SounderTransit

Final Report

CSE440 Section AB Fall 2018

Team

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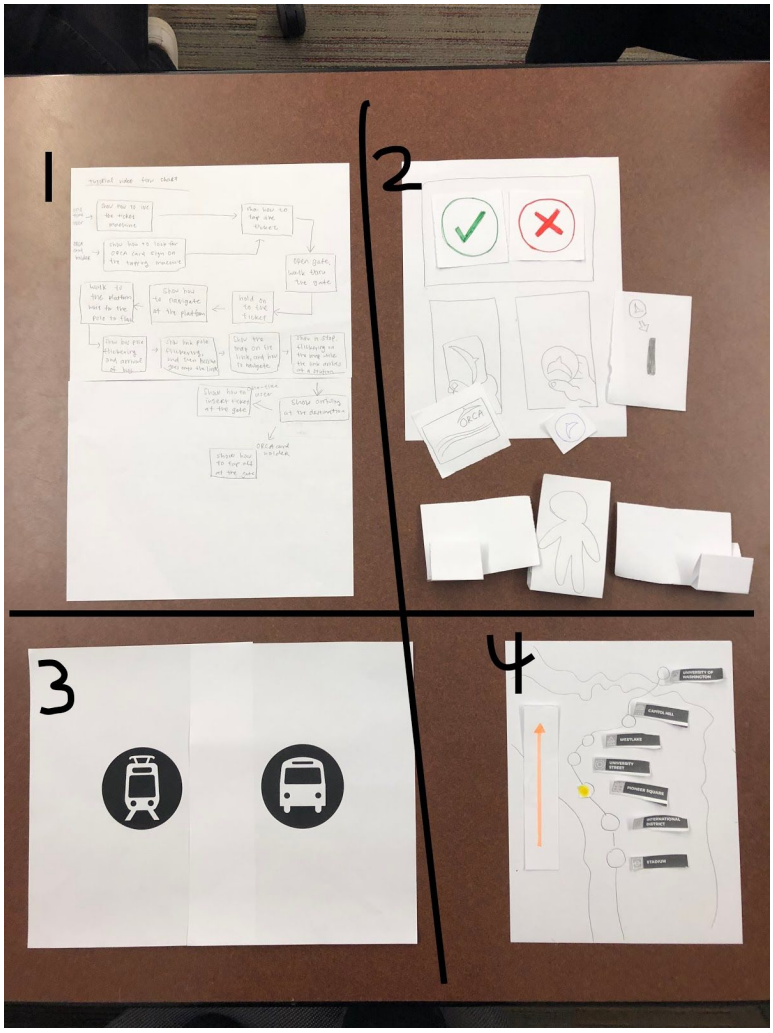
Problem and Solution Overview

Seattle now ranks as the fastest-growing big city among the 50 largest U.S. cities. Since 2002, the Link and bus ridership has grown at more than twice the rate of population growth [1], which makes traveling within the Greater Seattle Area faster and more convenient. However, our research has shown that the payment system and integration of bus and Link stations can actually be more confusing than convenient. The current Link payment system requires riders to go through trial-and-error, peer assistance, and observations to learn about the and ticketing system. In addition, we also discover that the integration of bus and Link stations can be confusing for riders as they sometimes expect Link but see buses arriving or the other way around. Some riders also mention that they often have troubles figuring out the upcoming stations when they are riding the link. These problems especially arise among riders with limited English proficiency because there exists an extra barrier for them to fully understand and feel comfortable with the whole system.

To tackle the problems, we propose to make the Link more informative and intuitive. Regarding the payment system, we intend to include tutorial videos at the entrance of the stations and will be in the form of demonstrations instead of explanations so we can eliminate the language barriers while educating riders about the payment system. The station would also be implemented with gates so it will be obvious to the riders as to when and where to tap their tickets. To help riders easily navigate through Link, we will have maps and signs at the stations and on Link cars to inform them about the information needed.

[1] https://www.citylab.com/transportation/2017/01/a-growing-seattle-goes-all-in-on-transit/512321

Initial Paper Prototype



Our initial paper prototype focused on replacing English instructions with graphics and building a more responsive payment system, which includes adding 1) an instructional video, 2) a responsive physical gate with clear and nonlinguistic labellings, 3) a clear flashing indication of the incoming transportation for either the Link and the bus, and 4) a real-time responsive map that indicates the current, as well as past and future, station of the rider.

The critical aspects of this design centered on two tasks, which are teaching riders, especially riders with limited English proficiency, to understand the Link payment system and helping riders navigate to their destination smoothly. A key feature that was prominent in this early prototype was the physical gate and the tapping machine at the station. With physical constraints, the gate reminds riders to pay before taking the Link, and the tapping machine prevents riders from tapping on the wrong area or inserting ORCA coin in the wrong spot. Another key piece that also came out of this prototype was the idea of having a real-time responsive map and a unique icon for each station. The map not only showed the relative location of each station, so the riders could have a better understanding of the area, but also had an arrow and yellow flashing light indicating the direction the Link is heading and the current station the rider is at. By including a unique icon for each station, we believed that it would help riders with limited English proficiency to recognize each station more easily.

Testing Process

We executed two heuristic evaluation on two participants separately and three usability tests on three different participants separately. We conducted the heuristic first and modify our testing process and then we conducted our usability tests.

Heuristic Evaluation

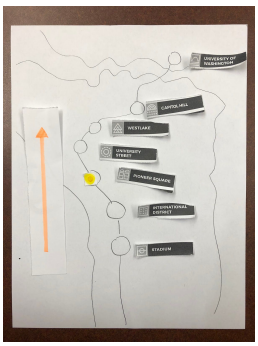
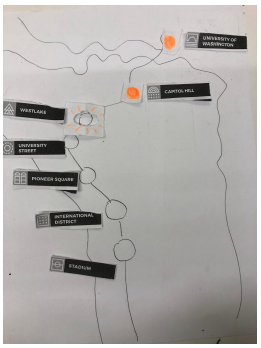
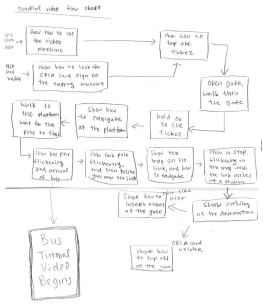
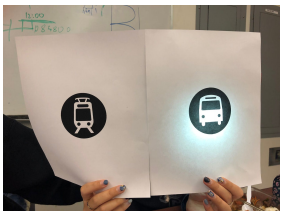
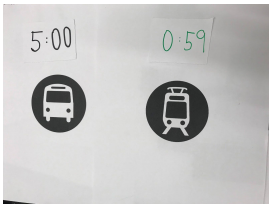
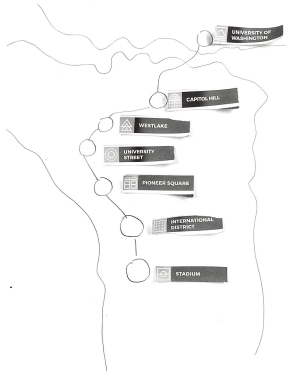
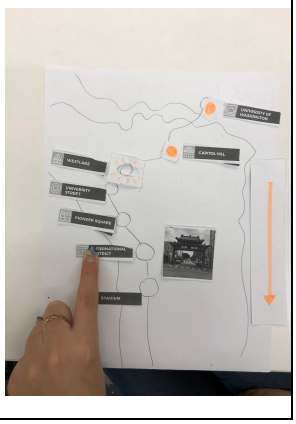
We executed two heuristic evaluations on two of our classmates' projects from the other design team. Half of our group did the heuristic evaluation with one participant and the other half did it with the other, both evaluations were done at the same time. They did not have prior knowledge of our problem and solution so they were able to give us a fresh perspective and help us see if our design was intuitive and well-rounded enough. Our design was evaluated against the list of 10 design heuristics with a focus on visibility of system status, error prevention, a match between system and the real world as well as aesthetic and minimalist design. In the process, we explained an overview of how the system would be used in a storytelling way so that the evaluator can see how a user might interact with each part of our system. From the process of our first two evaluations, we realized that we should not imply our participants on what should the next step be when using our design. It can be intuitive for us designers to give out words that could possibly hint our participants on what actions are required by our system, but through the process we realized that it could harm the result of the testing, and therefore we should consciously avoid doing so.

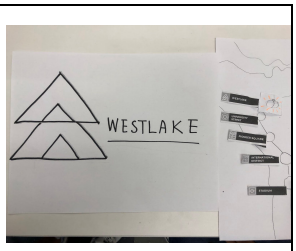
Usability Test

After the heuristic evaluation, we also executed usability tests on three participants who do not know about our design. One participant was a friend in the CSE lab, another was Kelley's roommate and the last one was another classmate in our class. During the first usability test, we just showed them the video flowchart paper as a simulation of seeing the video. However, we realized that being new to the whole system, most words on the flowchart might not really make sense to them and it is also a lot to read. For the next two usability tests, we decided to start off the usability test with the storyteller showing the participants how to use the system without talking to them and just performing. In the process, we let the participants use our system as we give them tasks to do and while they did that one member of the team observed and identified parts where the participants were lost or confused. We kept updating them with the situation and what was happening in the system on the surface of the system and ask them what would they do in that context. Learned from the first two heuristics, we tried not to provide implications on what should the next step be. However, as we tried not to provide too many details that might harm our result, we realized that we did not provide sufficient background details or context to help them best put themselves in the shoes of an actual user. We also found that we need to tell them more about their identities on how they are new to the city and do not really know much English to help them identify the possible flaws of our design. After the whole test, we asked the participants for feedback of our system as well as parts where they were confused or wished that it could have been done better.

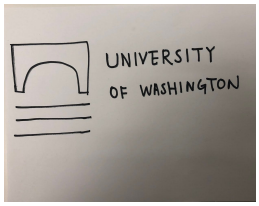
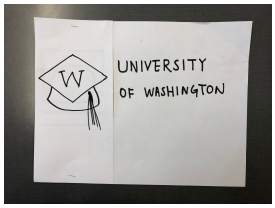
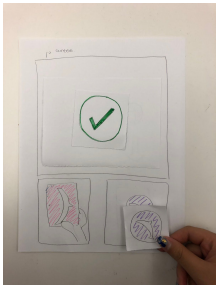
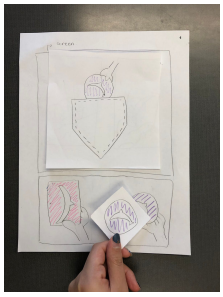
Testing Results

Heuristic Evaluation

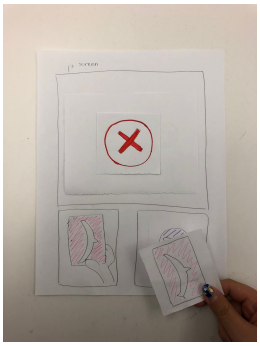
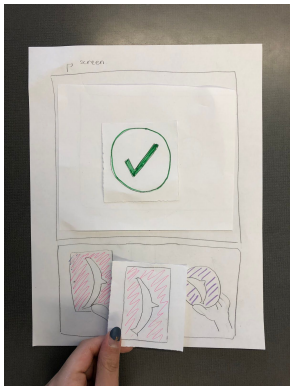
Image	Issue	Change	Fixed Image
	**Visibility of System Status on Map** On the map that shows the current train location and direction, it can be hard to tell if the indication is the current position or the next position	All the stops the train has been to will remain lit while the next stop will flicker. The rest of the stops that the train has not been to will remain un-lit.	
	**Help and Documentation** When buying a ticket, an uninformed user might not realize that a ticket is good for either the bus or the train. They might think they have to buy the correct ticket type	There will be another tutorial video specifically for bus transportation, but this beyond our problem and design	
	**Visibility of System Status on Flashing Pole** It might be hard to tell what it means for one icon be blinking versus the other. (bus vs. train)	Adding a visible number countdown to the estimated arrival time	
	**Matching between System and real world on Icons** If one does not know the destination (e.g. “Stadium”), it is hard to associate the icon with the destination they are going. A picture of the destination would be helpful.	*Fix 1:* The map would be interactive and the picture would pop up after one taps on the icon/text of a station.	

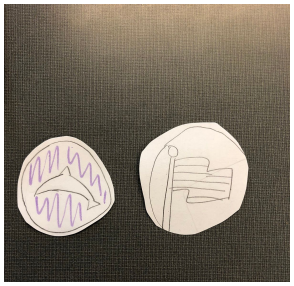
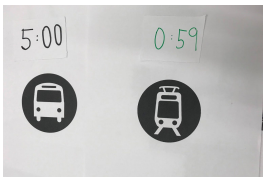
same image as above	**Matching between System and real world on Icons** *(continue)*	*Fix 2:* Include the icons on the sign on the platforms of each station and associates station names with the icon at all times.	

Usability Test 1

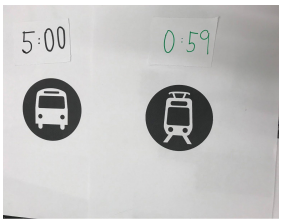
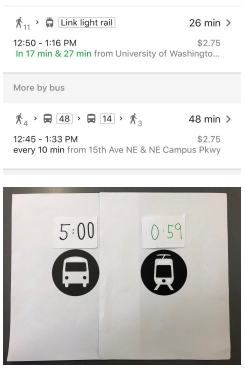
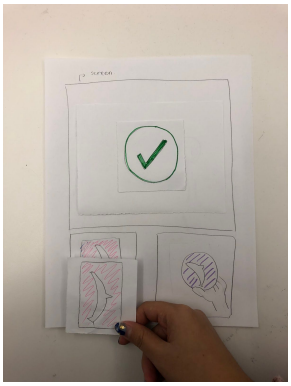
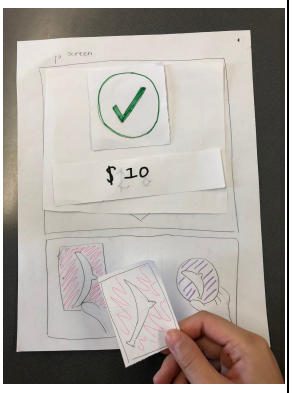
Before	Incident & Severity	After	Revision
	**[Negative | Severity: 3]** We currently utilize the existing set of icons that Link design but barely used, but the user indicates that the icons are too abstract and hard to distinguish		We decide to use a new set of icons that are more concrete and easily understandable
	**[Negative | Severity: 2]** The user is unsure if she needs to keep the ticket while taking the Link		We add additional animation showing one putting the token back to its bag on the gate screen.

Usability Test 2

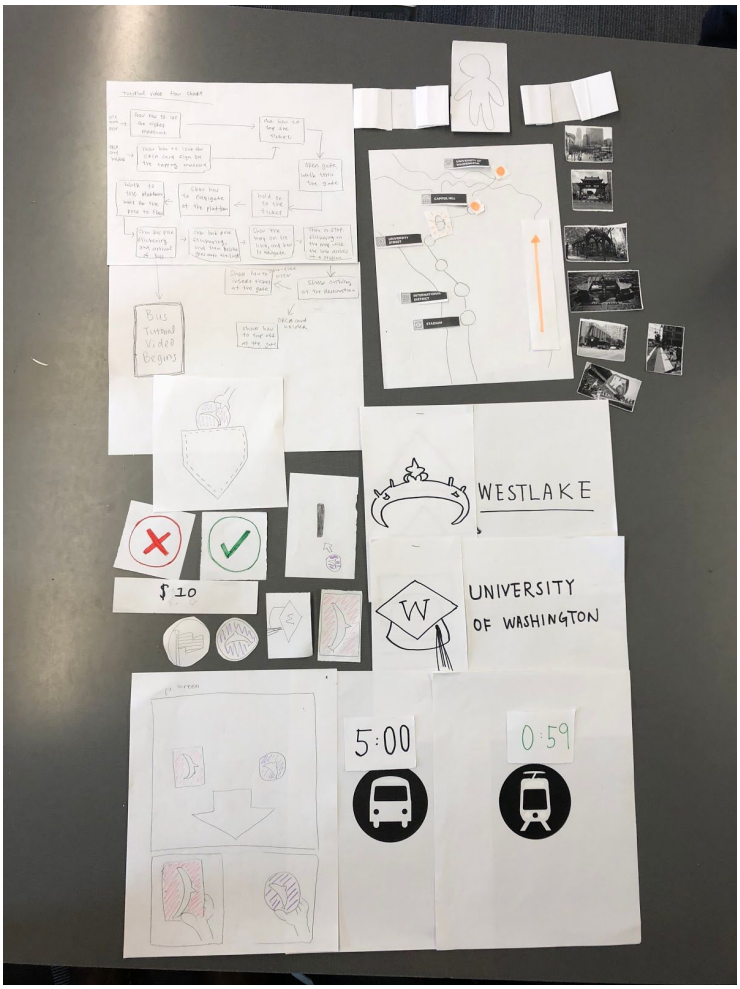
	**[Negative | Severity: 1]** The existence of two tapping areas for ORCA card and coin holder respectively sometimes confuse the riders yet they still are able to tap to the corresponding spot.		We merge the two areas for entering gate as there should not be any difference mechanism-wise.

	**[Negative | Severity: 3]** The user finds it inconvenient to have to walk up to the map and see which station they are currently at.		The ticket now updates real-time information about the current station on the back of the token so riders know where they without looking for a map in the car.
	**[Positive]** The user thinks the icons for the Link and the bus are very clear and self-explanatory	N/A	N/A

Usability Test 3

Before	Incident & Severity	After	Revision
	**[Negative | Severity 2]** The user mentions that it is almost impossible to associate the Link logo to the Link if it was his first time taking the link.		We modify the icons a bit to make it consistent to the ones on google map.
	**[Negative | Severity 3]** The user does not know how much he or she has spent on this trip or how much money remains on the Orca card.		We included the remaining balance on the screen for ORCA card users.

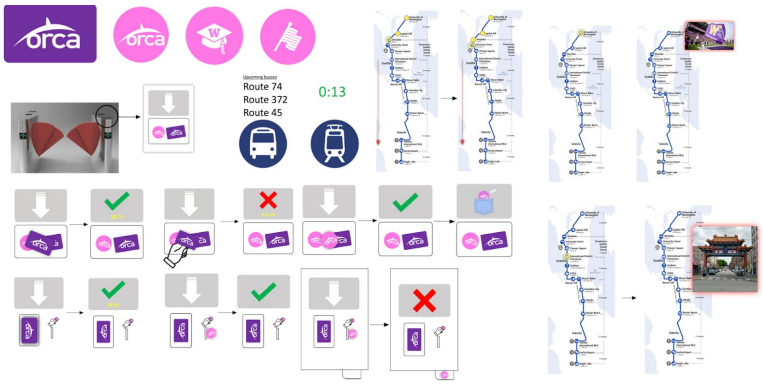
Final Paper Prototype



Our final paper prototype is shown on the right, and it has been significantly iterated upon since the original paper prototypes used for heuristic evaluations and usability testings. The majority of the changes can be found in testing result section, but as a brief highlight of what has been changed: 1) the map in the Link car now uses solid light to indicate the stations that have been passed and flashing light to indicate the following station, 2) the interface of the tapping machine displays the remaining balance in the ORCA card after tapping, and 3) the back of the ORCA coin now shows the embossed icon of the destination to remind one-time rider which stop they should get off.

To improve the task of guiding riders how the Link payment system works without knowing much English, the entry tapping machine now combines two different tapping areas, ORCA card and coin, into one to increase the flexibility. If an ORCA card is tapped, the screen will display the remaining balance in the card. If an ORCA coin is tapped, the screen will display an instructional image to remind the rider to keep the coin in his or her pocket. This way, the user does not have to go through trial and errors while trying to tap their ticket in the correct area, and the user will be informed to keep their one-time ticket during the trip. In regard to the task of helping riders navigate to their destination easily, we change the icon of each station to a more intuitive and relatable one, such as a graduation cap for the University of Washington station, and the user can now tap on the station on the map to see real photos of the area. Moreover, the use of solid light and flashing on the map make the passed stations and the following station distinguishable. In addition, the icon in the back of the ORCA coin now constantly reminds the rider their destination, so the rider can more easily recognize and match their destination to the according icon on the map.

Digital Mockup



For the digital mockup, we refined the visual design and added flowchart to better present the expected behavior of our design. The critical changes we made were that we added constraints to prevent incorrect payment. The system would not allow ORCA card holder with a negative balance to enter the gate, and it would stop one-time rider with ORCA coin from exiting at the wrong station by rejecting the coin and returning it via the coin outlet. In addition, concerning the budget of making a digital coin that provides real-time information of every station with a screen, we decided to use plastic embossed coins with icons of different destination and installed a chip in the coin that vibrates as a reminder when Link light rail is approaching such final station.

Task 1: Making correct payments at the right place and time

The interface on the physical gate is composed of a screen that shows information such as the status of the gate and the remaining balance on the ORCA card and a tapping/coin-inserting area. The gate will behave accordingly to ensure riders make correct payments and prevent possible wrongful behaviors. It will complain and show a red cross when riders 1) tap ORCA card with negative balance while entering, 2) tap ORCA card or coin at wrong area, and 3) insert ORCA coin at wrong destination stop that requires higher cost. Otherwise, the screen will show a green check mark and show any corresponding information such as remaining balance and instructions on keeping the coin.

Task 2: Identify the right public transportation on the right side of the station

Based on the feedback we received, we implemented the timer with expected waiting time for Link light rail and the bus routes in operation at the current station so the bus riders get to know what the upcoming buses are. The distinct functionality of Link light rail and buses provided by the poles also helps rider differentiate the poles for Link light rail and buses respectively. The interactive maps installed on platforms and in Link cars allow riders to get station information by tapping station icons. In particular, maps in Link cars also provide real-time station status (i.e. the current and following stop Link is headed).

Discussion

In the process of defining our design, we gained an understanding of how feedback can narrow the scope of our problem and designs. Our process can be seen as a process which included framing purposes, interviewing relevant users, reframing our purposes, defining our designs, conducting tests, and refining our designs. While what we learned was more generalized, we were able to experience the process of changing our purpose and designs accordingly in the process of actually doing it. We perceive the importance of repeatedly gathering thoughts from others and reframing our purposes and designs for improvements.

We adjusted our tasks as we interviewed users and did behavior mapping at the Link station. At first, we aimed to eliminate language barriers for non-English speakers and therefore we focused on somehow translating words for our users. However, after we interviewed a bus driver as well as bus and Link light rail riders, we realized that English speaking and reading ability was not the drainage divide for whether an individual can correctly use a public transportation. The determinant was actually if the person has learned the system from someone else yet, either by observation or by words from friends. Therefore, we changed our tasks from not only helping non-English speakers to understand the system but also making the system more intuitive such that non-English speakers can learn the system easily and not need to have uncertainty at any point during the process. The another change we made is that we decided to focus mainly on Link Light Rail instead of both buses and Link because we have discovered that the Link has a strict fare enforcement policy, more complicated payment system, and very few information desk staff, whereas the bus drivers are usually able to help the passengers when they have any problem with payments.

Also, as we were defining our design, we made a couple of changes based on the feedback from our usability tests. For example, we replace the unintuitive symbols with another set that had symbols that were more relatable to each one of the stations. We also implemented a timer feature to the stations indicating the waiting time for the next shift of link and buses because one of our users told us that the lights could have been more informative. We modified our panels at the gates as well as the ticket forms so that riders are able to get the information needed and complete the desired as simply as possible.

Regarding what we could have learned more about our design, we could aim more on quantity when we first brainstormed for ideas. We narrowed down our topic early on in our planning phase so instead of exploring more possibilities, we committed to a topic fairly quickly. We did modify and narrow our designs to be more tasks focused during the brainstorming activity in the session, but in the process, a lot of solutions that we came up correspond to the solutions that already exist. Therefore, one of the things that we could have explored more would be thinking more out of the box and perhaps seek for inspirations more.

Appendix

Usability Testing Script:

The steps we plan to use for our future usability tests are:

- Introduce our design and the purpose of our design
- Tell them that during this simulation, they will try to go from the University of Washington Station to Westlake Station by Link
- Tell them about the demonstration video and act out the demonstration video without talking
    - Show that there is a gate that blocks the way with the small figure we have
    - Show that if they had the orca card they will tap on the left side
    - Show that if they had the orca chip they will tap on the right side
    - Show that when a link is coming, the link light pole will start blinking
    - Show that while the link is moving, the station that is lit up will change as the link gets from station to station
    - Show that when the passengers leave they are supposed to tap on the left side of the machine if they have an orca card
    - Show that when the passengers leave they are supposed to insert the chip in the right side of the machine if they have an orca chip
- Tell them that the video is finished and that they have acquired an orca card now and they are standing right in front of a gate, ask them what they want to do right now
- Show them the machine interface and ask them to perform actions they feel appropriate to get through the gate
- Tell them they are at the platform now and there is a blinking light for one of the symbols, ask them if they want to get on (the bus will be blinking at this moment)
- Tell them it is blinking again (now it is the link blinking) and ask if they will get on it when it stops
- Show them the map and tell them they just left the University of Washington station, which station do they think will be coming up next
- Tell them that they have arrived now and that they are at the gates again, ask them what they would do now to get through the gate.
- Inform them that the test is over and thank them.