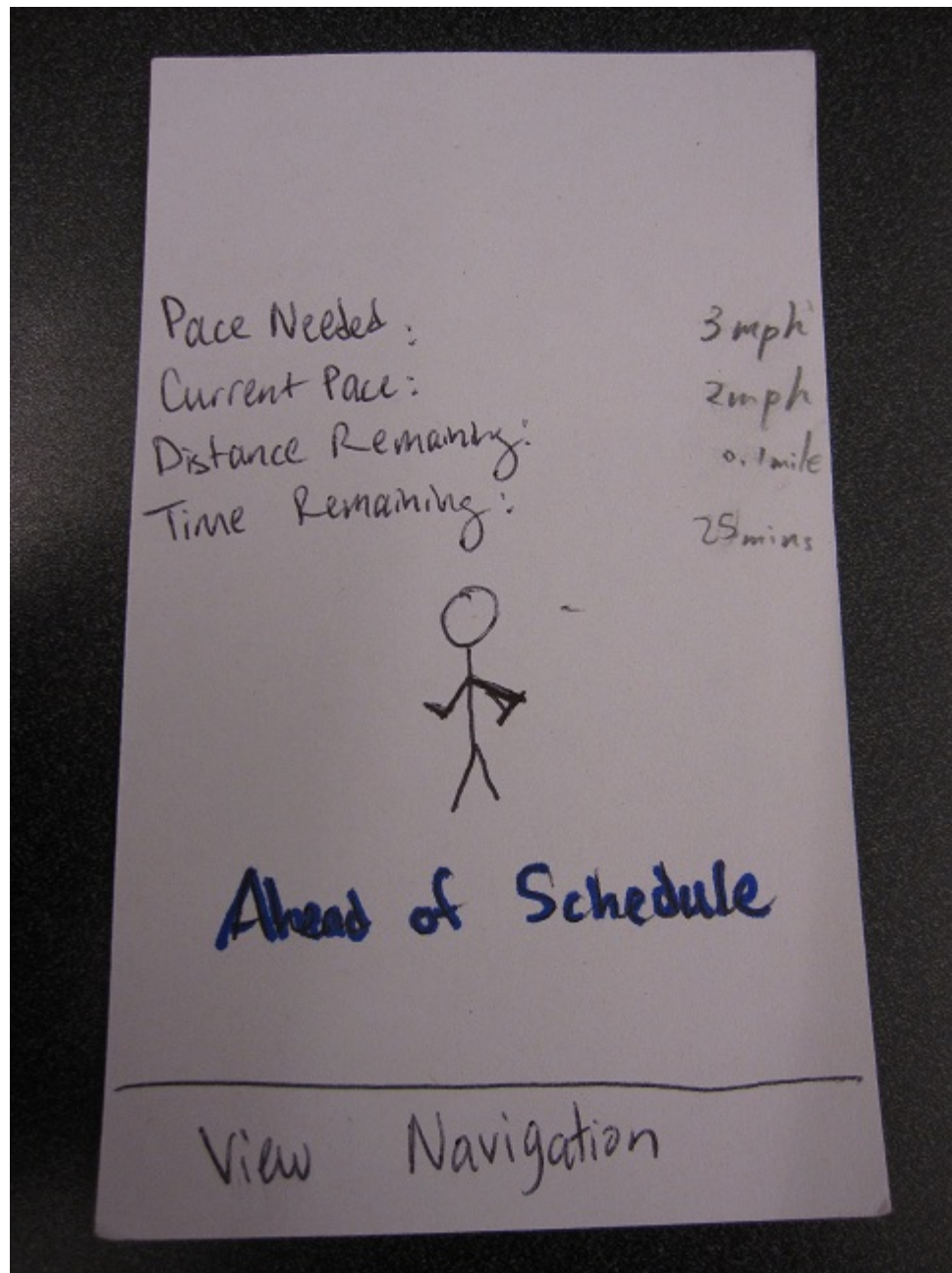


Figure 3-3, pace screen for ahead of schedule.

#### **OnePaceAway Setting Screen:**

These are the setting screens for OnePaceAway. In this screen, users can modify the amount of time they wish to wait before an estimated arrival time of a bus at their bus stop. This screen also allows users to set their maximum pace to account for varying preferences of speed (i.e. injured users may not walk more than 4 miles an hour and businesspeople don't mind running). OnePaceAway can use this pace setting to recommend users to take the next bus if their speed isn't fast enough to catch a bus. Users can additionally toggle settings if they want OnePaceAway to consider heavy vehicle traffic and poor weather. If they set *heavy intersections* to "On", OnePaceAway will avoid high vehicle traffic when making paths to bus stops. If users set *poor weather* to "On", estimates of time will account for the maximum pace



allowed and use a multiplier to decrease the expected speed.

Arrive before bus by

☐ -  ☐ +

min

Maximum Pace (max 10 mph)

☐ -  ☐ +

mph

Account for:

Heavy intersections

☒ On ☐ Off

Poor weather

☒ On ☐ Off

---

Save | Cancel

Figure 4-1, settings screen with poor weather and heavy intersection set on

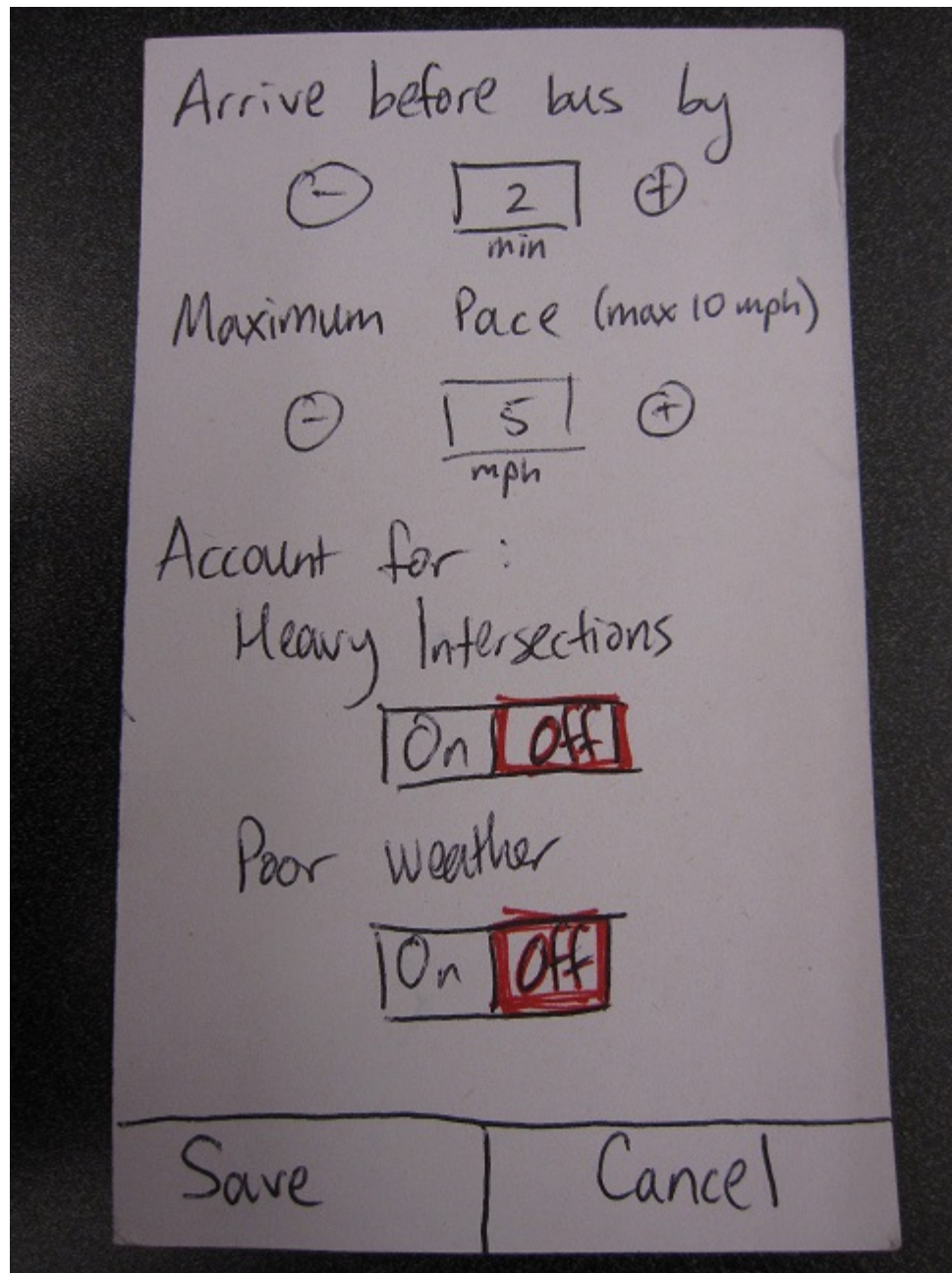


Figure 4-2, another settings screen with heavy intersections and poor weather set off

*Miscellaneous*

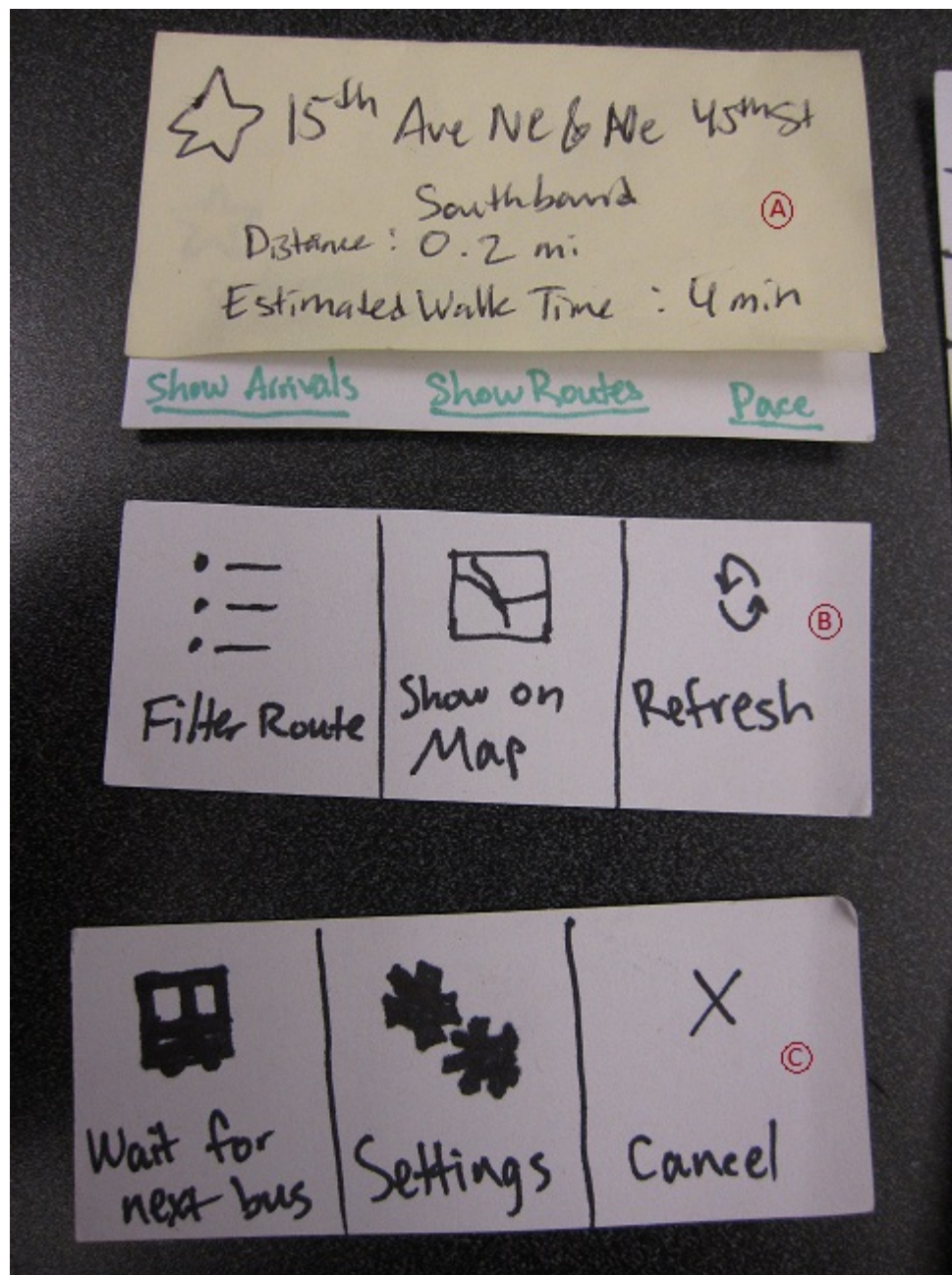


Figure 5-1, a few of the pop-up menus. The top one that appears when a stop is clicked and the bottom that appears when the menu button is clicked from the pace screen.



45mst  
min  
Pace

⌂  
esh

1

⌂ Bus Options

Show Route Info

Show Only This Route

Show Route Schedule

Show Pace

(A)

Your needed pace exceeds  
the maximum pace(7mph).

Do you want to catch the  
next bus (372)?

Yes	No
-----	----

(B)

Figure 5-2, a pop-up to let the user know they probably can't make their bus

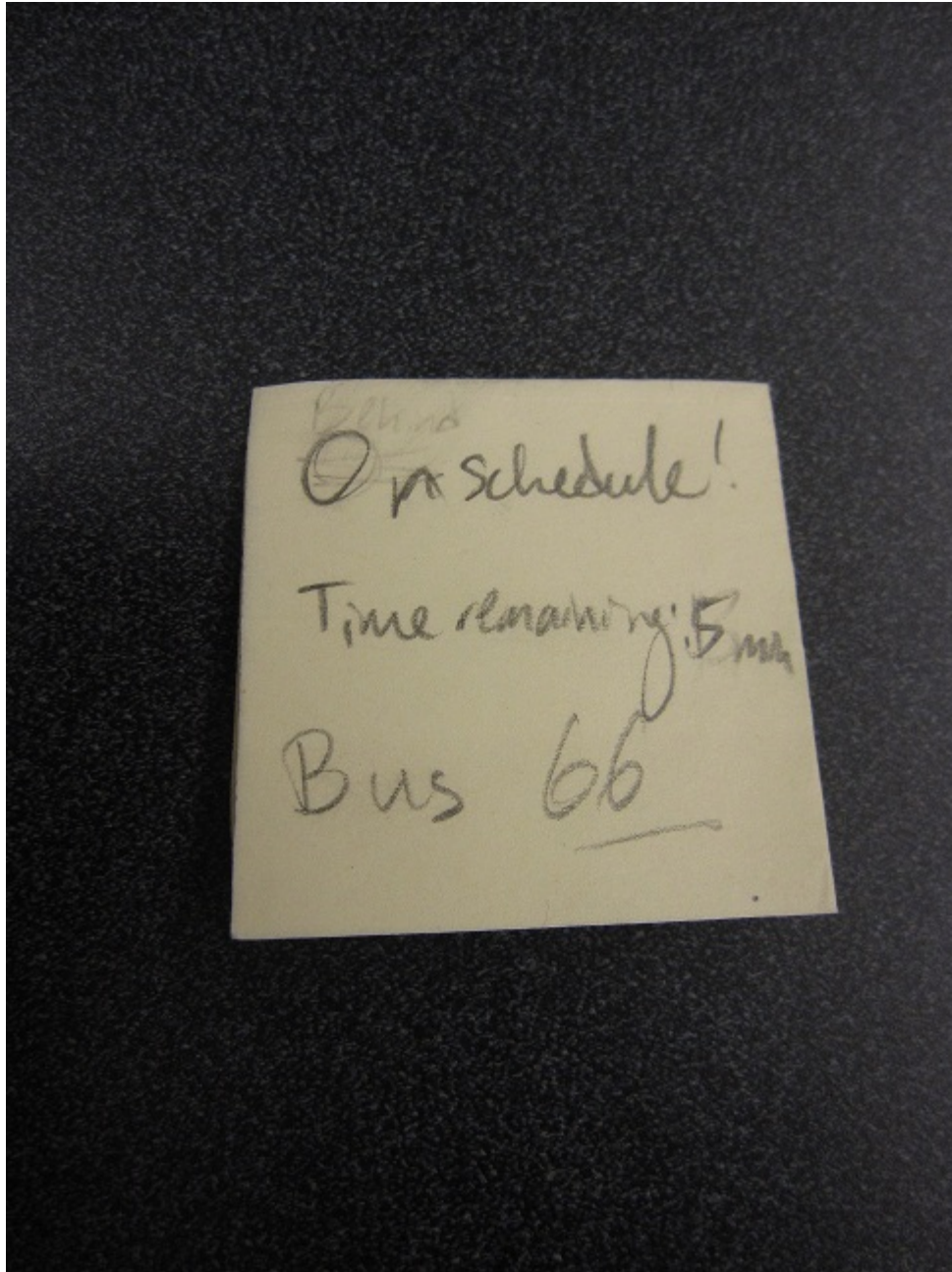


Figure 5-3, a menu that is on the navigation map to give the user bus information while on the map

## Testing Method

### *Participants*

In our search for user testing participants, we specifically set out to gather a diverse group with varying knowledge of, and familiarity with, the OneBusAway application and Android phones. Specifically, we targeted:

1. Novice - Someone who has never used an Android phone or OneBusAway
2. Intermediate - Someone familiar with either Android phones or the OneBusAway application
3. Expert - Someone who has used and is comfortable with both an Android phone and OneBusAway

We searched around the UW campus and surrounding bus stops for volunteers, asking them quick questions to check if they fit our desired criteria. We were able to successfully find a satisfactory pool of testers that met our criteria listed above. Rebecca, our novice user, has not used OneBusAway before and is relatively unfamiliar with the Android interface. Ciara, our intermediate user, is familiar with using an Android device and knows a little about OneBusAway. Kale, our expert user, uses OneBusAway daily on his Android device.

### *Environment*

Our prototype testing were conducted in low-stress environments including the H-Bar in the Physics building, a study room in Odegaard library, and the CSE atrium. These locations helped participants relax and act naturally while using our prototype. We placed our interface prototype on a table in front of the participant while the team gathered around to observe and interject during the testing process.

### *Tasks*

For the first task, we had the user get to a stop while also having them account for heavy traffic intersections. We described the following scenario to the participant:

“You are wandering around an unfamiliar area and want to know how to get to a nearby bus stop. Because it is an area with a known high crime rate, you want to get there in a timely fashion (avoiding heavy traffic where possible) and also minimize waiting time. Please find:

- How to get to 45th and 15th southbound while avoiding heavy traffic
- How long it will take to get to the stop”

For the second task, the user needed to travel a slightly longer distance and account for the snowy weather. We described the following scenario to the participant:

“Time is tight and you want to know how fast you need to travel to catch a bus. It is currently snowing and this may affect how fast you can travel. Please find:

- How fast you need to travel to catch the any route at 45th and Roosevelt Way
- Account for the poor weather

Start walking, then check the application again to make sure you are on schedule.”

For the third task, the user needed to switch to the next bus route since the first one was missed. We described the following scenario to the participants:



“You want to find how to get to a bus stop from your current position (near the fountain). You are also unwilling to travel faster than 7 miles/hr. If the pace needed ever falls above 7 miles/hr, you are willing to catch the next bus. First, set a maximum pace of 7 then find how to get to Stevens Way and Okanogan Lane.

You start walking towards the stop and become lost. Please check OnePaceAway again and check the path again.

(Here, the user will see that the path has dynamically adjusted using their new position. The pace needed will be above 7 miles/hr and the user will be presented with the option to catch the next bus. User should opt to catch the next bus.)”

### *Procedure*

Our testing procedures with each participant started with introducing OnePaceAway and providing a high-level overview of how and why our application adds to OneBusAway and what kind of problems it would solve. We made sure to place emphasis on the fact that we were testing the interface and not the users. We told the user the task and then had them try to complete the task. If they became stuck we would repeat what needed to be done and see if they could figure it out. If not, we either gave small hints or had the user skip the task (depending on how critical the feature was). We ended up making the “account for heavy traffic” optional. This made the first task easier and also helped us to get a better baseline for the user’s knowledge of the android interface.

If they didn’t figure out how to use our interface then after testing we would tell them how to get to the pages to see how they thought it could be improved and to show them the rest of the interface.

We tested in multiple environments, for the first test, we had Brendan explain, Michelle run the device, and Yizhou, Haochen, and Adam take notes. For the second test, we had Adam explain, Haochen run the device, and Yizhou take notes. For the third test Michelle explained and ran the application and Adam took notes.

### *Test Measures*

We focused on the test subjects vocal feedback and ability to complete the task without straying from the desired path as a test measure for our experiment. If they said they were stuck, we would remind them of their task and encourage them to continue looking through the screens. We also made note of when a user would hesitate due to lack of confidence in their selection. We wanted to know when the user felt confused by our interface.

### **Testing Results**

During testing, we found some common problems and parts of the design they liked.

#### Basic problems:

Some users we tested were unfamiliar with the Android and OneBusAway interface. This led to some basic problems such as not seeing the back button or the menu screen that are part of the Android hardware. They wanted us to also have these buttons as part of our interface so that it was less reliant on the Android interface.

#### Getting to pacing screen:

Participants had a hard time getting to the pace screen. Most participants wanted to just walk to the bus stop since they were familiar with the area. We let them know that they had to at least make a route and they searched through the OneBusAway and OnePaceAway pages that were in the scope. They usually just stumbled upon the pacing page through trial and error and told us that it was unintuitive. One participant thought that we should instead call it navigation since it was eventually leading to a route on the map.

#### Finding the settings page:

Users had problems getting to the setting screen. It could only be accessed by clicking the menu button underneath the pace menu. Even though we were telling them to change the settings, they still didn't want to since it wasn't necessary and was hard to find. They clicked around to try and find the settings page with very low success. This menu button was usually outside the scope of our project since the menu button usually doesn't go anywhere useful. One user liked the settings there while another user wanted to have it as part of the screen so that she didn't have to go searching to find it.

#### Problems Using the settings page:

One of our users was unsure what accounting for heavy traffic would do. He thought it made more sense to say, "Account for traffic lights." They seemed to just be following directions when changing some of the settings. They had plenty of questions about changing their maximum pace and whether it was useful or not, but they didn't think of what the accounting for poor weather option did.

#### Useful parts of the interface:

Users had a pretty easy time of getting through the third task. There were some problems caused by the fact that they still couldn't find some parts of the interface, but they got through the tasks. Two of them liked the navigation map that showed them how to get to their destination, but one of them wanted us to also have a text version of the navigation map to give them turn by turn directions of where they needed to go.

The notice to show that they missed their bus was informative. They usually showed disbelief that they somehow missed the bus but found it helpful to be able to quickly track the next bus.

### **Interface Revision Sketches**

We made some slight changes to both the pace screen and the OnePaceAway setting screens.

These are mainly targeted towards major usability issues uncovered during user testing.

Arrive before bus by

⊖  ⊕  
min.

Maximum Pace

⊖  ⊕  
mph.

Adjust pace for poor weather

☐ ON ☒ OFF

SAVE CANCEL

The sketch shows a settings page with three main sections. The first section, 'Arrive before bus by', has a minus button, a text input field, and a plus button, with 'min.' written below. The second section, 'Maximum Pace', has a minus button, a text input field containing the number '4', and a plus button, with 'mph.' written below. The third section, 'Adjust pace for poor weather', has two radio buttons; 'ON' is unselected and 'OFF' is selected (indicated by a checkmark). At the bottom are two buttons: 'SAVE' and 'CANCEL'.

Figure 6-1: OnePaceAway settings page, with adjustment for poor weather off. Note the missing “Account for heavy traffic” option.



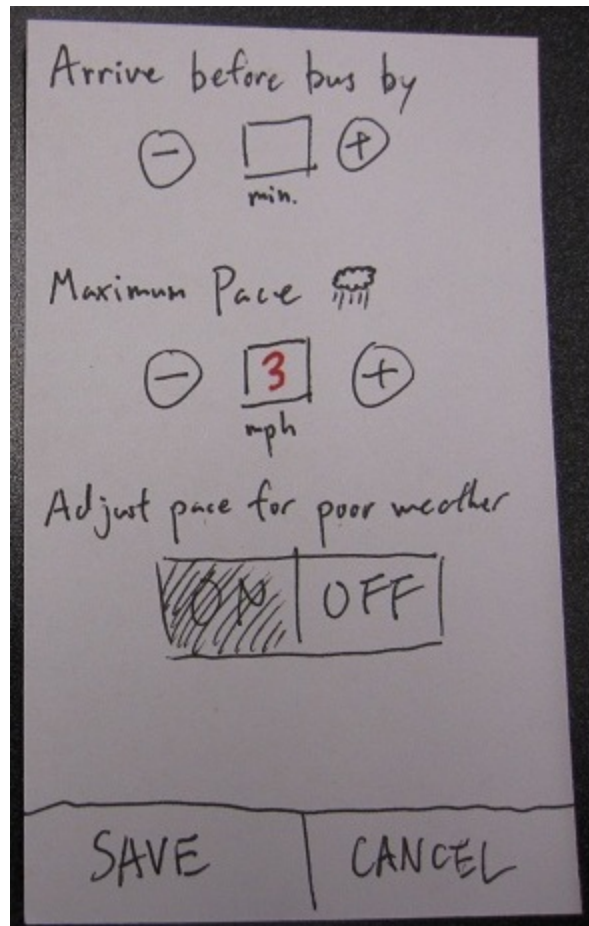


Figure 6-2: OnePaceAway settings page, with adjustment for poor weather on. Note the icon next to “Maximum Pace” and the red font denoting that the value is being modified.

One common difficulty we found in our user testing was the fact that users did not know what the “Avoid heavy traffic” and “Account for poor weather” functionality in the settings page were for. In reviewing these features, we found that the “Avoid heavy traffic” feature was in fact a poorly defined feature. There were too many variables to consider when finding a walking path that avoids heavy traffic and outside of the scope of our application. We felt that this feature served no real useful purpose so we made the decision to cut it as a feature and thus remove it as an option from the settings.

As for the “Account for poor weather” feature, which simply reduces the set “Maximum Pace” by 20%, we made some adjustments that makes it more clear what it is doing. We renamed the label to “Adjust pace for poor weather” to denote that the feature will make adjustments to your pace, as well as adding a small rainy cloud icon and turning the font red for the maximum pace value if the feature was turned on. This gives the user much clearer feedback on what the purpose of turning the feature on and off is for.

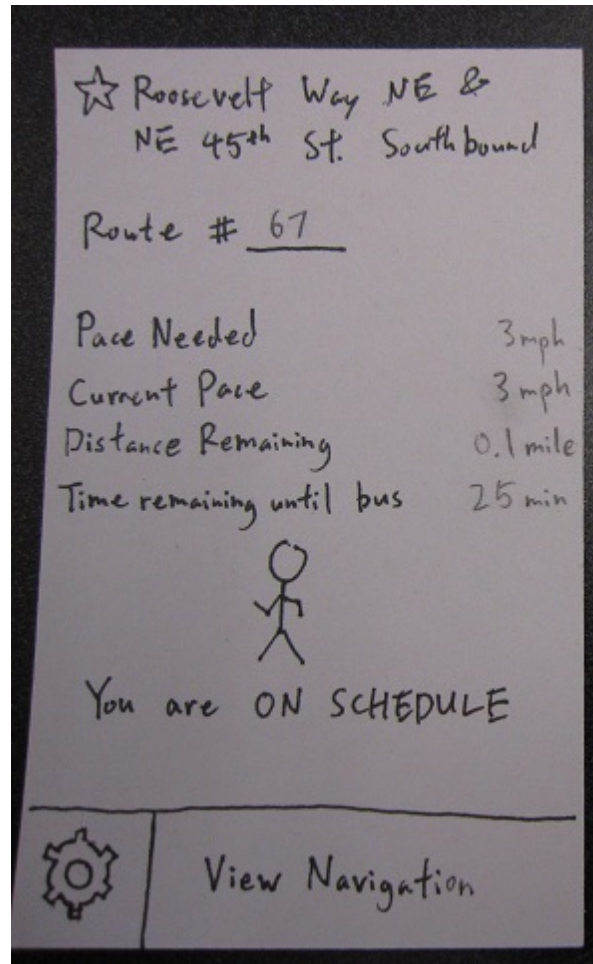


Figure 7-1: Revised pace screen.

Some users needed minor clarifications on what each field on the pace screen meant. We improved the wording on this screen to make things a lot more clearer with less ambiguity. Also, one of the biggest problems we found during user testing was the fact that users did not know a settings screen was accessible from the pace screen. To fix this, we added a button on the bottom left that takes the user straight to the settings screen. It is still accessible by pressing the Android menu key, but with this change it is very obvious to the user that a settings screen exists.

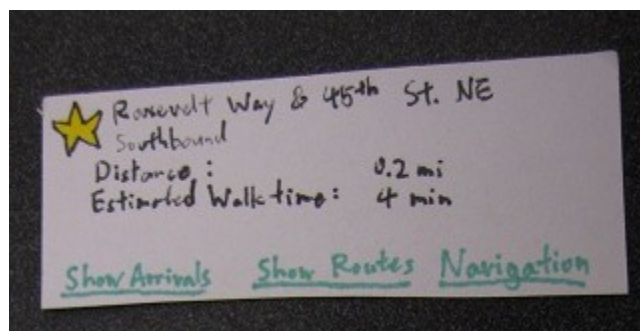


Figure 8-1: The revised bus stop pop-up on the map screen.

Another major problem we found during user testing was that users did not know what the “Pace” option was for in the bus stop pop-up on the map screen. We renamed this to “Navigation”, which is a term that is more clear and related to the functionality that is accessible from it. Also, it is not pictured here, but pressing the “Navigation” button will take the user to the bus routes screen. Here, the user will select a bus route to start pacing to. This eliminates the rather ambiguous previous functionality of “Pace” automatically pacing to the soonest arriving bus at the selected stop.

Other than these screens, we deemed everything else coming out of user testing satisfactory and were left unchanged.

## Summary Discussion and Lessons Learned

In summary, users would like to see our interface being more explicit and intuitive. Currently, it has a tendency to require too many button presses and is occasionally too vague to be of any help. Since we have information about the bus’s and user’s time until arrival to the stop, we need to explicitly say which of the two moving bodies we are talking about. The menu button needs some clarification, as it should take users to the same or similar menu (depending on the selected option) no matter which screen the user is on. Some of the setting options proved to be unnecessary or not very useful because it was too mundane. The *account for heavy intersection* option, for example, didn’t help very much and just added clutter to the appearance of the settings page.

An additional thing for us to note is wording is critical. If menus and other buttons are limited to only 2-3 words, it is important for us to select words that are not only concise but descriptive enough to get our point across without getting confused with other options (i.e. Show Routes vs Pace).

## Appendix A: User Testing Notes

Participant	Task	Severity Rating	Detail
Rebecca	1	-	Didn’t know where the menu button was
	1	0	Wanted a better search function in OneBusAway – this is outside the scope of our project.
	1	-	Found directional arrows on bus stop markers in map very clear
	1	2	Understood that the “Pace” button was for pacing screen. However, didn’t know that the button paced to the soonest arriving bus at that stop.



	1	-	Understood that the “View Navigation” button was for the navigation map
	1	3	<p>Didn’t know that it was possible to account for heavy traffic. In extension, didn’t know that the settings menu existed.</p> <p>Solution: Increase visibility of settings menu</p>
	1	1	Didn’t know how to return to previous screen. This stems from participant’s lack of experience with Android.
	1	-	After “Pace” was clicked, there was a lot of info to absorb on the pace screen
	1	2	Expressed confusion over why the OnePaceAway menu was accessible from only the pace screen. Felt that this contributed to unusable design.
	1	-	Once menu was found, found it easy to get to settings.
	1	2	Felt that design was unintuitive due to too many menu buttons. In other words, there were too many options presented at once.
	2		Couldn’t figure out what pace was needed.
	2	-	Successfully turned on feature to account for poor weather.
	2	0	Wondered what would happen if she wanted to walk faster than 10 mph.
	2	1	Confused on what the difference between “Time remaining” vs “Estimated Walk Time” was.
	2		Couldn’t figure out what pace was needed to arrive at her stop on time.
	3	0	Tried to pull up the menu from the map.
	3		Remarked that it felt strange to press menu after already looking at the pace.
	3		Correctly noticed that if she became lost she could just pull up her map.
	3	1	In trying to find a new route, she thought the “Show Route” button on the menu that appears after clicking a stop on the map meant walking route.
	1,2,3	1	Always clicked “Pace” as opposed to selecting a

			bus route for a stop first before clicking “Pace”.
Kale	1	-	Correctly pressed the desired stop.
	1	1	Didn't like how there were no clear directions to get to the navigation screen.
	1	4	Confused on how to get to navigation. Proceeded to try random buttons and went through many menus before finding the right now.  Problem: Function of the “Pace” option was too unclear
	1	4	Didn't know what the “Pace” option was for. See above.
	1	3	Didn't know that the feature to account for heavy traffic existed. We ended up explaining the feature to him.
	1	1	Tried to press the star on the routes info bar, which doesn't actually do anything.
	2	1	We needed to clarify that “Behind schedule” means that the user is behind schedule, not that the bus is behind schedule.
	2	1	Suggested clarifying what the numbers on the pace screen mean.
	2	3	Didn't know that the “Pace” button targets the next arriving bus at the stop.
	3	3	Didn't know you could access settings from the menu.
	3	2	Asked how he would know which bus he is currently pacing to. Suggested that instead of “Time Remaining”, we can change it to “Time Remaining until <bus route> arrived>” on the pace screen.
	1	1	Was unclear on what the “Avoid Heavy Traffic” feature in the settings was for. Suggested “Avoid traffic lights” for better wording.
	1	1	Suggested a “Navigation” button added to the menu that appears when a stop is pressed on the map.
	1,2,3	-	Liked how easy it was to tell how fast you are moving and how far you are away from your destination.

	1,2,3	-	Liked the Navigation feature. He uses Google Maps when he doesn't know where a bus stop recommended by OneBusAway is located. This feature helps integrate this step into OneBusAway.
	1,2,3	-	When discussing how we can better increase the visibility of the settings option, he remarked that it would be annoying if settings was placed anywhere other than the menu.
Ciara	1	2	Assumed that she would get walking directions by typing in a route.
	1	2	Wanted step-by-step directions for the navigation directions instead of just a map and suggested a button that would provide this.
	1	-	Rather than finding the navigation feature in OnePaceAway, remarked that she would rather use the map and manually find a path.
	1	-	Clicked on bus stop, then traveled to the bus stop.
	2	1	Asked if there was something to account for weather. Perhaps our settings is too hidden away.
	2	1	Asked what the numbers for minutes until arrival were
	2	1	Tried to hit current pace to adjust the current pace.
	2	0	Asked what would happen if she clicked "View Navigation"
	2	1	Asked where the settings for inclement weather was. Again, perhaps our settings are too hidden away.
	2	1	Participant claims to have "tried everything" but couldn't figure out how to account for the weather.
	2	2	Assumed that there was no menu on pace screen because there was no menu in the preceding screens.
	2	-	Found settings only after we nudged her in the right direction with vague hints.
	2	-	Other than the process of finding it, user found the settings screen to be intuitive to use.
	3	-	Remarked that it should be fine if speed is under 6mph.
	3	1	Tried to click on the numbers in the pace screen.

	3	0	Remarked that there shouldn't be a speed cap on maximum pace.
	3	1	Asked if arrival time was adjusted, would pace get adjusted as well?
	3	1	Found the "Catch next bus" prompt to be weird without it being an actual screen.