

## **Usability Evaluation: Expert Review**

Mobile application: *Transit App*

<https://transitapp.com/>

*Chhavi Kumar*

**1. What interface did you choose to evaluate? Why did you choose to evaluate it? What are specific aspects of the interface that you hope to learn more about?**

I chose to evaluate the Transit App; it is a mobile application that provides real-time location data of public transit systems by utilizing crowdsourcing data to get the location of trains and buses. The app works in more than 175 metropolitan areas around the world. The app displays a map with all the bus and train routes with stops in color-coded nodes and edges. It also provides detailed information on all the transit stops, and timing. It also provides users suggestions on which route they should take based on their current location and destination. The app uses crowdsourcing by requesting the users to complete a short and simple survey, asking about the punctuality, and crowding of the bus. The app has few gamified elements in the app which makes it more interactive and appealing to the users. One of the features of the app is that it has a leader's board of all its users and displays who has provided the most surveys and helped with data collection.

The transit app is also known to be somewhat popular with the students at UMD and is advertised as a reliable transit tracking tool to new students. Because of the combination of crowdsourcing and gamified elements, I want to understand if the users receive the complete information that they need. Because the app's purpose is to provide information on public transits, the information needs to be accurate and should be sufficient enough so the user can complete their original goal (reaching their destination on time). I am also curious if the users find the application engaging and have a positive user experience.

**2) Who would be the typical users for this type of interface? Please discuss their age, computing experience, computing environment, job responsibility, and education level.**

There is a range of users who would use this interface. Users who do not have a car or cannot drive would be one category of users who would typically use this interface. For computing experience, the typical user would need basic knowledge of navigating on a touchscreen phone to be able to use the application. The app is somewhat similar to google maps, so if any users have used Google Maps before, they should be able to navigate the app on a basic level. In my opinion, the age

range for the typical user would be from the age of 12 to age 65. However, the application's functions, layout, and aesthetic designs make it seem to be more targeted toward younger users, ideally between teenagers to adults (at least 30 years old). For job responsibility and education levels, the user does not need to have a high education level or high job responsibility since the app uses simple language and provides the information/instruction/directions mainly in a visual format, for example, maps, icons, timer display, etc. Moreover, for the job responsibility, the targeted audience would be students since they use public transportation more frequently than adults who usually have cars for transportation.

**3) Briefly describe some common tasks a user would perform using the interface including the task goals. Indicate which tasks you will be exploring with the evaluations and which you will not (e.g., not collecting personal health or financial information).**

Using any transit tracking app, the users have a few main task goals. One could be to arrive at a destination on time or to choose the correct transit route to arrive at the correct location. Another goal could be for the user to save money by opting for the cheaper transit option (i.e. choosing public transport over expensive Uber/Lyft/Taxi rides). The main purpose of the Transit app is to help users find the best bus or train route from their location to their destination.

The app has a range of functionalities that help the users achieve those goals. The Transit app uses the smartphone's GPS to track the users' location in real-time and provide transit/route options available near their location. Additionally, the GPS helps locate the different buses on the app's map and lets the users know how far the buses are from the user's location. The app also displays a timer for each bus route, notifying the users how much time it will take a bus to arrive at the user's starting stop.

The app also has a "Go/Stop" option, which is similar to Google Maps, and allows users to start their route navigation. This helps the users with a) making sure they are on the correct bus following the correct route and b) allowing the app to collect the user's location and share it with other users on the app. Once the user gets on the bus and starts the navigation, the timer switches to display a different timer (also assisted with voice notifications) that provides the user information on how much time it will take to arrive at their destination and when to get off.

Another feature of the Transit app that was already mentioned was the crowdsourcing feedback. It is the main data collection method used to track a) the crowd level and the punctuality of the bus, and b) provide the exact location of the buses in real-time using the user's smartphone GPS (when they are on the bus and using the Transit app). I intend to explore the usability of the navigation features provided by the app. I want to investigate if the users are able to understand and interact with the maps, directions/instructions, and other visual information in an effective manner.

I will not be analyzing the on the task of account and avatar creation (offered by the app to track leaderboard) since this is not one of the goals that the users are trying to achieve with the Transit App.

#### **4) Which set of heuristics did you use for the heuristic evaluation, and why did you choose those?**

I selected *Ben Schneiderman's 8 golden rules* for the heuristic evaluation:

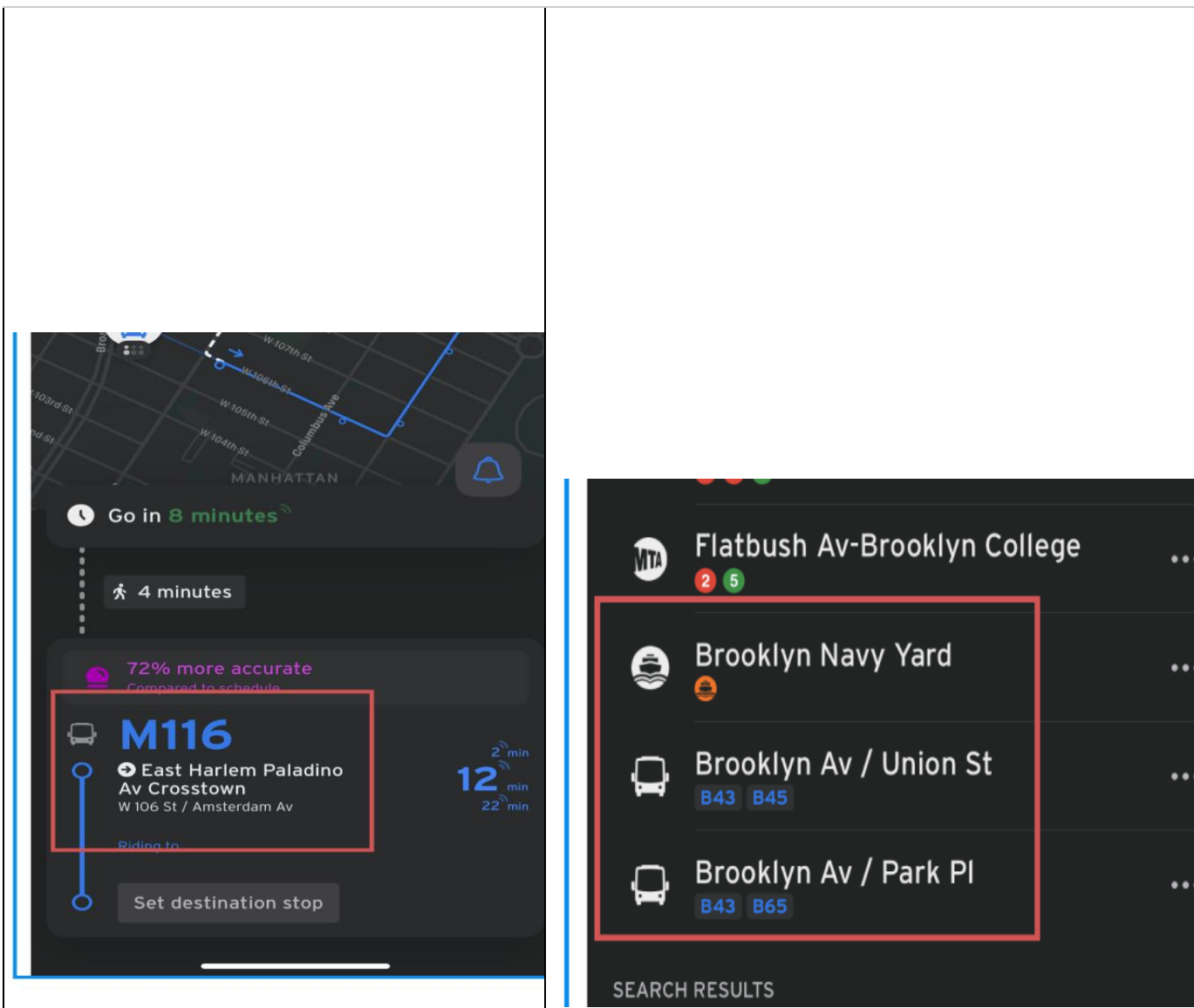
1. Strive for consistency.
2. Seek universal usability.
3. Offer informative feedback.
4. Design dialogs to yield closure.
5. Prevent errors.
6. Permit easy reversal of actions.
7. Keep users in control.
8. Reduce short-term memory load.

I chose the *Schneiderman's 8 golden rules* because I was already familiar with these heuristics and believe that it would provide sufficient information on the application evaluation. The *Schneiderman's 8 golden rules* is also the most commonly used rules used to evaluate interfaces as it applicable in most interactive system and compared to *Nielsen's 10 Heuristics*, it has fewer categories for interface evaluation. For a mobile app, I believe the *8 Golden Rules* would suffice to provide me with enough information, whereas *Nielsen's 10* might be redundant.

**5) From the results of the expert review, what interface problems did you discover? What suggestions do you have to improve each of these problems? Be specific as to which heuristic helped you discover the needed improvement.**

1. Strive for consistency.

Issues	Recommendation
<p>Most of the app's layout follow the same format throughout the app with only one exception. The following page is the exception that displays a time chart of all the transit options. This design out isn't too inconsistent and does aid to the needs of a diverse user group. Its described in a way that the only the locals would understand what the directions/labels mean (is it the bus # or the station name? ) this is mostly in the home/main page. it later provides a more/better informative page later.</p>	<p>I would suggest all pages to contain the same information throughout the UI layouts, that way the users would be able to familiarize themselves with the app quicker and use it more efficiently.</p>
Screenshots:	
Before	After



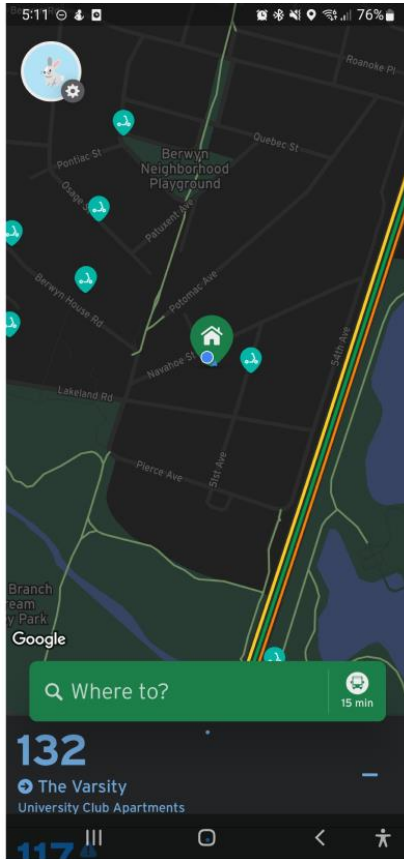
2. Seek universal usability.

Issue	Recommendation
<p>The app is designed differently from the popular/mainstream navigation tool like google maps. This makes the app innovative but not as intuitive to the users. It can be confusing for new users (even with high-level computing experience) to navigate within the app to find the information they are looking. For a fairly new UI layout, the app also provides the information in the most minimalistic and simple way, which</p>	<p>I would add a short tutorial of all for the features/pages/tools for the users. this would be help them understand the app quicker and better.</p>

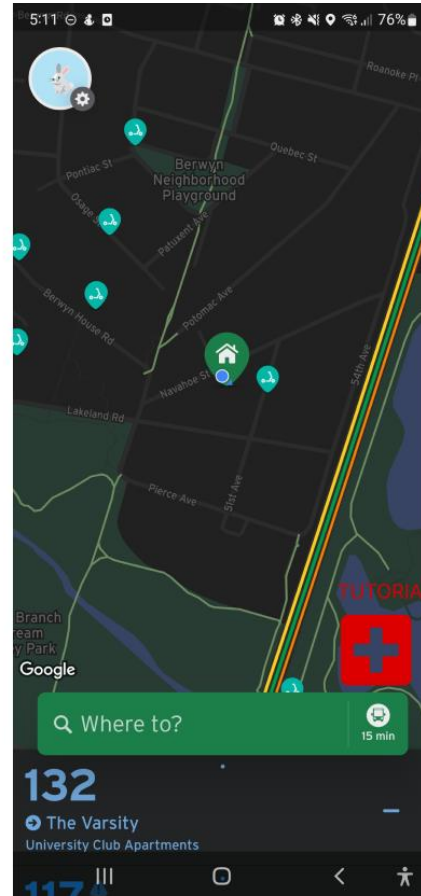
makes it even harder for users to use the app properly.

Screenshots:

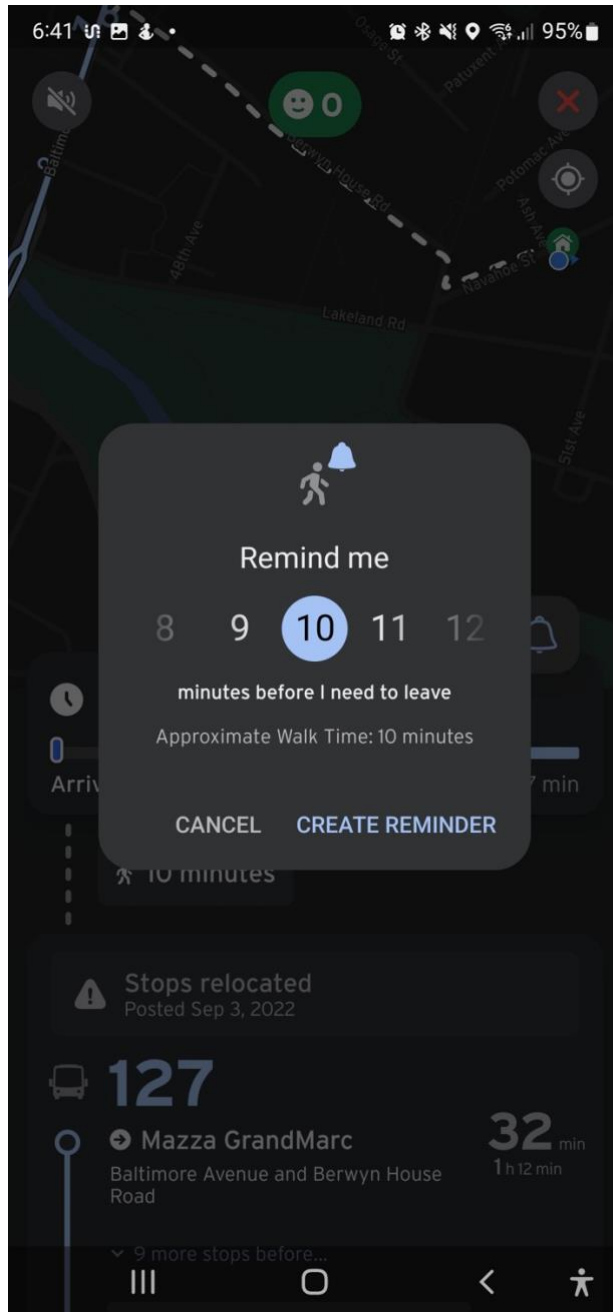
Before



After



3. Offer informative feedback: Provides user excellent informative feedback. The app offers various forms of feedback from vibration of touchscreen to proving timed notification in regard to the users destination/trip.

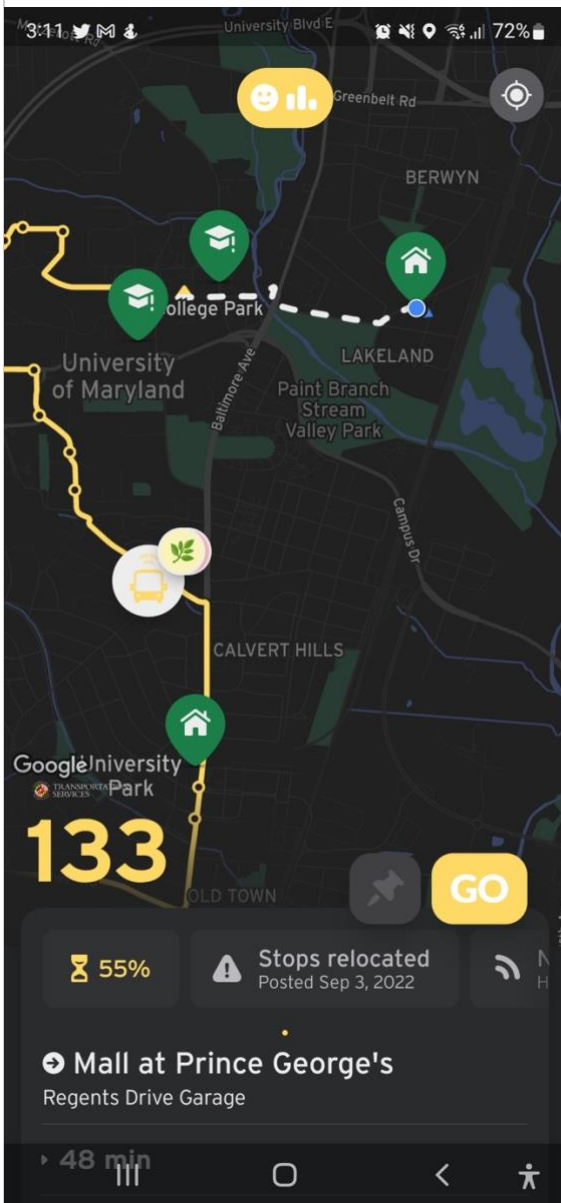


**4. Design dialogs to yield closure:** the app provides dialogues to let users know that their task has been completed. Once the user arrives at their end destination, the app provides a small notification to let the user know that the trip has come to an end.

Screenshots:

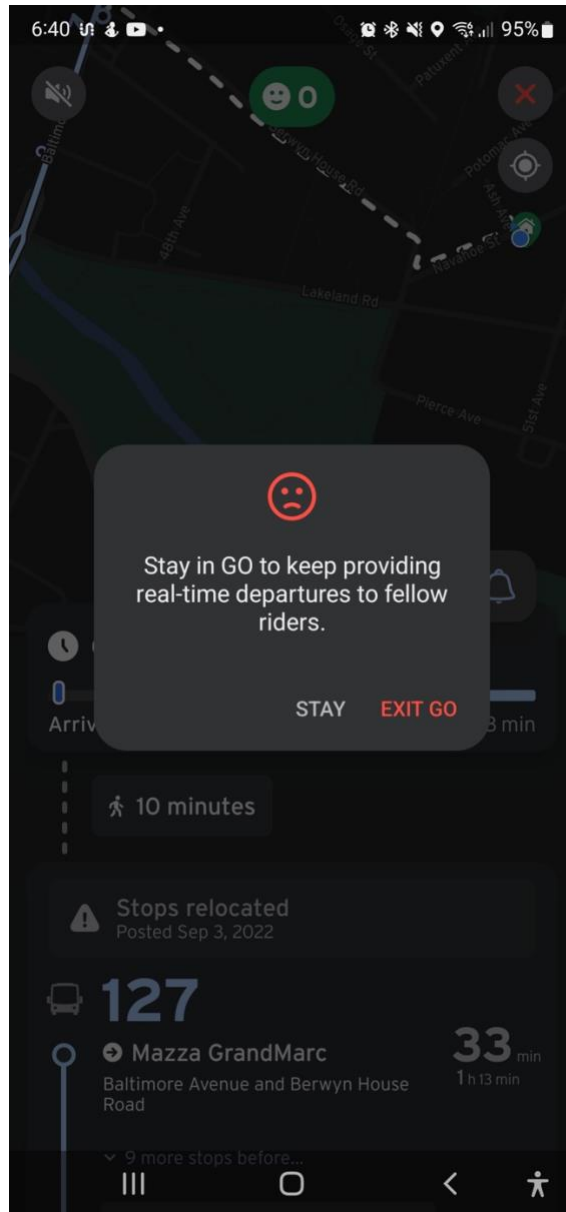


**5. Prevent errors:** The app allows the user to follow themselves on the map, which helps prevent user-based errors.



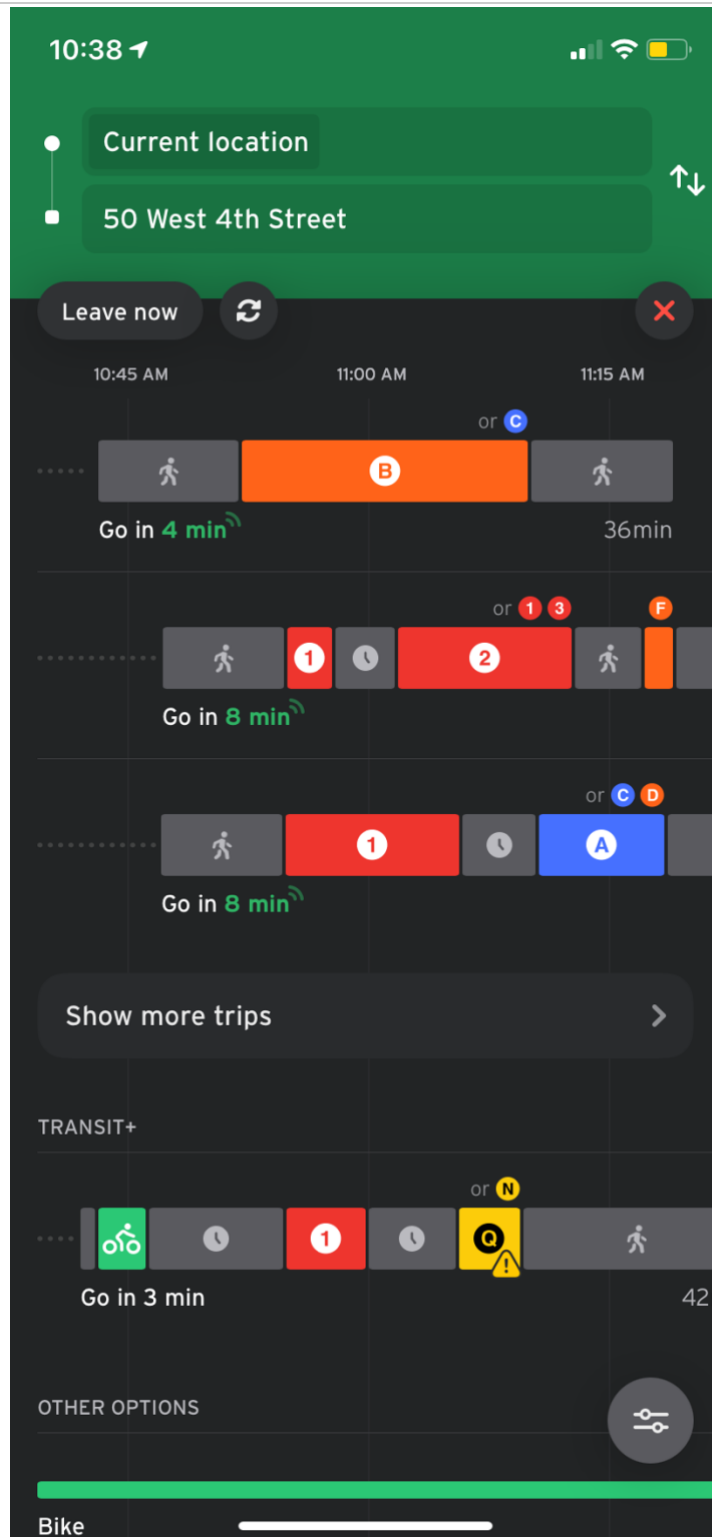
**6. Permit easy reversal of actions:** Users can easily navigate back and forth in the app and can reverse an action. One main feature is that a user can end a trip at any given time once they start it.

Screenshots:



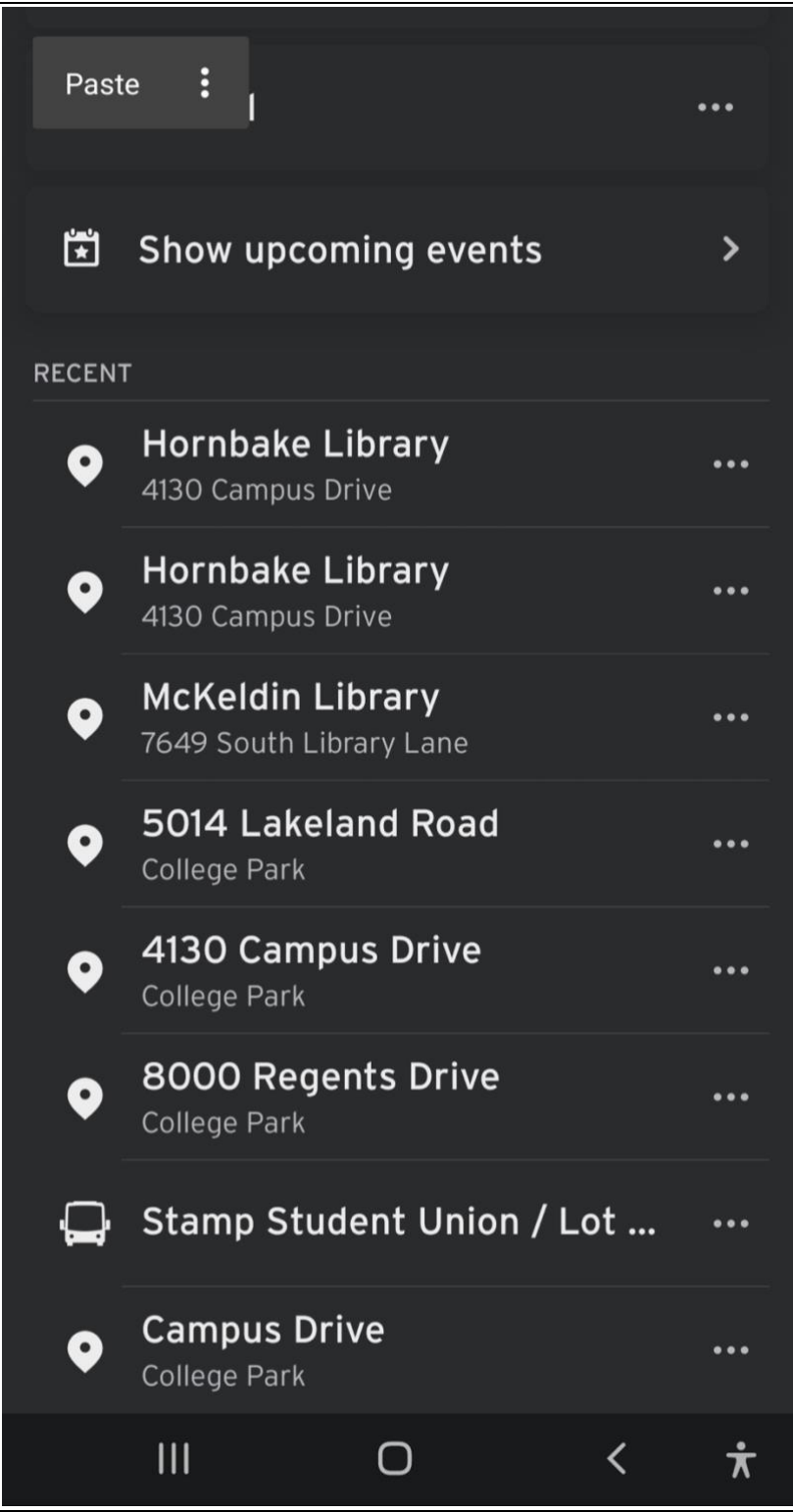
**7. Keep users in control:** The app provides the user with a time map with detailed information about the time it will take the user to walk/bus/taxi to their destination, which keeps the user in control

Screenshots:



**8. Reduce short-term memory load:** The app does a good job with reducing short-term memory load as it saves all destination location. It also has the feature of adding the destinations in a 'favorite' category, making it even easier for the user to add their destination even more quickly.

Screenshots:



## Usability Evaluation: User Testing

[ Transit App: <https://transitapp.com/> ]

*Chhavi Kumar*

### 1 Usability Study Methods

#### 1.1 Procedures

For the usability evaluation, I chose to evaluate the Transit App, a mobile application that provides information on all available public transit in the listed locations. Since it's a mobile application with no available web version, I decided to conduct moderated, in-person user testing to make it easier to observe users while interacting with the application. To perform the usability study for the transit app, I requested all users to download the app on their personal phones and interact with the application. I would give the users tasks to perform and make a note of the outcomes before moving on to the next task. I requested the users to talk out loud while they engaged with the app and describe their satisfaction or frustrations with the app as they performed each task.

I want to point out that most participants for this study were UMD students who already had the Transit App installed on their personal phones. However, all of them admitted being at a novice level with the Transit app since they either didn't rely on it frequently enough or didn't use it at all because they found Google Maps (or other alternative navigation/transit app) to be simpler to use.

For four out of the six participants (three main users and one pilot user), the testing environment was set in my home in the common area. While for the other two users, I decided to travel to their house since they lived out of state since it would have been difficult for them to travel to me. For the testing environment, I was only required to have a secluded, quiet area where I and the users could sit down together and perform the testing-observation tasks. I made sure that the testing area was quiet and free of any interruptions so the participants would not be distracted during the evaluation. For the two users who were located outside of Maryland, I made sure that the user's homes had an area where they felt comfortable doing the test and made sure to remove any distractions from the testing area before beginning the test.

The tools and devices used for the user testing were the following:

- **User's personal phone:** to use the Transit app on their phones for the evaluation.
- **Timer on my phone:** Used to record the time for each task performed
- **Laptop and notebook:** record notes on the user's success rate for each task and takes notes on their emotional level while they interacted with the app.

## 1.2 Recruitment

The user-testing had a total of six users participate in the evaluation. One of the users participated as a pilot user, and the other five as the main users. A majority of the users were recruited from the UMD campus while a couple of them were recruited from out of the Maryland area. The users were chosen from friends and acquaintances and were selected based on their interest level in either the study or in the Transit app itself. 1.3 Participants

## 1.3 Participants

The user testing took place from the 14th to the 18th of November, and the test was conducted in-person for all participants. The following is information on the participant demographics (please note, no real names are mentioned in the testing, the presented names are **Pseudonyms** and are only used for the purpose of this evaluation):

PID OR Pseudonym	Age	Gender	Education	Job	Technical Experience	Date of Eval
<i>Pilot:</i> Clara	24	Female	Completing Graduate-School	Grad-Student	<b>Technical:</b> Expert <b>Content:</b> Novice	14 <sup>th</sup> Nov
<i>Main:</i> Mavis	24	Female	Completing Graduate-School	Grad-Student	<b>Technical:</b> Competent <b>Content:</b> Competent	15 <sup>th</sup> Nov
<i>Main:</i> Anna	23	Female	Completing Graduate-School	Grad-Student	<b>Technical:</b> Competent <b>Content:</b> Novice	15 <sup>th</sup> Nov
<i>Main:</i> Polly	23	Female	Completing Graduate-School	Grad-Student	<b>Technical:</b> Competent <b>Content:</b> Novice	16 <sup>th</sup> Nov
<i>Main:</i> Abe	19	Male	Completed High School	Undergrad-student	<b>Technical:</b> Expert <b>Content:</b> Novice	18 <sup>th</sup> Nov
<i>Main:</i> Steven	25	Male	BA Degree	Accountant at a company	<b>Technical:</b> Expert <b>Content:</b> Novice	18 <sup>th</sup> Nov

I previously mentioned that the possible typical user for the application would be individuals who heavily rely on public transportation. That would mainly be adults without personal cars, and students who use public transportation for school. Furthermore, the application's functions, layout, and aesthetic designs seem to be targeted toward younger users, ideally between teenagers to adults (at least 30 years old). Based on this, a majority of the recruited users fall in the specified category as almost all of them were students and had some experience using alternative navigational and transit tools (Google Maps, Waze, government-owned transit websites).

A few of them owned personal cars and did not require to use public transportation. However, they mentioned that they used public transport occasionally due to personal reasons (Anna, Clara, and Steven owned personal cars). One participant (Steven) was an outlier as they were a working adult with a car and never relied on public transportation.

## 2 Usability Study Tasks

### 2.1 Pilot Study

The following is the initial task list that was tested out with the pilot user to test whether the task list was simple and concise enough for the main users to follow without any misunderstandings:

Task #	Description
1	Add the following information to the transit app
	a. Add “home” and “work” address to the transit app
	b. Add University of Maryland College park MD, USA in the favorites option
2	Turn off “Ridehail” and “Personal Bikes” from the transit’s filter options
3	Find active and inactive route/lines for the following locations:
	a. Your current location
	b. Mall at Prince George (3500 East-west Highway)
4	List all the stops for the following lines: (change the question use only bus)

	a. UMD Shuttle 132
	b. UMD Shuttle 116
5	Find the quickest route from UMD to New Carrollton Station
6	Disable everything except for the 'Bus' option from the app filter:
7	Choose an available bus line from your current location and start the route 1hr from the current time.
8	Create a reminder for route and set it to 5min prior to leaving.
9	Start the selected route and set the destination to its 5 <sup>th</sup> stop
10	Visit the transit website through the transit app.

After the pilot user testing, I realized that having sub-categories interfered with the flow of the testing, and the user would have trouble understanding the tasks. Therefore, I decided to break down the sub-categories into their own separate tasks to make it easier for the users. Furthermore, the pilot user pointed out that my task list was too focused UMD area. They suggested that navigations and searches for the tasks need to be more general so the users can use the app to its full potential.

Example: Task# 1 being broken down into two tasks and shifting the focus away from the UMD area:

- Task #1: Add your 'home' and 'work' address in the Transit App Locations
- Task #2: Add the city 'Boston, MA' to your Transit App Locations

The transit app's main function is to provide information on public transportation based on the user's location. However, it also has the function to search, filter, and get information on any lines/routes of any location if the user puts in the area they want to search for. I was intrigued by this and wanted to explore this more during the user testing and investigate if the users are able to use such features on their transit app. Therefore, I decided to add multiple tasks that were similar to one another, the only difference being the location the users would be searching for.

Example Task# 4: broken down into multiple tasks instead of having subcategories and also adding tasks more tasks like task#4:

- Task#4: List all the stops for line 86 (based in College Park, MD)



- Task#5: List all the stops for line F6 (based in College Park, MD)
- Task#6: List all the stops for MBTA BL (based in Boston, MD)
- Task# 7: List all the stops for Framingham/Worcester rail (based in Boston, MA)

As a result of these improvements, I obtained more than the required 10 tasks lists.

## 2.2 Usability Tasks

**Task#1:** Add “home” and “work” address to the transit app.

**Task#2:** Add Boston MA, USA and College park MD, USA in the favorites option.

**Task#3:** Turn off “Ridehail” and “Personal Bikes” from the transit’s filter options.

**Task#4:** Find all active and inactive route/lines from your current location.

**Task#5:** Find all active and inactive route/lines from Mall at Prince George (*Address: 3500 East-west Highway*)

**Task#6:** Find all Active and inactive route/lines from Boston South Station (*Address:700 Atlantic Ave*)

**Task#7:** List all stops for Bus 86 (*Based in College Park, MD*)

**Task#8:** List all stops for Bus F6 (*Based in College Park, MD*)

**Task#9:** List all stops for MBTA Framingham/Worcester (*Based in Boston, MA*)

**Task#10:** List all stops for Bus MBTA BL (*Based in Boston, MA*)

**Task#11:** Find the quickest route from your home to work.

**Task#12:** Find the quickest route from New Carrollton Station, MD, USA to 701 first street northeast, Washington DC, USA

**Task#13:** Disable everything except for the ‘Bus’ option from the app filter

**Task#14:** Choose an available bus line from your current location and start the route 1hr from the current time.

**Task#15:** Create a reminder for route and set it to 5min prior to leaving.

**Task#16:** Start the selected route and set the destination to its 5<sup>th</sup> stop

**Task#17:** Visit the public transit website listed in the transit app

## 2.3 Task List Rationale

The task-list was generated based on a variety of navigation functions that was available in the

The task-list was generated based on a variety of navigation functions that were available in the application. I focused on tasks and goals that related to navigation, direction, and clarity of information provided by the app to aid users with their goal to reach their correct final destination and punctuality and if the application was user-friendly/user intuitive. Some features that were reviewed for the evaluation: app filters, favorite lists, reminders, visual maps, etc.

These tasks were important as it helped me understand if users were (a) able to understand all the features and (b) if they were able to use them successfully to perform the navigation-related tasks. To test the usability of the tasks, I first ran the tasks myself multiple times to ensure that each task was simple enough to follow. I then ran a pilot tester Clara to perform the tasks while I observed. After the pilot test, I received a couple of feedback from Clara regarding the language used for the tasks and the level of effort/demand each task required. I made final tweaks in a couple of the tasks to ensure that the main user testers would be able to understand and attempt the tasks with as minimal misunderstanding as possible.

## 3 Results

All testing for the usability evaluation took between 25-40 min. the following is the data for each user and how much time was taken to complete the usability testing:

Users	Time taken
Mavis:	38 min
Anna:	30 min
Polly:	35 min
Abe:	25 Min
Steven:	40min
<b>Average time:</b>	<b>33.6 min</b>

## Task Summary:

**Task#1:** [Add “home” and “work” address to the transit app.]

- **Overall Task Summary:** this task took between 30 seconds to 1 minute and 57second (with an average of 51.8 seconds)
- **Overall Participant Behaviors:** all participants were successful in completing the first task and almost all participants were able to figure out the pathway for adding their home and work addresses to the app. Steven took longer than average users because they made a mistake initially when adding their address (spelling mistake) and were not able to figure out how to correct the mistake (a different path needs to be taken to re-add the home address). Eventually, Steven corrected his mistake and completed the task successfully

**Task#2:** [Add Boston MA, USA and College park MD, USA in the favorites option.]

- **Overall Task Summary:** this task took between 45 seconds to 2 minutes and 7second (with an average of 80.6 seconds or 1 minute and 20.6 seconds)
- **Overall Participant Behaviors:** 4 out of 5 users were able to complete the task successfully: Users Mavis, Anna, Abe, and Steven. Most participants struggled with this task and were initially confused about how to add locations to their favorites. Except for User Mavis, all other users were looking at the incorrect path to complete the task. Eventually, all users, except for Polly, were able to figure out the correct path and completed the task. Polly was not able to figure out the correct path and after multiple attempts, they gave up on the task and decided to move on.

**Task#3:** [Turn off “Ridehail” and “Personal Bikes” from the transit’s filter options.]

- **Overall Task Summary:** This task took between 8 seconds to 1 minute and 33 seconds (with an average of 38.6 seconds).

**Overall Participant Behaviors:** Only 3 out 5 users were able to complete the task successfully: Users Mavis, Polly, and Steven. User Anna misunderstood the task and turned off the wrong options in the filter, even though she was able to find the correct path. User Abe was unable to complete the task at all as he was struggling to find the correct path to get to the options setting, and after multiple attempts, he finally gave up after 1min and 33sec and decided to move on to the next task.

**Task#4:** [Find all active and inactive routes/lines from your current location.]

- **Overall Task Summary:** This task took between 10 seconds to 1 minute and 10 seconds (with an average of 32 seconds).
- **Overall Participant Behaviors:** 4 out of 5 users completed this task successfully: Users Mavis, Polly, Abe, and Steven. User Anna was able to

find the active routes for her current location but wasn't able to find the inactive line, she presumed that she completed the task. If Anna took more time with the task, they would have been able to locate the inactive lines and would have completed the task successfully like other users. Other than user Anna, all users found this task to be fairly easy and simple to complete.

**Task#5:** [Find all active and inactive route/lines from Mall at Prince George (*Address: 3500 East-west Highway*)]

- **Overall Task Summary:** This task took between 10 seconds to 1 minute and 37 seconds (with an average of 57.6 seconds).
- **Overall Participant Behaviors:** 3 out of 5 users were able to complete this task successfully: Users Anna, Abe, and Steven. User Mavis and Polly were unable to complete the task as they struggled to find the correct path for locating all active and inactive routes for the given location. Even with a success rate of 3 out of 5, 3 users (Mavis, Anna, and Polly) struggled a bit in finding the information. Anna eventually used a different path to find the information (locating the address directly on the map instead of using the search bar). Users Abe and Steven were able to quickly figure out the correct features to use to find the needed information.

**Task#6:** [Find all Active and inactive route/lines from Boston South Station (*Address: 700 Atlantic Ave*)]

- **Overall Task Summary:** This task took between 10 seconds to 1 minute and 24 seconds (with an average of 31.2 seconds).
- **Overall Participant Behaviors:** after task# 5, 4 out of 5 users were able to complete this task, and in a much shorter time: Users Mavis, Anna, Abe, and Steven. User Polly was the only user who was not able to complete the task. The reasoning behind this is related to task Task#2 [Add Boston MA, USA and College park MD, USA in the favorites option]. Since Polly wasn't able to complete task 2 and add Boston as one of their favorite locations in the app, she was having a much more difficult time finding the given address (which is set in Boston). The Transit app saves all the locations that the users add to their favorites and can provide all transit-related information on those locations. Because of user Polly's unsuccessful completion of task 2, their success rate for this task was affected.

**Task#7:** [List all stops for Bus 86 (*Based in College Park, MD*)]

- **Overall Task Summary:** This task took between 14 seconds to 1 minute (with an average of 29.6 seconds).
- **Overall Participant Behaviors:** only 2 out of 5 users were able to successfully complete this task: Users Polly and Steven. User Abe made a few attempts in finding the information before giving up at 30 seconds, as he could not figure out what method/pathway to use other than the search

bar. Users Anna and Mavis assumed that they completed the task successfully, however they failed to realize that they found the information for the wrong bus (they both found line 86 based in Boston instead of College park).

**Task#8:** [List all stops for Bus F6 (*Based in College Park, MD*)]

- **Overall Task Summary:** This task took between 8 seconds to 1 minute (with an average of 26 seconds).
- **Overall Participant Behaviors:** 3 out of 5 users were able to complete the task successfully: Users Anna, Polly, and Steven. Users Mavis and Abe tried using the search bar to locate the information for the specified bus but were not getting the correct output from the application. Eventually, they both gave up and decided to give up and move on to the next task. User Abe gave up much quicker since he was facing the same issue in the previous task and was convinced that there isn't a way to get the information for Bus F6.

**Task#9:** [List all stops for MBTA Framingham/Worcester (*Based in Boston, MA*)]

- **Overall Task Summary:** This task took between 12 seconds to 1 minute (with an average of 37.2 seconds).
- **Overall Participant Behaviors:** 3 out of 5 users were able to complete the task successfully: Users Mavis, Anna, and Steven. Users Polly and Abe were not able to find the bus line. Abe was still struggling to find the correct pathway to find the bus lines on the app whereas Polly was facing the same issue as task#6. Since she did not save Boston as a favorite in her Transit app, the app wasn't able to provide her with the needed information on the Boston routes.

**Task#10:** [List all stops for Bus MBTA BL (*Based in Boston, MA*)]

- **Overall Task Summary:** This task took between 12 seconds to 2 minutes and 48 seconds (with an average of 63 seconds or 1 minute and 3 seconds).
- **Overall Participant Behaviors:** 4 out of 5 users were able to complete the task successfully: Users Mavis, Anna, Abe, and Steven. User Abe finally realized that in order to find a bus or transit line for an area different than their current location, they first need to search the location on the map and then input the desired transit line. User Polly faced the same issue as task#9 since she didn't add Boston to her transit app's favorite location and was getting a bit frustrated with the results.

**Task#11:** [Find the quickest route from your home to work.]

- **Overall Task Summary:** This task took between 19 seconds to 1 minute and 26 seconds (with an average of 53.8 seconds).

- **Overall Participant Behaviors:** 2 out of 5 users were able to complete this task successfully: user Mavis, Polly, and Steven. For Steven, there was an unexpected output from the app displaying that there is no available route from his home to his work location. This is due to the fact there is a limited number of buses running in the area he lives in (a car-reliant area). He was able to find the correct pathway to find the information, but the Transit app did not have enough information about his location. Both users Anna and Abe were able to find the correct pathway to get the information, however, they both failed to identify the quickest route.

**Task#12:** [Find the quickest route from New Carrollton Station, MD, USA to 701 first street northeast, Washington DC, USA]

- **Overall Task Summary:** This task took between 33 seconds to 1 minute and 6 seconds (with an average of 51.2 seconds).
- **Overall Participant Behaviors:** All users were able to complete the task successfully and were able to identify the correct route. This task is deemed to be an easy task by the users.

**Task#13:** [Disable everything except for the 'Bus' option from the app filter]

- **Overall Task Summary:** This task took between 9 seconds to 30 seconds (with an average of 15.8 seconds).
- **Overall Participant Behaviors:** All users were able to successfully complete the task and most took a minimum amount of time. Around this time, User Abe finally figured out Task#3 since both task#3 and Task#13 share the same pathway.

**Task#14:** [Choose an available bus line from your current location and start the route 1hr from the current time].

- **Overall Task Summary:** This task took between 25 seconds to 1 minute and 33 seconds (with an average of 43.6 seconds).
- **Overall Participant Behaviors:** 3 out of 5 users were able to complete the task successfully: User Mavis, Anna, and Abe. User Polly was able to find a route and choose a departure time 1 hour from the current time, however, she was not able to start the route as she didn't realize that the app had a start button to initiate the selected route. Steven was able to find the correct pathway for this task, however, the app presented an unexpected output. Since Steven lives in a car-reliant area, there were no active bus lines available for him to perform the task on.

**Task#15:** [Create a reminder for the route and set it to 5min prior to leaving.]

- **Overall Task Summary:** This task took between 6 seconds to 59 seconds (with an average of 23.8 seconds).

- **Overall Participant Behaviors:** 3 out of 5 users were able to complete this task successfully: users Mavis, Anna, and Abe. Since Polly did not start the route for Task#15, she wasn't able to find the 'reminder' button which appears after the user starts their route. Steven also wasn't able to complete the task due to the unexpected output from the app, again due to the unavailable active lines in his area.

**Task#16:** [Start the selected route and set the destination to its 5th stop]

- **Overall Task Summary:** This task took between 10 seconds to 1 minute and 15 seconds (with an average of 41 seconds).
- **Overall Participant Behaviors:** 3 out of 5 users were able to complete this task successfully: users Mavis, Anna, and Abe. Polly was able to find the path which allows the user to select their destination, however, she wasn't able to actually set the destination for the task. For Steven, even though he wasn't able to start the route, he was still able to find the path that allows user to set their destination. But again, due to unexpected app output, the app didn't allow Steven to set his desired destination for the selected route.

**Task#17:** [Visit the public transit website listed in the transit app.]

- **Overall Task Summary:** This task took between 20 seconds to 48 seconds (with an average of 38.2 seconds).
- **Overall Participant Behaviors:** 2 out of 5 users were able to complete the task successfully (Polly and Steven) while the other 2 failed to complete the task (Mavis and Anna) and 1 experienced an unexpected output from the app (Abe). Mavis and Anna were unable to correctly identify the public transit site and opened the link to the Transit app instead. While for Abe, there was no public transit website listed on his transit app.

After evaluating the user testing, I identified few tasks that the users struggled with the most. Any task that had more than one user fail the task, I categorized them as difficult tasks for the users. Therefore, task# 3, Task# 5, Task# 7, Task# 8, Task# 9, task# 11, and task# 17. I did not take tasks with unexpected app output into consideration for this since the users were able to identify the pathway but weren't able to perform/complete the task due to the error/unexpected results in the app itself. The users also displayed a considerable amount of frustrations for these tasks during user testing and were not happy with how complex the app was and the number to clicks it took them to figure out the features. One user specifically said that "this app has too many unnecessary features which over-complicates the process", while another user expressed amazement for all the valuable feature the app had but never got to try before the user testing.

**Table 1: Raw User Testing Data:**

Legend: Success = **S**; Attempted but failed = **AF**; Data Not Available = **DNA**

\*Please note, that since all users attempted all the tasks, I did not have a legend for “Did not Attempt”

Task#	TASK LIST	Mavis	Anna	Polly	Abe	Steven
1	Add “home” and “work” address to the transit app.	S	S	S	S	S
	TIME	46 sec	36 sec	30 sec	30 sec	1min 57 sec
2	Add Boston MA, USA and College park MD, USA in the favorites option.	S	S	AF	S	S
	TIME	45 sec	1 min 10 sec	1 min 11 sec	1 min 30 sec	2min 7 sec
3	Turn off “Ridehail” and “Personal Bikes” from the transit’s filter options.	S	AF	S	AF	S
	TIME	17 sec	26 sec	8 sec	1 min 33 sec	49 Sec
4	Find all active and inactive route/lines from your current location.	S	AF	S	S	S
	TIME	1 min 10 sec	19 sec	43sec	10 sec	18 sec
5	Find all active and inactive route/lines from Mall at Prince George ( <i>Address: 3500 East-west Highway</i> )	AF	S	AF	S	S
	TIME	1 min 13 sec	1 min 37 sec	1 min 28 sec	10 sec	20 sec
6	Find all Active and inactive route/lines from Boston South Station ( <i>Address:700 Atlantic Ave</i> )	S	S	AF	S	S
	TIME	15 sec	32 sec	1 min 24 sec	10 sec	15 sec
7	List all stops for Bus 86 ( <i>Based in College Park, MD</i> )	AF	AF	S	AF	S
	TIME	1 min	16 sec	28 sec	30 Sec	14 sec
8	List all stops for Bus F6 ( <i>Based in College Park, MD</i> )	AF	S	S	AF	S



	TIME	1 min	35 sec	8 sec	15 Sec	12 Sec
9	List all stops for MBTA Framingham/Worcester (Based in Boston, MA)	S	S	AF	AF	S
	TIME	20 sec	55 sec	1min	12 Sec	39 Sec
10	List all stops for Bus MBTA BL (Based in Boston, MA)	S	S	AF	S	S
	TIME	15 sec	12 sec	1min 30 sec	30 Sec	2 min 48 sec
11	Find the quickest route from your home to work.	S	AF	S	AF	S (Data not available)
	TIME	55 sec	45 sec	1min 26sec	1 min 4 sec	19 sec
12	Find the quickest route from New Carrollton Station, MD, USA to 701 first street northeast, Washington DC, USA	S	S	S	S	S
	TIME	52 Sec	45 sec	1min 6 sec	1 min	33 sec
13	Disable everything except for the 'Bus' option from the app filter	S	S	S	S	S
	TIME	10 sec	10 sec	30 sec	20 sec	9 sec
14	Choose an available bus line from your current location and start the route 1hr from the current time.	S	S	AF	S	DNA
	TIME	27 sec	25 sec	28 sec	45sec	1 min 33 sec
15	Create a reminder for route and set it to 5min prior to leaving.	s	S	AF	S	DNA
	TIME	6 sec	13 sec	59 sec	20 sec	21 sec
16	Start the selected route and set the destination to its 5 <sup>th</sup> stop	S	S	AF	S	DNA
	TIME	10 sec	39 sec	1 min 15 sec	20 sec	1min 1 sec
17	Visit the public transit website listed in the transit app	AF	AF	S	DNA	S
	TIME	30 sec	48 sec	45sec	20 sec	48 sec

**Table 2: Task Time**

PID OR Pseudonym	Task numbers																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Mavis	46 sec	45 sec	17 sec	1 min 10 sec	1 min 13 sec	15 sec	1 min	1 min	20 sec	15 sec	55 sec	52 sec	10 sec	27 sec	6 sec	10 sec	30 sec
Anna	36 sec	1 min 10 sec	26 sec	19 sec	1 min 37 sec	32 sec	16 sec	35 sec	55 sec	12 sec	45 sec	45 sec	10 sec	25 sec	13 sec	39 sec	48 sec
Polly	30 sec	1 min 11 sec	8 sec	43 sec	1 min 28 sec	1 min 24 sec	28 sec	8 sec	1 min	1 min 30 sec	1 min 26 sec	1 min 6 sec	30 sec	28 sec	59 sec	1 min 15 sec	45 sec
Abe	30 sec	1 min 30 sec	1 min 33 sec	10 sec	10 sec	10 sec	30 sec	15 sec	12 sec	30 sec	1 min 4 sec	1 min	20 sec	45 sec	20 sec	20 sec	20 sec
Steven	1 min 57 sec	2 min 7 sec	49 sec	18 sec	20 sec	15 sec	14 sec	12 sec	39 sec	2min 48 sec	19 sec	33 sec	9 sec	1 min 33 sec	21 sec	1 min 1sec	48 sec

**Table 3: Task Performance:**

**Legend:** 1 =Successfully Completed Task; 2 = Attempted, but did not Complete Task; 3 = Did not Attempt Task; \* = unexpected output from the app

PID OR Pseudonym	Task numbers																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Mavis	1	1	1	1	2	1	2	2	1	1	1	1	1	1	1	1	2
Anna	1	1	2	2	1	1	2	1	1	1	2	1	1	1	1	1	2
Polly	1	2	1	1	2	2	1	1	2	2	1	1	1	2	2	2	1
Abe	1	1	2	1	1	1	2	2	2	2	2	1	1	1	1	1	*
Steven	1	1	1	1	1	1	1	1	1	1	*	1	1	*	*	*	1

## 4 Discussion

### 4.1 Problems

From the mentioned tasks in the 'Results' section, I could identify the problem areas for the app, which are the following:

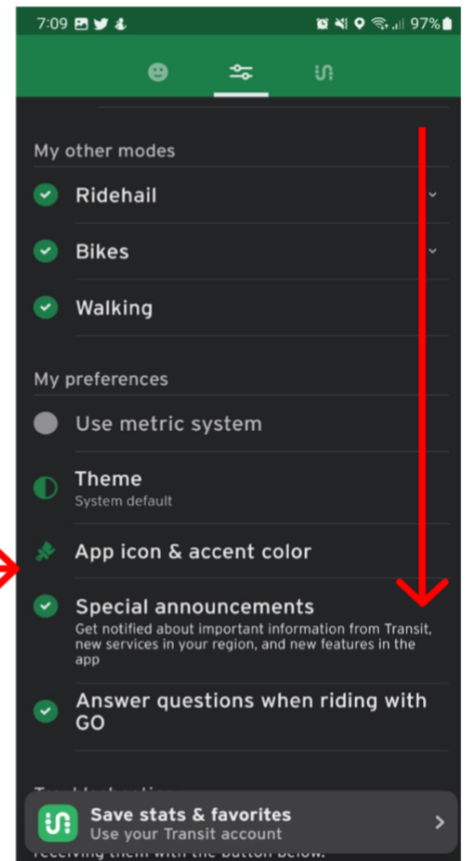
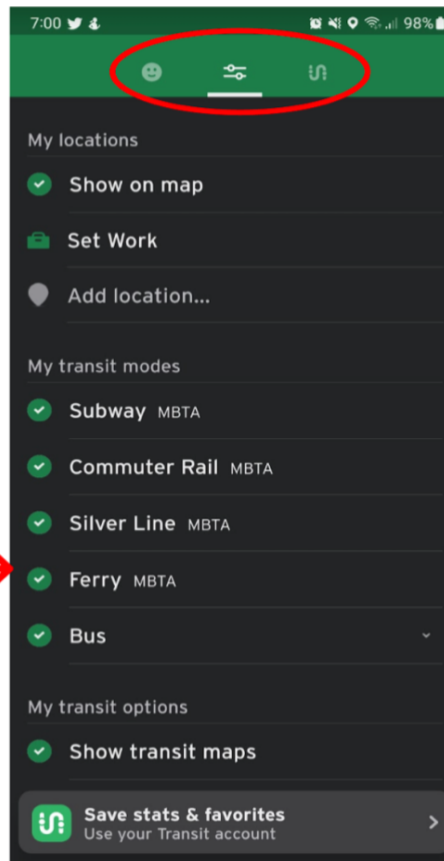
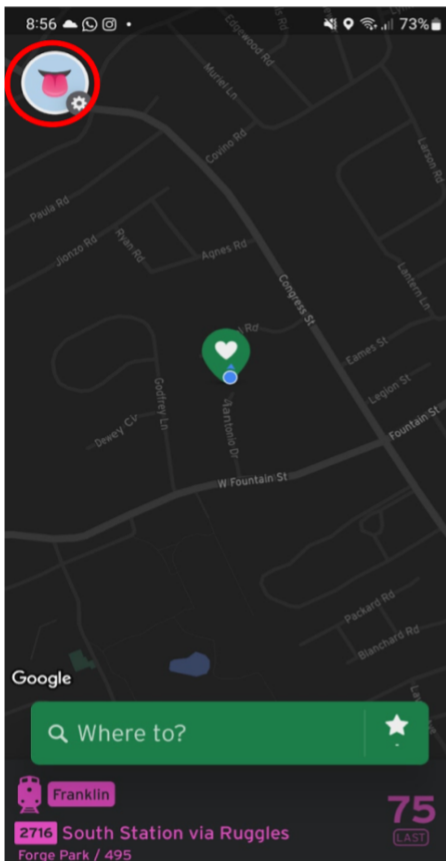
- Transit app's 'setting/filter' page
- Transit app's 'more options' icon.
- Transit app's search bar input and results.
- Transit app's visual time map

The issues identified are related to Ben Schneiderman's rules for 'Keeping Users in Control' and 'Preventing Error'.

#### **Transit App Settings/Filter page:**

This issue falls under 'Keeping Users in Control' From Ben Schneiderman's 8 Golden Rule. During the user usability testing, I noticed that 4 out of 5 users were struggling to locate the settings and filter page. This page is quite important as it has the option to add the user's home address, work address, and other favorite locations. It also has the

feature to filter transit options like 'subway', 'rail', 'bus', 'ferry', and more. The problem with the settings and filter button is that (a) the settings button is not obvious enough, and (b) the filter option is hidden in the setting menu which confuses the users.



**Setting Button:** the setting button of the app is marked in red. As shown in the screenshot, the setting icon is attached to the bottom of the user's avatar profile picture (pfp). The icon itself is extremely small and hard to notice. A majority of the user mistook the setting button as just a 'user profile' button and didn't think of clicking on it for any filter-related task initially.

When the users finally did click on the setting button, they had a hard time finding the filter option on the page.

**Filter page:** the setting page has three options on the top of the app marked in red. The options are, from left to right: General User Account (links to Uber and Lyft account and saved favorite transit lines), Filter options, and More Info on Transit App. The user faces the same issue as the setting icon, all icons presented are too small for the users to notice, and hence it takes them much longer to figure out how to filter options.

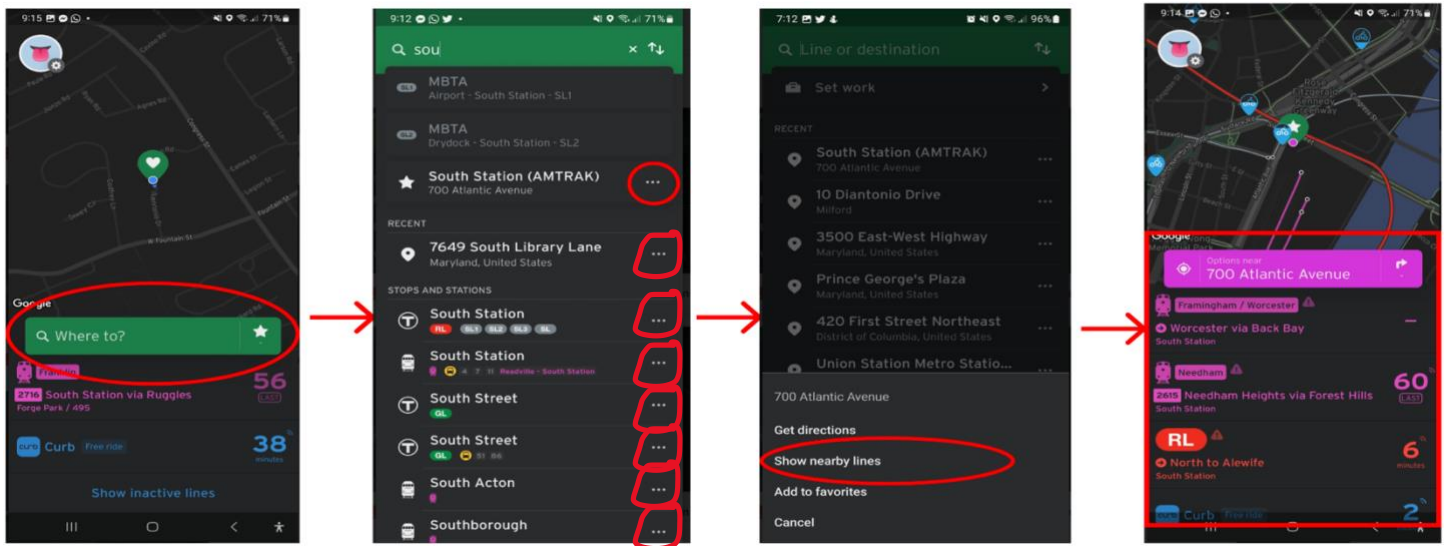
As shown in the screenshot, the filter page contains the 'work' and 'home' addresses, the transit mode filter option (continued in next screenshot).

**Filter page continued:** When the user scrolls further down in the filter page, they find other modes of transportation like 'ridehail', 'bikes', 'walking'. This page also has the option to set the theme and app accent color for the user's personal transit app.

The settings and filter page is essential information that the users should know and be able to find easily. The page needs to be displayed in a more obvious way to make it easier for the user to find and be more user intuitive.

### Transit app's 'More Options' Icon:

This issue falls under 'Keeping Users in Control' From Ben Schneiderman's 8 Golden Rule. During the user usability testing, the majority of the users were unable to find the correct pathway to get information on 'all available transit lines' of locations other than their current locations. The Transit app is designed in a way that is similar to Google Maps where it provides all the necessary information for any transit mode. However, the features work a lot differently than Google Maps, which the users were aware of, nor did they have any means of knowing that. Users assumed that if they simply search a given address, the Transit app would automatically provide them with all available transit lines and options. This is incorrect, the app provides available transit options for locations that are further away from the user's current location. For example, if the user is in College Park, MD, and searching for transit options for Boston, the app automatically presents all available options. However, if the user is in College Park, MD, and searching for transit options for New Carrollton, MD, the app would take the user to a different page providing them the route options to get to New Carrollton (the task is to find options near New Carrollton, not find options that will take you to New Carrollton). This is a valuable feature for the users, but unfortunately, because of the small 'options' icon, the users neglect the button and are unable to complete the task correctly. Following is the pathway with the listed issue:



The user uses the search bar to either located the address or the bus line. Search bar is selected in red.

(In this instance, the user is searching for 'Boston South Station AMTRAK')

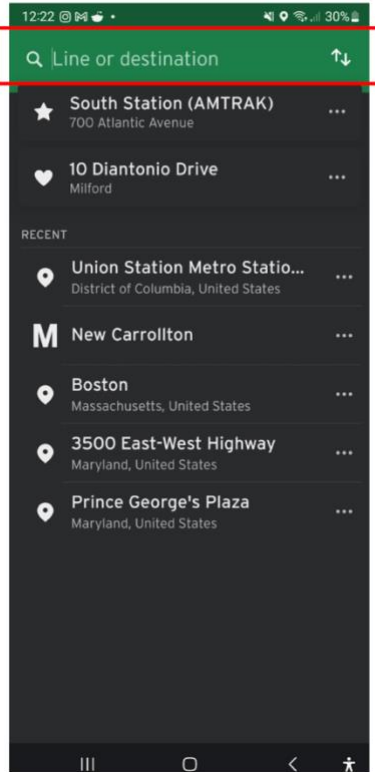
While typing the desired address is displayed, and usually the users would click on the address (selected in blue), which would take them to a different page and show them the route options to get to the location. Instead, the user should click on the 'options' icon (selected in red). As shown in the screenshot the option icon is too small to be noticed and also in grey/white color which doesn't indicate that it is clickable

Once the user clicks on the 'options' icon, a menu pops up from the bottom of the app with the following options: 'Get Directions', 'Show nearby lines', 'Add to favorites', 'Cancel'. The user should click on the 'Show nearby lines' (Selected in red) to get information on all transit lines available from that location.

Once the user selects the 'Show nearby lines', the app opens a new page, displaying all the available lines from the location (in this instance the Boston South Station AMTRAK).

**Transit app's search bar input and results:**

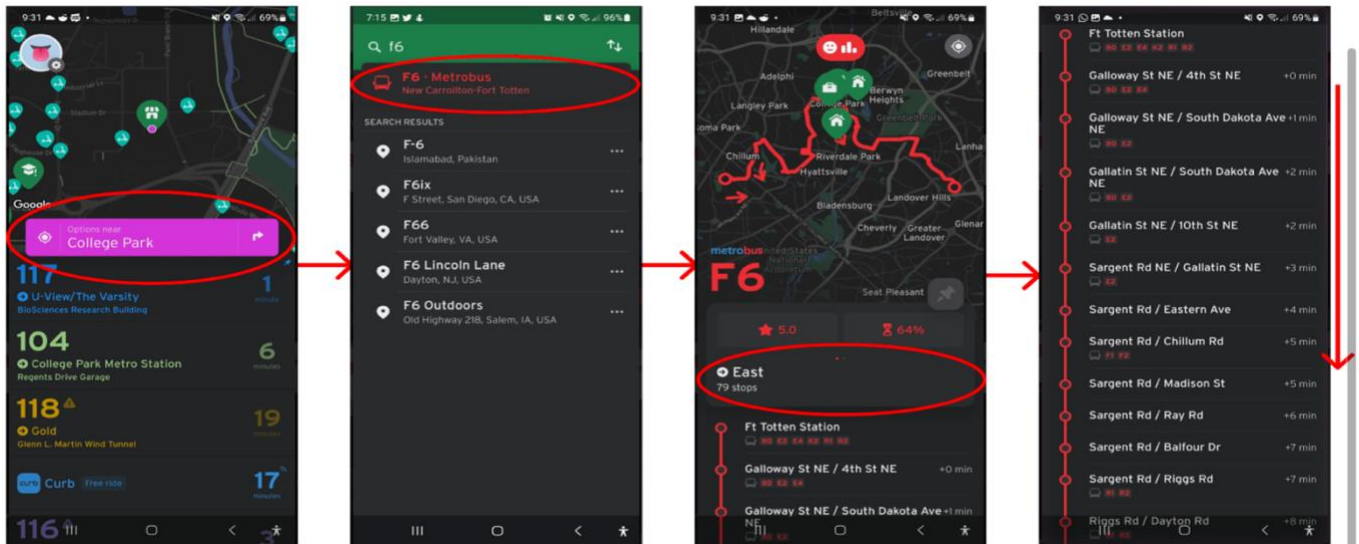
This issue falls under 'Keeping Users in Control' From Ben Schneiderman's 8 Golden Rule. As mentioned, the Transit app is designed with similar features and functions to Google Maps, however, the feature and functions are hard to figure out for most users. During the user usability test, there was one task that the users struggled with a lot and created the most frustration among them because it was not clear in the app how to utilize it. The task related to finding the transit lines by their name (e.g.: MBTA BL, MBTA Framingham/Worcester). The apps search bar suggests that users are able to search transit lines by the names as shown in the screenshot:



When the user clicks on the search bar (selected in red) to input information/data, the search bar displays the following 'Line or destination', suggesting that users can search both addresses and transit lines. The suggestion is inaccurate, and there should be another signifier in the search bar to provide the users with details on the correct pathway for proper navigation.

However, this is inaccurate. Similar to the issue of finding available lines of a given location, the users can only search for the transit lines that are able to search the specific lines if they are near the area where the transit lines are in service. E.g.: if a user is in the Boston area, they can only search Boston services successfully but not for College Park transit services. Although there is a process that allows users to search for services outside of their current location, it is not specified in the Transit App. To be able to search for services outside of the user's current location, the user first needs to search for the location/address of the area where the transit service is available. E.g.: if the user is in Boston and wants to search for transit line F6, which is serviced in College park, the user would first search for "College Park, MD". Once the

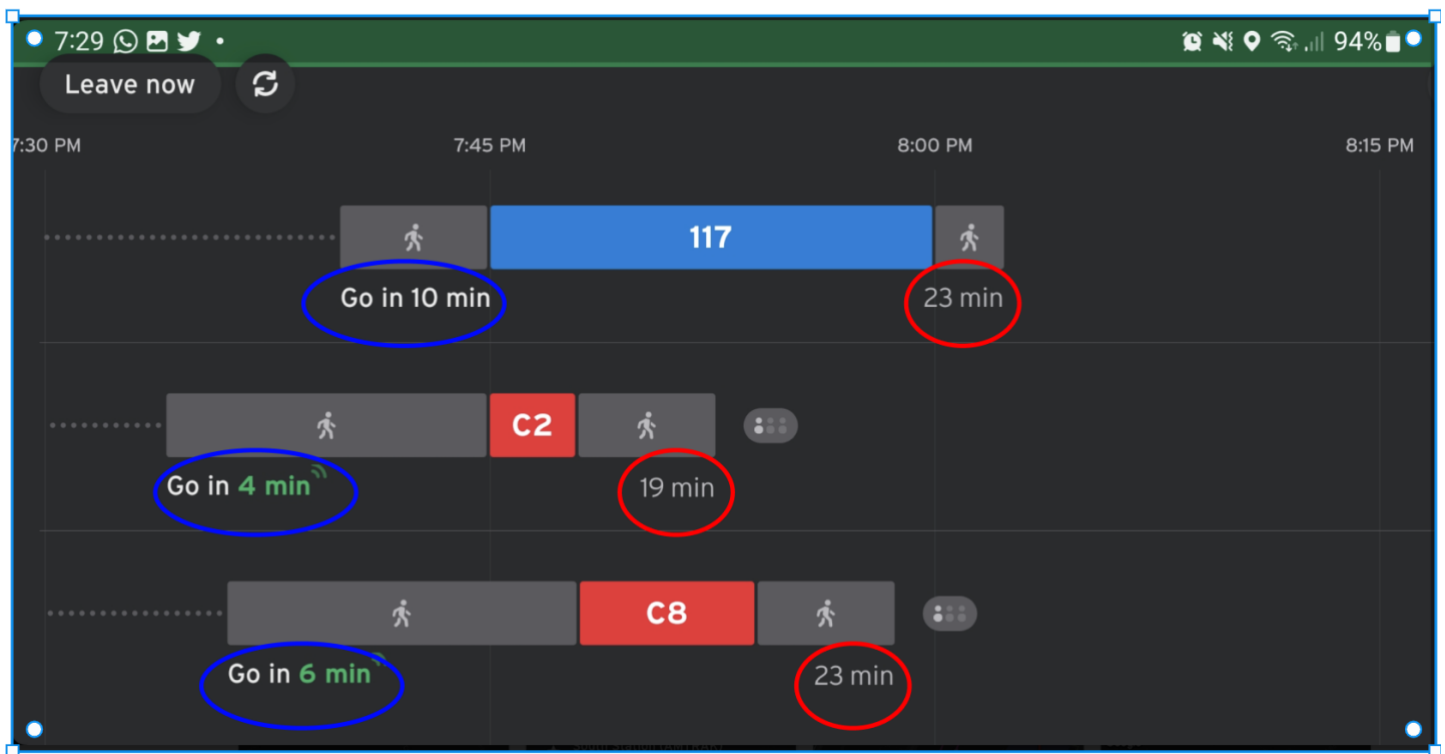
Transit app recognizes the input, it will show the map of College Park in the app, and then from there, the user can search for any transit line service in College Park, MD.



Please Note, these screenshot to provide evidence that the correct pathway exists in the app, but there is no way for users to identify that.

**Transit Apps Visual Time-Map:**

This issue falls under ‘Preventing Error’ From Ben Schneiderman’s 8 Golden Rule This is a somewhat of a minor issue with the app, most new users do not identify the quickest route on the time-map provided the Transit App. This is due to the two different times that is presented in the time map as shown in the following screenshot:



In the time-map, there are two different times presented, one highlighted in blue and other in red. The time highlighted in blue is the time for when the user should leave in order for them to catch the transit line for that specific route. While the time presented in red is the amount of time it will take the user to complete the route to and reach their destination. Both times are presented in the same location, which is under each time-map. The poor placement and the lack of description confuses new users and can lead to disorganization and effect the users trip planning and punctuality for arrival time.

### Issues from the Heuristic Review:

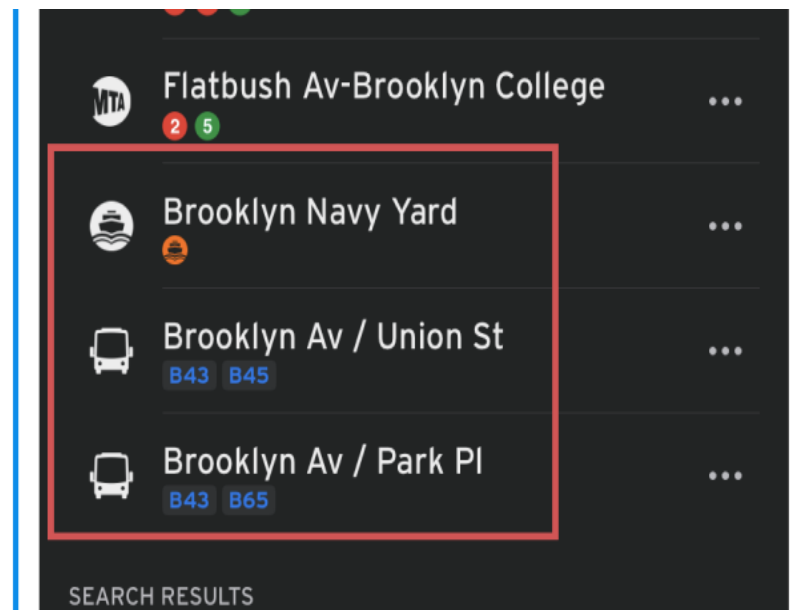
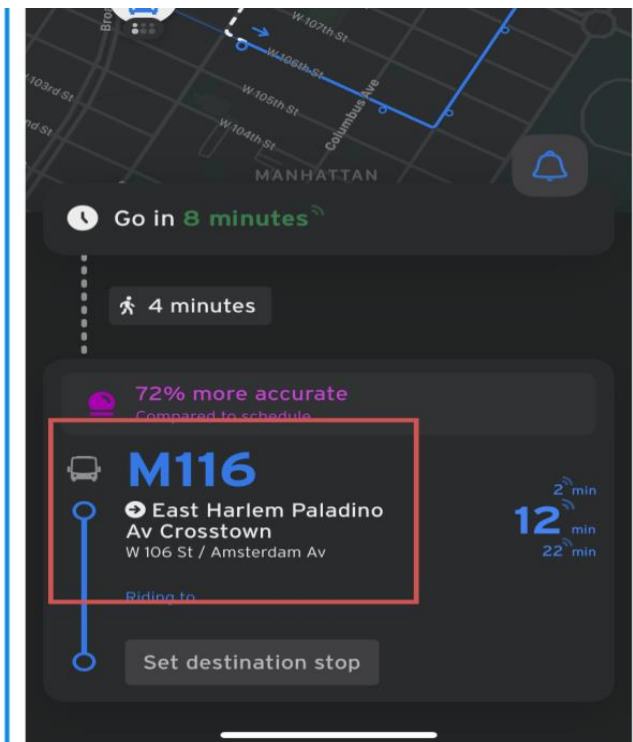
For the heuristic review in my previous paper, I identified two issues, namely in consistency and universal usability.

### Universal Usability:

For universal usability I mentioned that the app is designed differently from popular/mainstream navigation tools like Google Maps, which makes the app innovative. However due to lack of details and tutorials from the app, makes it very difficult for the users to use the app to its full potential and can lead to confusion. Since the heuristics review, I was able to identify specific issues through the user usability testing (as mentioned earlier in the paper).

### Striving for Consistency:

For the consistency, I mentioned that the Transit app is pretty consistent with its layouts, formatting, etc. The only exception presented in the app is the time-chart or the time-map, which provides information in a simple yet in an effective manner (except for the placement of the displayed time which needs a little improvement). Another factor which effect the consistency of the app was the differently displayed names of the transit lines and stops. It was labeled in a way that only the locals would understand what the directions/labels mean (is it the bus # or the station name?).

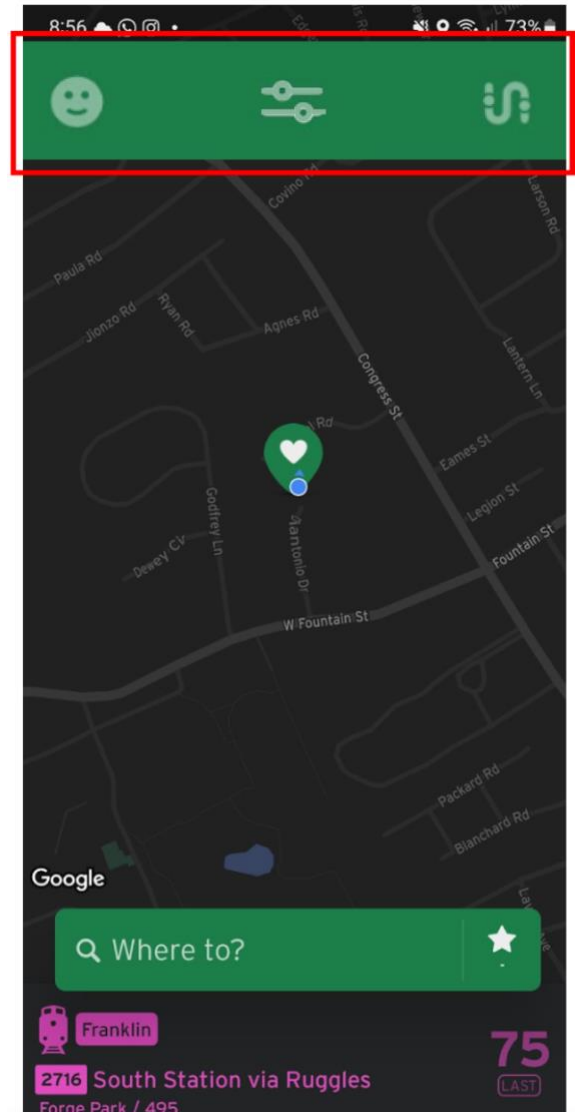
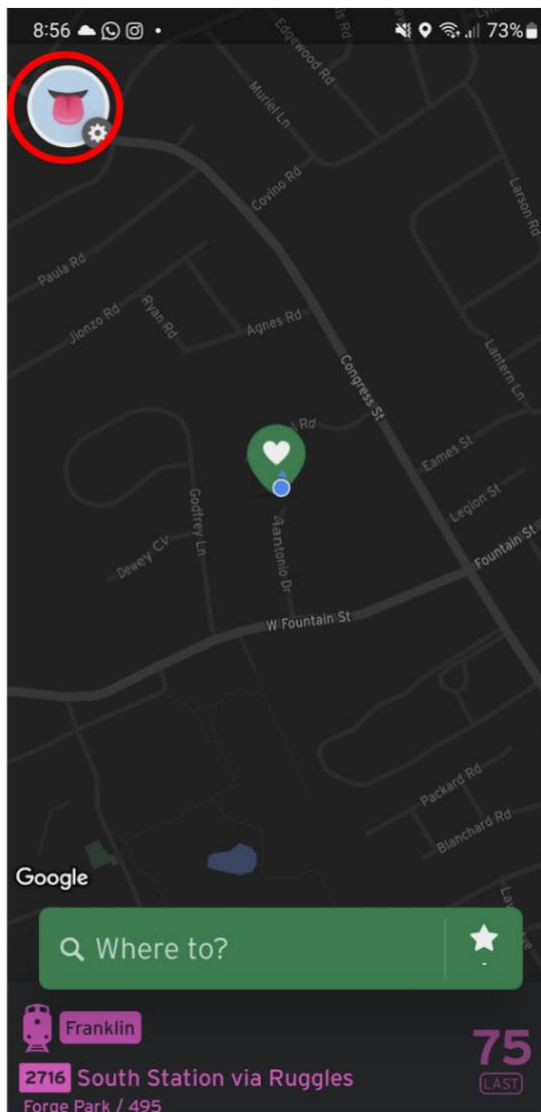




## 4.2 Improvements

### Transit App Settings/Filter page:

To improve the setting and filter pages for the Transit App, I would change the layout in a way so the 'General User page', 'Filter page' and the 'More App Information page' is constantly in display for the users. The icons would also need to be bigger for maximum visibility for the users. The following is an example of how it could be improved:

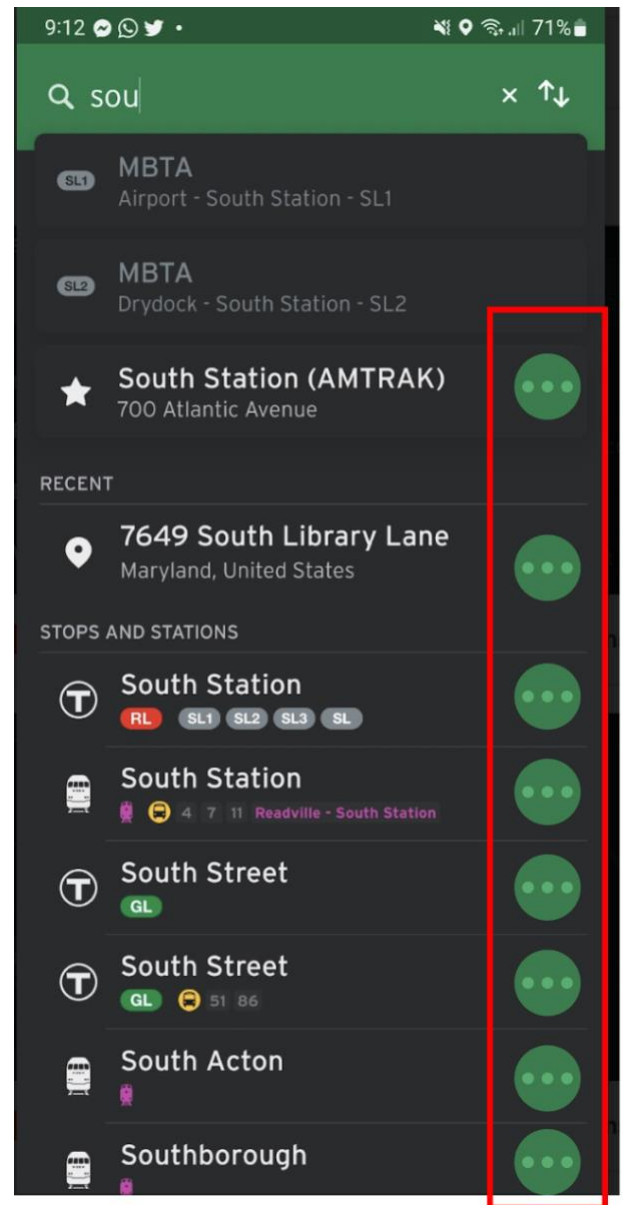
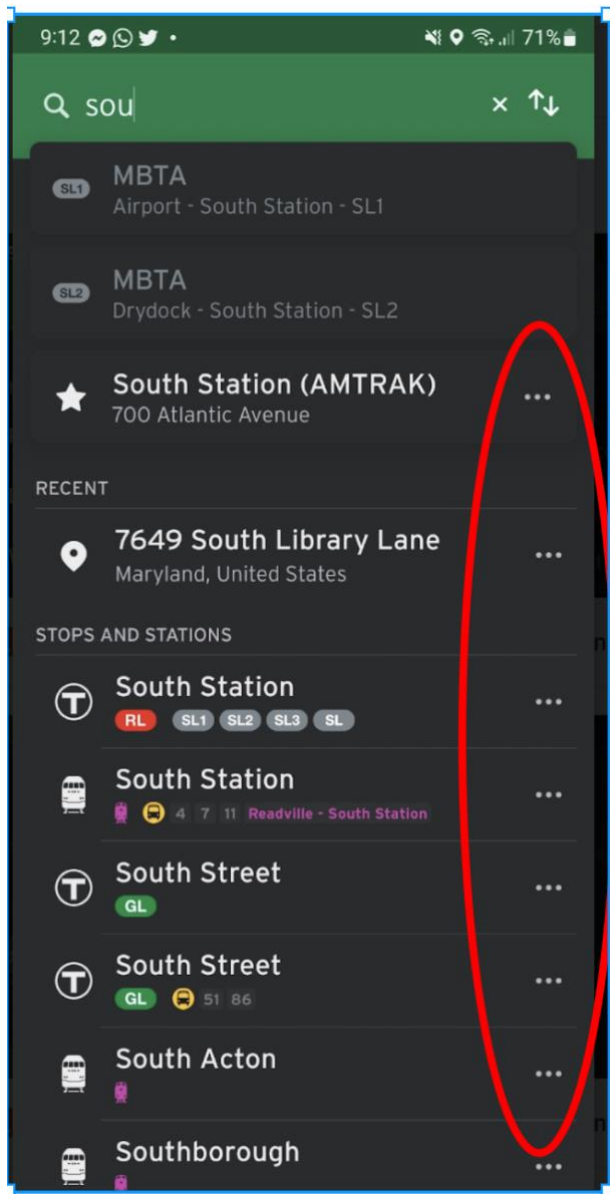


#### Left screenshot (Before), Right screenshot (After).

In the before screenshot, the three icons are never on display, they are only visible once the user clicks on the setting icon (highlighted in red in the screenshot). The lack of constant visibility of the most important features of the application doesn't help the user with usability. The users would hardly be aware of the feature in turn would not even think of using the filter options to ease their process of navigation.

For improvements, the three icons should be made bigger and should be consistently in view at the top of the app on all pages. This way, the users would always have immediate access to the key features and would be able to navigate in and out of the filter/settings pages easily and frequently.

To improve the 'more options' icon for every app input, the icons should be made bigger and should resemble a button more to indicate to the users that it is a clickable action. I would make the following improvement:



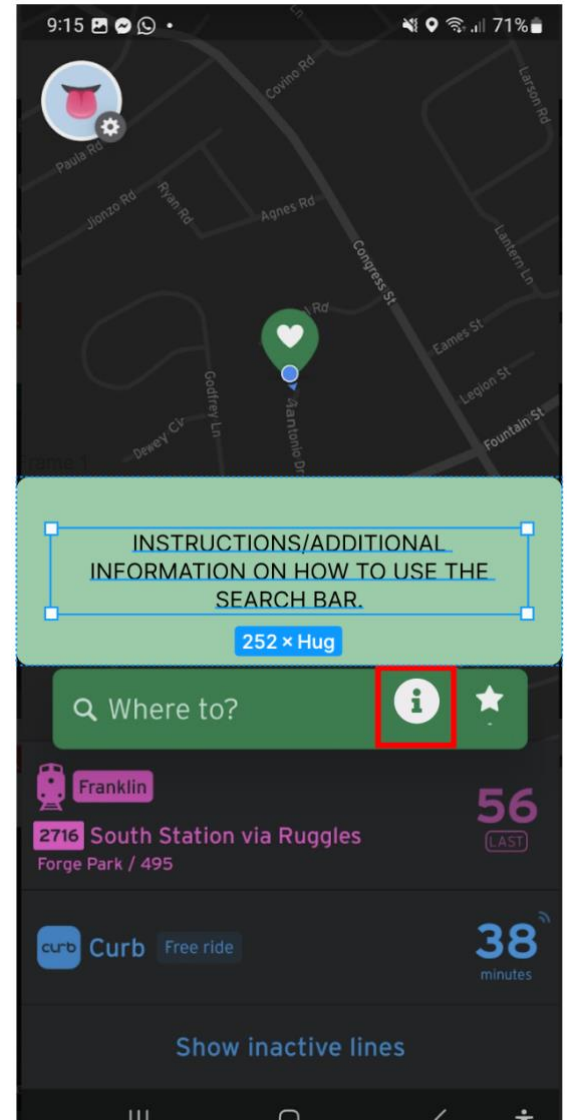
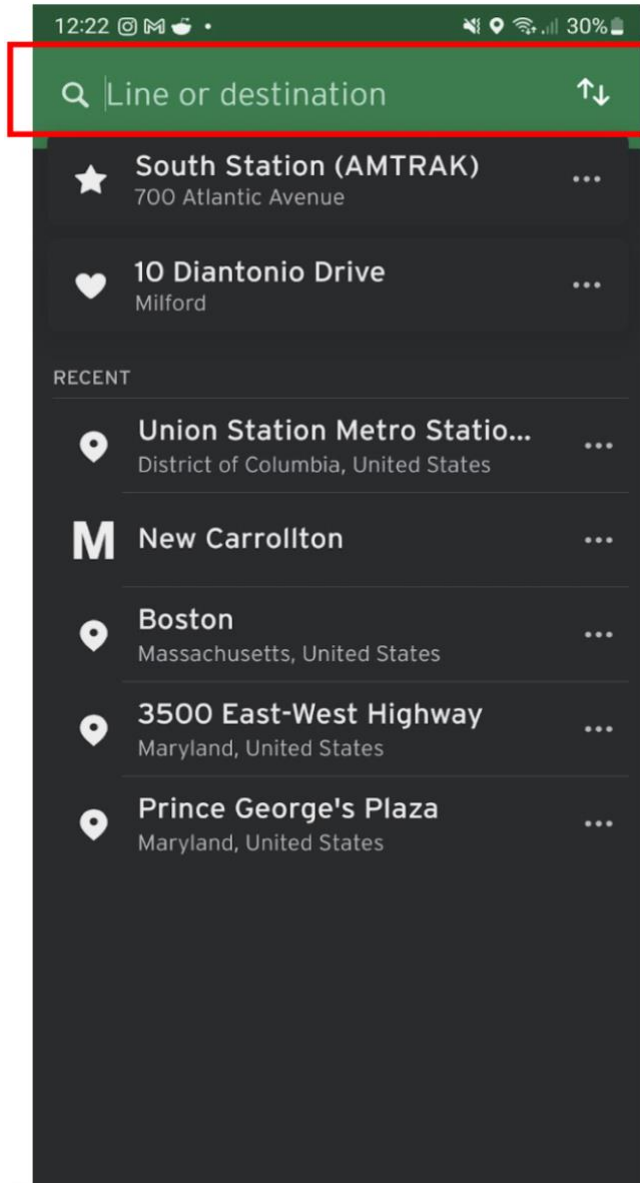
**Left screenshot (Before), Right screenshot (After).**

In the before screenshot, the options icon is very small and in a grey/white color. During the user testing, most of the users ignored this button when trying to complete a task. The icon size and color do not aid in its visibility and hence are constantly ignored by the users.

For improvements, the options button should be made larger to fit the section of the individual information displayed and should be designed to look like a functioning button (rounded button in this instance). The options button should also have more color to it to catch the user eye give them an indication that it is a functioning button.

### Transit app's Search Bar Input and Results:

To improve the 'search bar input and output results', there should be a small 'information' icon next to the search bar to indicate to the users of its full functionality and how to use it to its full potential and to their benefit.



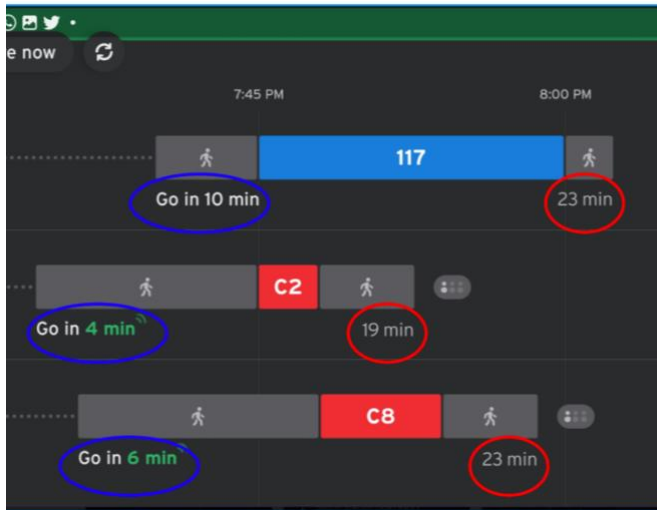
#### Left screenshot (Before), Right screenshot (After).

In the before screenshot, the search bar has only one signifier, which is the text 'line or destination', suggesting to the users that they can search either an address or a transit service by name. However, as mentioned earlier that is not exactly the case. The user should be provided with proper instructions to use the search feature properly and to its full extent.

For improvements, the search bar should be accompanied by another signifier. In the next screenshot, there is an 'info' icon in the search bar and a small pop on top of the icon with instructions for the user on how to use the search bar to its full potential. Another option could be for the app to have a page dedicated to a full app tutorial which could contain the information for using the search bar properly.

### Transit Apps Visual Time-Map:

To improve the readability of the time-map in the Transit app, I would place the different times in separately to indicate to the users that one signifies 'when-to-leave', while the other signifies 'duration of the route.'



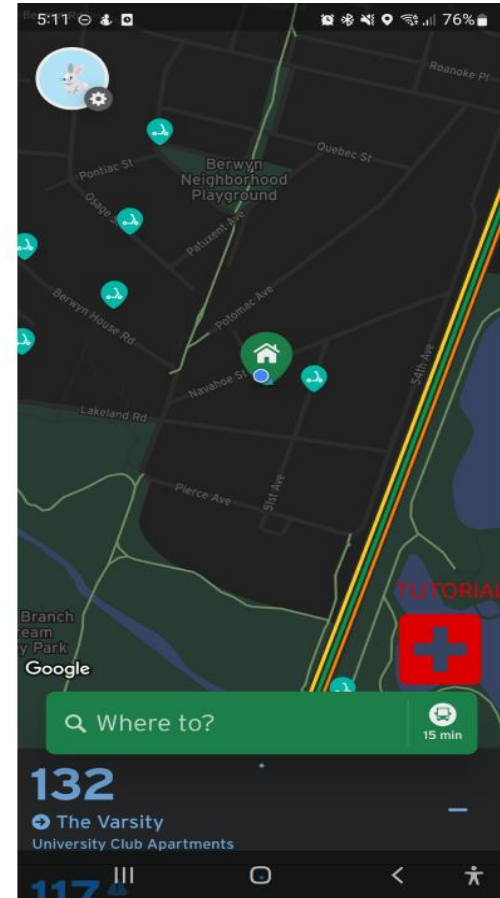
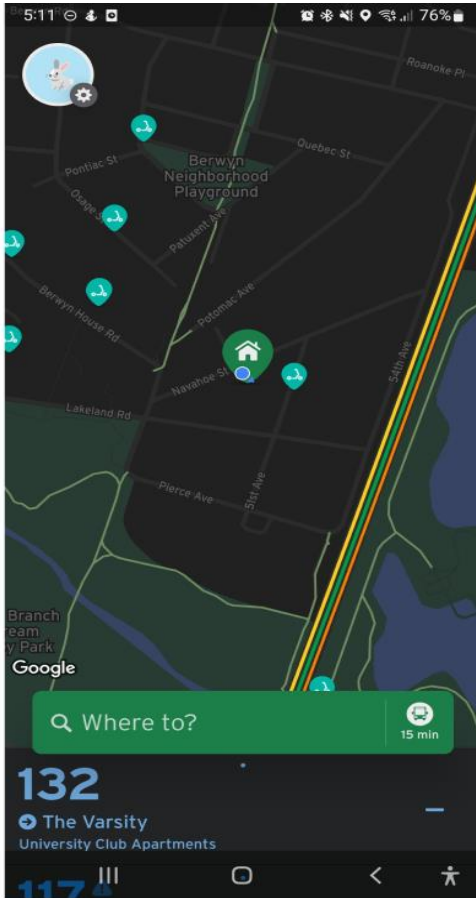
#### Left screenshot (Before), Right screenshot (After).

In the before screenshot, the time-map has two different times displayed at the bottom of the route bar. The different times are meant to indicate two different things, one is to indicate 'when to leave' in order to get to the transit on time, while the other displays the total time on route. However, as mentioned before that, even though, this is a very useful and helpful feature, the users are initially confused between the two and can make a mistake.

For improvements, I divided the position of the two different times. The 'when to leave' time, could be placed on top of the time-bar to notify the users when they should leave, whereas the 'total time on route' is placed at the bottom of the time bar. Another way to differentiate is by giving different time displays a different color. The 'total time on route' would be more aligned with the transit colors and would also clearly worded to there is confusion for the user when using this feature.

### Heuristics Review - Universal Usability:

For the universal usability, as mentioned in the previous paper, the improvements for such complex app design should be a simple yet thorough tutorial. The tutorial could be used very early stages of app usage (right after the app is installed), or anytime needed by the user if they forget how to use certain features, functions in the Transit app. The tutorial would be extremely beneficial for this app because it has a number of highly useful and helpful features and designs, but still needs to be able to communicate all its users properly in order to be a success.



**Left screenshot (Before), Right screenshot (After).**

The second screenshot has a small but noticeable button on top of the search bar labeled as the tutorial button. The tutorial button could be activated by the user at any given time if and when they need a refresher on how to use some of the application features.

**Heuristics Review - Strive for Consistency:**

The improvement for app consistency would be a minor one as the app would need to focus on formatting the information to be displayed in the same manner throughout all page outs. This way the users would be able to familiarize themselves with all unfamiliar routes and transit modes quicker and use the app more efficiently.

**Over all Improvements:**

From all the improvements listed above, I would prioritize the following three improvements for the Transit App:

- **Universal Usability – App Tutorial:** a general app tutorial that could be presented either at the early stages of the app usage (when the app is installed) or whenever the user feels like they need a refresher on the content, and features of the app. The user could use the tutorial as a guide/reminder to utilize all of the Transit app's

features. The reason I categorized this improvement as a priority is due to the numerous complex yet beneficial features presented in the application. The tutorial would cover many of the problem areas for the users without going through major design changes. In addition, it will provide the users with the needed information to utilize all of the app's features to its full potential.

- **User Testing – App setting and filter page:** the current design/layout for the settings and filter page is redundant and unnecessary and obscures the most important feature needlessly. Removing the settings button and replacing it with a permanent and layout-consistent top app bar that always displays the settings, filter options, and app info page throughout the app (and in visible size), would make the users more aware of the feature. Moreover, this would allow the users to use the three features more constantly and with greater ease as it would be more accessible to them.
- **User Testing – Time-map:** Although it is a minor flaw in the design, participants found the current time-map inconvenient and expressed that there could be a better way to display the two different times in a better way, to which I agree. New users get confused between the two times and end up choosing the wrong time for 'total route time'. Moreover, this could be a recurring issue even with experience users due to outside factors or simply because the two times are displayed in a similar manner. A different design layout for the displayed time would prevent the users from making a simple error and would be more effective in helping users complete their goals better.

## 5 Methodological Reflection

### 5.1 Comparison: Expert Review & Usability Testing

One of my predictions for the Transit app was that the app is not universally usable due to its innovative and complex features. Based on the user testing and their feedback, my predictions were accurate. The app had some familiar features, which the users were able to use and navigate through the app to find the needed information to complete the given tasks. For example, they were able to use the search bar, the interactive map, and some parts of the settings feature. However, the majority of the Transit app contained unfamiliar features, which turned out to be unusable for the users as they did not have information on how to utilize it. Some users were able to pick up on the features and functions as they proceeded with the usability test. However, a majority of the users were mostly frustrated with the app and were either unable to complete the task or took longer time than average.

## **5.2 Contrast: Expert Review vs. Usability Testing**

In contrast, I was unable to find flaws related to the following heuristics review: 'Prevent errors' and 'keep users in control'. According to the heuristics review, the app followed the guidelines that supported both standards. However, during the user-testing, I realized that even though the app implemented designs to enforce those standards, it was not enough to ensure its success. Moreover, I use the app frequently, which might have created a certain level of bias in my heuristic review.

## **5.3 Lessons Learned: Expert Review vs. Usability Testing**

From both heuristics review and usability testing, I learned that even though they each use different approaches, the main goal for both is to ensure user usability and help designers create an accessible, usable, and engaging interface. Heuristics review/expert review ensures that the app/web page follows the proper guideline from the early stages of design and development. However, it cannot predict whether or not the interface would be successful with the users and if they would be able to complete their goals properly and successfully without making any errors. Usability testing is the essential step that allows designer to observe the user interact with the interface and take account for human behavior and adjust their interface design accordingly.