Hermes

Stress Injury Tracking and Prevention for Runners

PROBLEM AND SOLUTION OVERVIEW

Runners frequently experience pain or discomfort while running, and repetitive stress injuries are common. Unfortunately, runners often struggle to determine what aches or pains are appearing with regularity or in concerning patterns. Preventing stress injuries from developing once minor pain has begun also presents a challenge for these athletes. Injury/pain tracking is known to be an important method for the diagnosis and prevention of stress injuries; however, there currently does not exist an effective solution in this space targeted at amateurs. Hermes tracks pain in addition to standard workout metrics such as distance, time and elevation. Using this data, Hermes draws insights and shows users correlations between workout metrics and pain. Intelligent suggestions for specific injury prevention exercises are also offered to the user based on the collected data. Overall, we hope that Hermes will empower runners to develop a better understanding of identifying stress injuries and provide support for injury prevention.
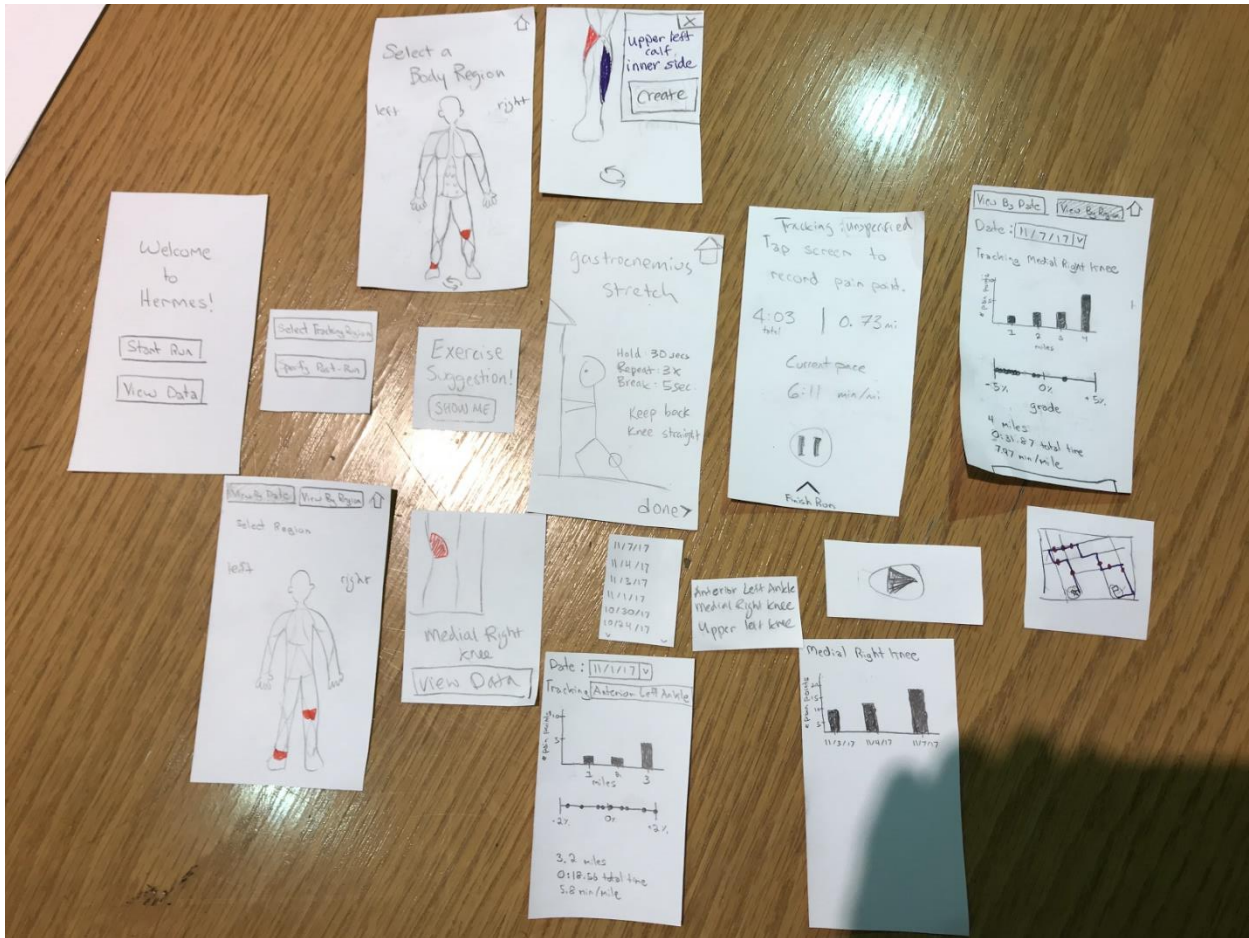
INITIAL PAPER PROTOTYPE

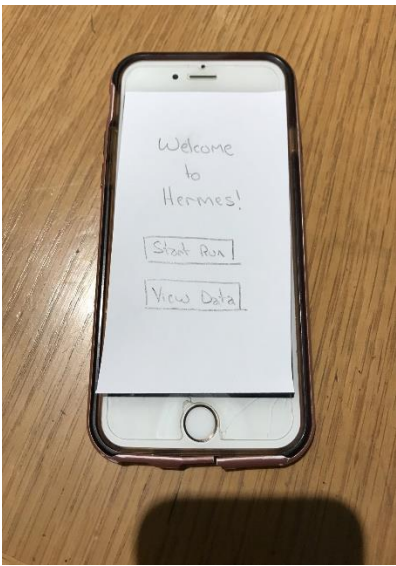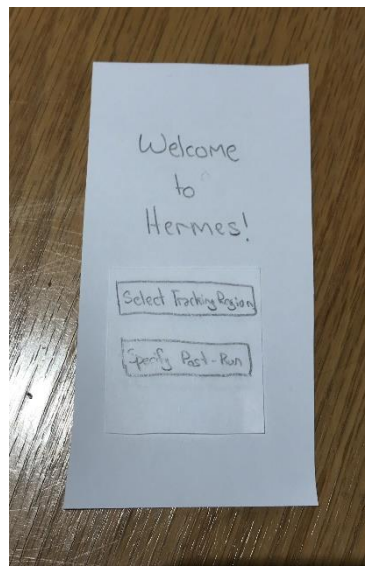Figure 1. All Paper Prototype Components

Figure 2. Start Screen
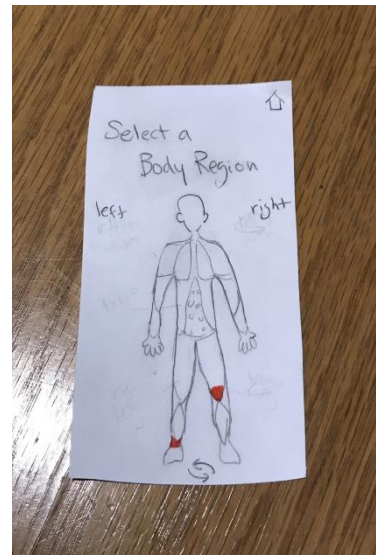

Figure 3. Select tracking mode

Figure 4. Select a body region

The user opens the app to the welcome screen (Figure 2). After pressing the "Start Run" button, the screen is modified as shown in Figure 3, so the user can select whether to specify their pain location before or after their run. By pressing "Select tracking region", they are taken to the next screen (Figure 4), which has a diagram of a body.
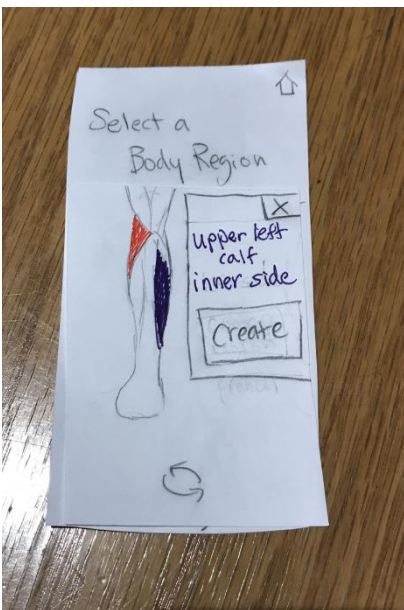

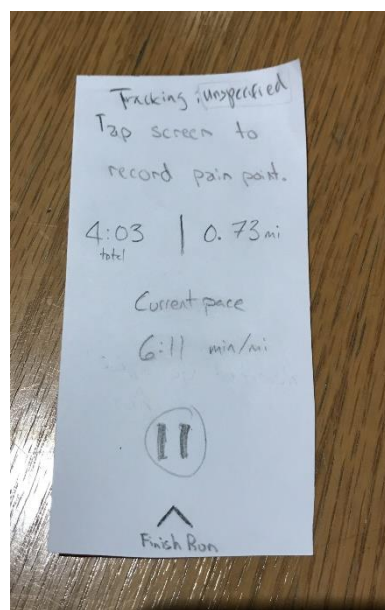Figure 5. Select body region focus
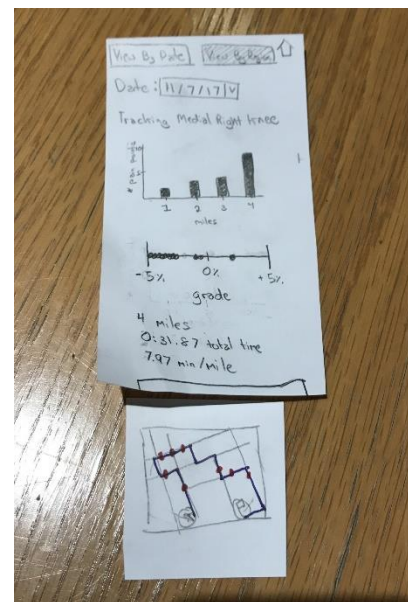

Figure 6. During tracking

Figure 7. Data display post-run

Selecting the left leg takes them to the zoomed in view (Figure 5), where they can tap the portion of the calf to select it and confirm by pressing "create". This takes them to the run screen so they can start their workout and see updates about their distance, mileage, and pace (Figure 6). Finishing the run will take them to the post-run screen (Figure 7), where they can view data for their workout.
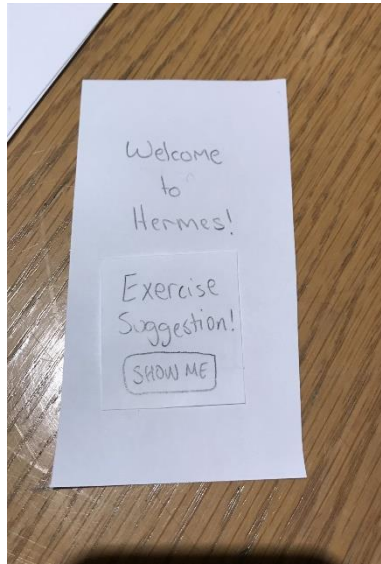
Figure 8. Start Screen

Figure 9. Exercise suggestion pop-up

The user opens the app to start the run (Figure 8). After "start run" is pressed, a notification pops up, suggesting that the user do an exercise (Figure 9).

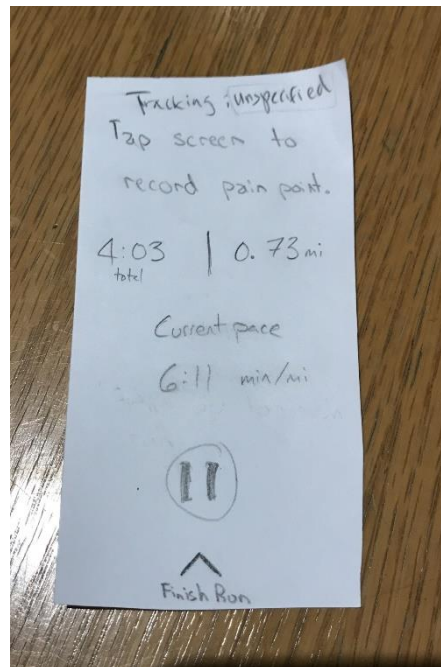

Figure 10. Suggested exercise instruction

Figure 11. During tracking

When the user clicks "show me," the exercise pops up, with instructions on how to do it (Figure 10). After the user has done the exercise and goes to the next screen, the running screen appears (Figure 11).
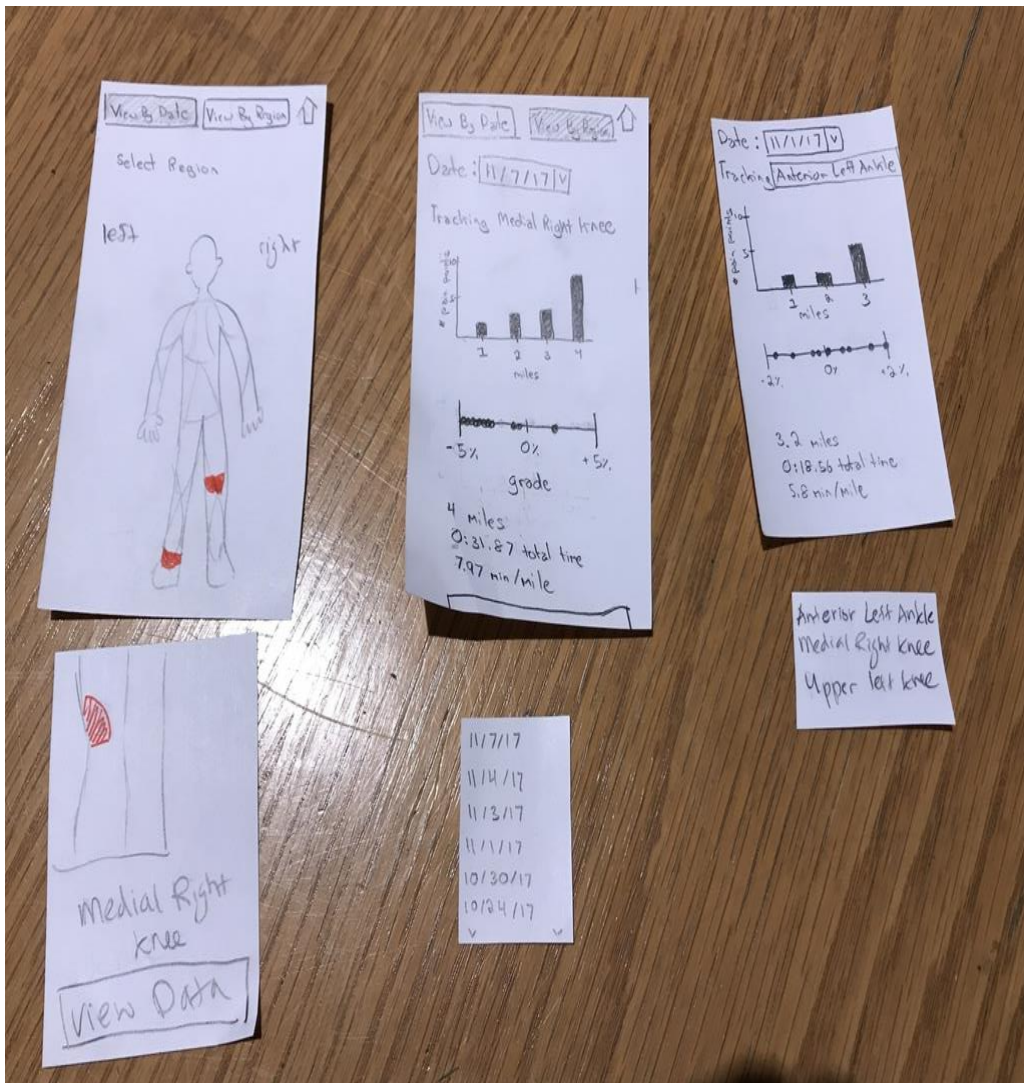
Figure 12. Additional prototype materials

Other screens to support data analysis and reflecting on past workouts. The user can view their data by date or by body region. These screens are not used in the two primary tasks shown above, but are still important to the design.

TESTING PROCESS

HEURISTIC EVALUATIONS

Our testing process began by performing two heuristic evaluations with other design groups in this class. Issues raised in these heuristic evaluations helped us quickly address significant design issues in our application before we moved on to usability testing. Most importantly, we were able to surface issues around the clarity of our design and how to carry out our tasks, which then allowed for the usability tests to run smoothly. The first heuristic evaluation was performed by the Pilltender group in class; the second was performed by the MOLO group in the CSE atrium the same day.

USABILITY TESTING

We conducted each of our three usability tests in the HUB during the evening, so it was a quiet environment with few distractions. For the first two tests, Alex played the role of computer, Diana facilitated the interactions with the participant, and Camille took notes. In the third test, Michael replaced Camille as the note-taker. Our usability tests were structured as follows:

1. Introduction, explain purpose of application and the usability test
2. Task 1: Track a run where they have pain in their left shin
3. Task 2: Engage with an injury-prevention suggestion that pops up at start of run
4. Task 3: View data from a previous run
5. Task 4: Track a run with pain in multiple body parts, classifying the pain points after the run
6. Questions regarding alternative methods of inputting pain points during the run
7. Questions addressing any confusion, what types of data they wished they could see, what they liked and did not like

A more detailed description of the structure of our usability tests can be found in the appendix.

USABILITY TEST #1: EILEEN

Our first usability test was performed with Eileen, a senior at UW who ran cross country throughout high school. Eileen was a co-captain for cross country her senior year of high school, so she is an avid runner and a part of our target audience. Eileen was not one of our design research participants, so she was unfamiliar with the goals of our application and thus able to offer unbiased testing.

The first test yielded some insights that helped us adjust our process for the following tests. Eileen was fairly quiet, so we realized that we needed to be more persistent about having the participant think out loud and share their thoughts throughout the entire duration of the test. Additionally, we were not very well organized in our final phase of the test where we asked the participant questions regarding what parts of the design they especially liked and disliked as well as

what additional data they would like to see. This prompted us to more concretely prepare which questions we wanted to ask after having the participants complete all the tasks.

USABILITY TEST #2: ALLIE

Our second usability test was performed with Allie, a senior at UW whom we had previously interviewed for design research. Allie is a frequent runner and was already somewhat familiar with our project goals, so she provided a different perspective compared to Eileen. The structure of the usability test was the same as described above. Allie completed the tasks quickly and easily, giving frequent feedback about what she liked and did not like as she went through the tasks. She thought out loud and gave us plenty of insight into how she was assessing each screen of the prototype.

After feedback from the first two usability tests, we decided to abandon the idea of allowing athletes to track multiple body parts on a single run, so we removed step 4 from the testing process. This was based on participants claiming that the feature would not be used often yet it introduced complexity and extra data entry requirements.

USABILITY TEST #3: JOSHUA

Our third usability test was performed with Joshua, a freshman at UW. Joshua does not run for exercise very often, but he does do other sports which involve running. As a result, he has never used any run-tracking applications. Testing our application with him allowed us to gauge how intuitive our design is to someone who is not familiar with similar products. Joshua was vocal and articulate, describing his thoughts as he went through the tasks. He suggested many possible features for our app as he interacted with it.

TESTING RESULTS

HEURISTIC EVALUATIONS

Our heuristic evaluations were helpful in addressing some overarching issues with readability and clarity of our design. Through feedback from these evaluations, we realized there were unclear expectations around what actions to take at various points of our tasks, so we added more instructional text to guide users. We also decided to alter the flow of body part selection, only allowing users to select which body part to track after the run, since first time users did not understand what they were doing when they entered this flow before having run with the application. In addition, we changed the language to be more casual and natural, so it was easier to understand without already having the context and understanding of the application that we had as designers.

USABILITY TEST #1: EILEEN

Our first usability test revealed some expectations about interacting with various elements of the user interface that we had not considered. We decided to change our design to support these attempted interactions, since these were idiomatic and natural to the participant. These changes included allowing users to swipe side to side to navigate between data pages from sequential runs and clicking on the body part listed as a way for users to change which body part was being displayed on the "view by body part" page. The first test also helped us understand what data the athletes wanted to see at the various data screens. We were unsure at first what to display to users, but Eileen helped us understand that it would be good to see more data, including insights about correlations that the application had gathered for various injuries and extra information for each run on the "view by body part" data pages. Finally, this usability test helped us fix some confusing aspects of how we presented the data to the athletes. We improved the clarity of our paper prototype to indicate that the pain point graph was categorical and not continuous. In addition, we changed the type of graph used to display pain points and elevation so it was clear, since Eileen did not realize the graph was showing elevation data.

USABILITY TEST #2: ALLIE

The second usability test prompted us to make a major change to our second primary task. Specifically, Allie disliked how the exercise suggestion popped up when she attempted to start a run, claiming that once she was intending to run, she didn't want anything to get in the way of that. We discussed possible solutions with her, and eventually settled on moving the exercise suggestion pop-ups to occur after runs are finished. This prevents the exercise suggestions from feeling intrusive while also allowing them to leverage data that was just collected, making them immediately relevant. We wanted to still provide value to athletes at the start of their runs, so we elected to instead give smaller tips and insights (such as suggestions to avoid certain routes or elevation gain due to recently collected pain data) at the start of their runs. These tips do not interrupt the flow of an athlete who wants to head out for a run, but can still guide them to make adjustments that could alleviate or prevent injuries.

Allie also gave us feedback which allowed us to refine which data we display to athletes and the clarity of language used throughout our application. We incorporated data about pace in the post-run data screens at her suggestion. Additionally, Allie found the medical terms from body part selection (such as "medial") confusing, so we elected to use colloquial terms instead to increase clarity. Finally, we changed the language in our app from body "region" to "body part", since this is closer to how people would naturally refer to the concept we were presenting. Because users don't need to learn extra terminology that is specific to our application, it presents a clearer manifest model when the application is first used.

Using feedback from Allie and Eileen, we realized that the functionality of tracking multiple body parts in a single run would be rarely used, yet it introduced a burden on users and greatly complicated the manifest model presented by our application. Thus, we decided to remove this functionality after the second usability test, only allowing users to select a single body part after a run where they record pain.

USABILITY TEST #3: JOSHUA

Unfortunately, our third usability test did not yield many changes to our design. There were few critical incidents, as Joshua was able to understand and interact with the design very easily. Most of the issues that he raised were suggestions for further features. We chose not to implement these features in our design as they would have been outside the scope of our primary tasks. Additionally, they would have introduced significant complexity to the design which we did not have much time to test further. Joshua did provide feedback on ways to make the UI clearer for the maps, so we improved the readability of the icons to accommodate.

USABILITY TESTING REVIEW

All three of our usability testing participants expressed concerns about the burden of taking out a phone and swiping the phone screen as the method of recording a pain point during the run. Through discussions with each participant around alternative methods of input, we eventually settled on the idea of using a Bluetooth-paired ring with a single button. Athletes can pair the ring with their phone ahead of time, and will simply press the button on the ring, which does not interrupt their stride or require them to interact with a screen. We are also supporting the swipe functionality for users who do not have the ring device. This change to the method of input improves the ease of carrying out a frequent action which is core to the completion of our first primary task.

DESIGN CRITIQUE

We did not receive any specific design critique from the TAs, other than including a site map. Our design critique from peers was focused on heuristic evaluations, which are explicated above.

FINAL PAPER PROTOTYPE
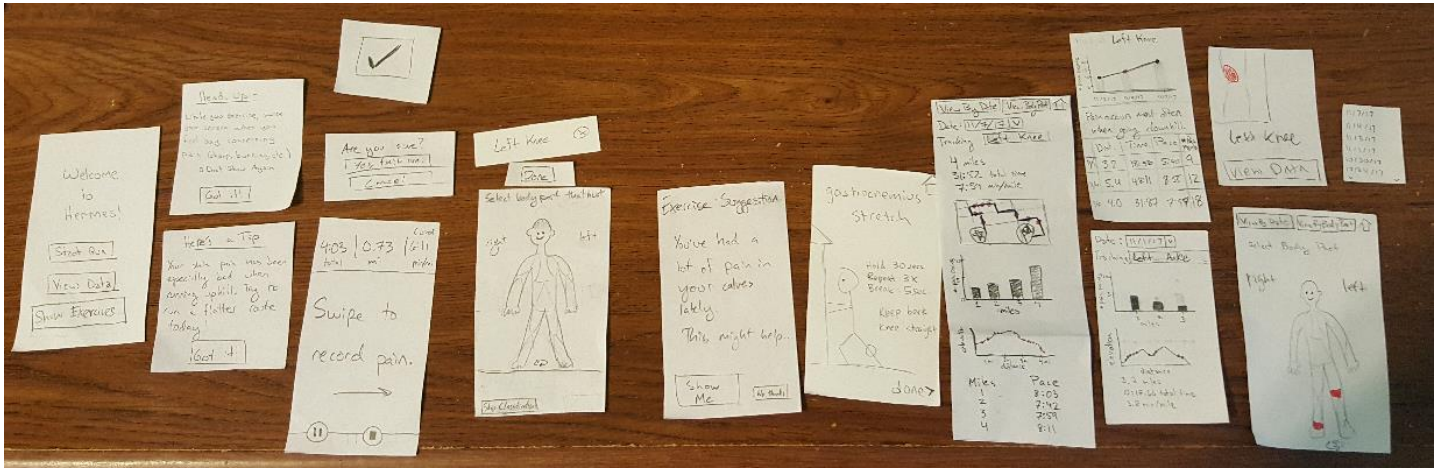
OVERVIEW

Figure 13. Final paper prototype overview
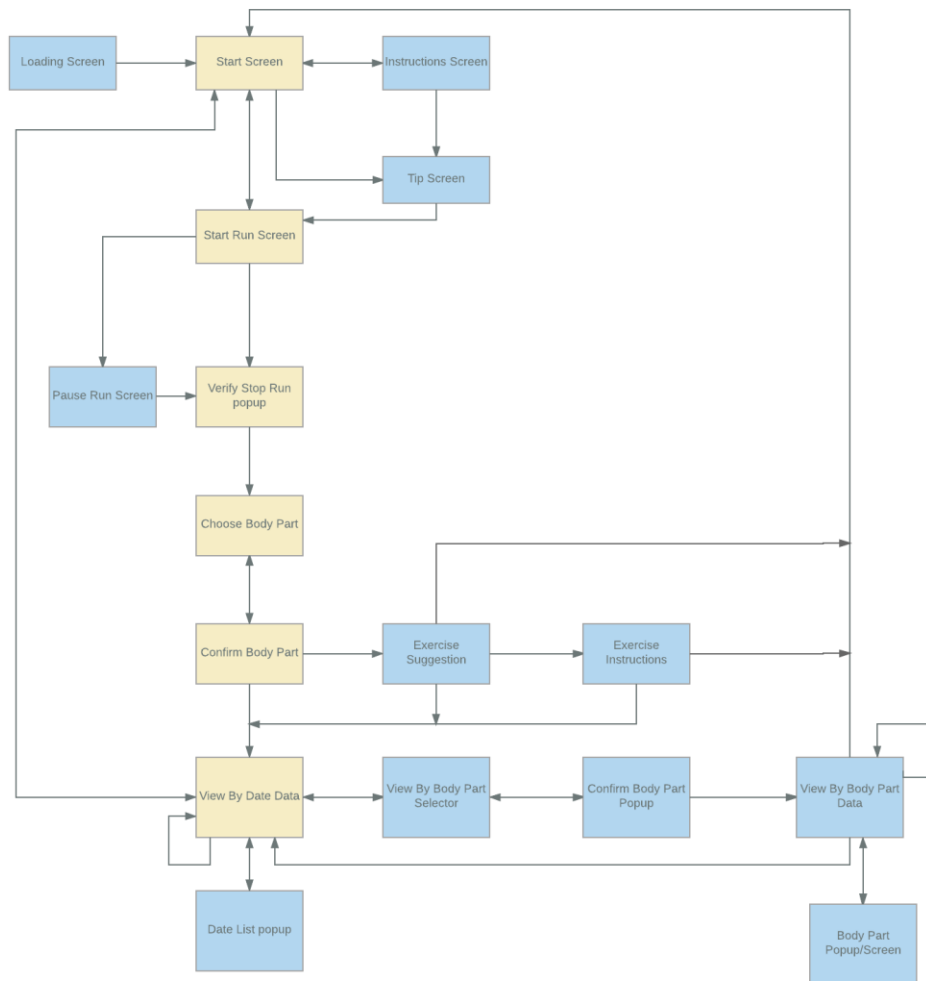
Figure 14. Site Map

Figure 14 is the site map. We used this to clarify the general user flow and how the screens were connected to each other. For example, we realized from this that there should be a popup confirming the deletion of that run's data.

TASK 1
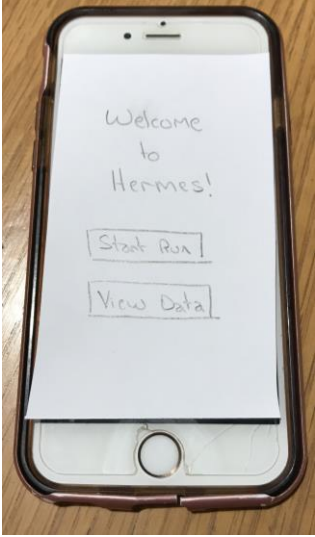
Figure 14. Start Screen
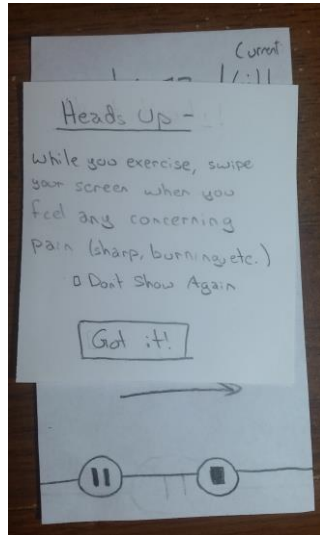
Figure 15. Instructional Pop-up
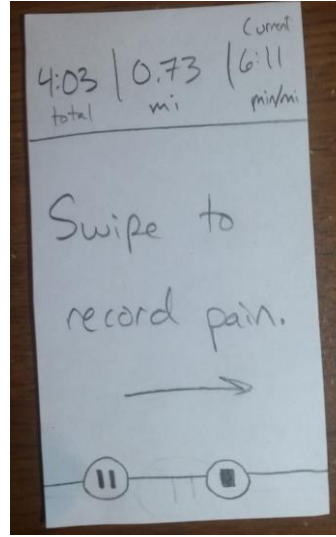
Figure 16. Running Screen.
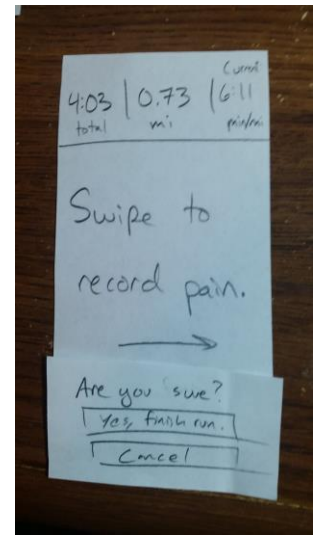
Figure 17. Finish Confirmation

The user opens the app to the welcome screen (Figure 14). After pressing the "Start Run" button, a popup detailing instructions on how to record pain is shown (Figure 15). When "Got it!" is pressed, the popup disappears to fully reveal the run screen, so they can start their workout and see updates about their distance, mileage, and pace (Figure 16). Tapping the stop button to finish the run will trigger a popup, checking if they are sure they would like to finish the run (Figure 17).
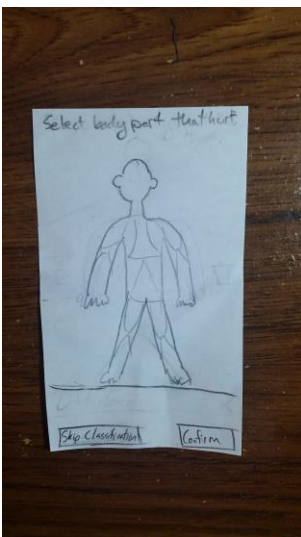
Figure 18. Select Body Part
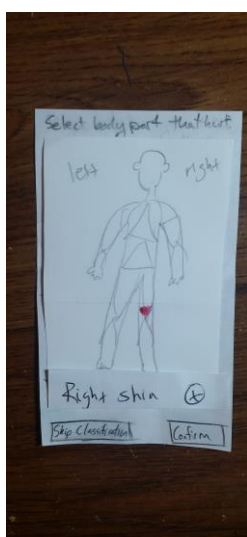
Figure 19. Confirm Body Part
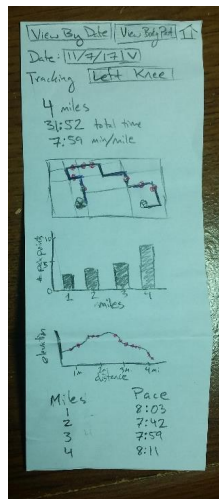
Figure 20. Data View

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Pressing "Yes, finish run" to confirm it will take them to a screen with an image of a person, where they can select the body part they wish to track (Figure 18). Once they select the right shin, the body part will be highlighted, and its name will appear on the bottom (Figure 19). Finally, when "Confirm" is pressed, a screen where they can view data for their workout will appear (Figure 20).

TASK 2

Figure 21. Start Screen   Figure 22. Suggestion Pop-up   Figure 23. Running Screen   Figure 24. Finish Confirmation
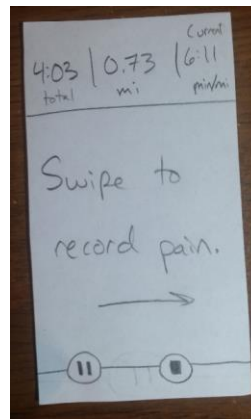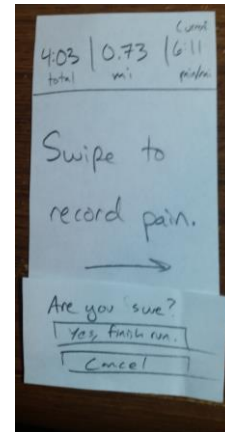
The user opens the app to start the run (Figure 21). After "start run" is pressed, a notification appears over the run screen (Figure 22), suggesting that the user avoid hills during their run due to hill-related pain in previous runs. When the user taps "got it," they begin their run as normal (Figure 23).

Figure 25. Select Body Part   Figure 26. Body Part Confirmation   Figure 27. Exercise Suggestion   Figure 28. Exercise Animation
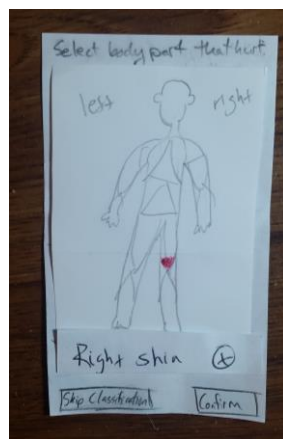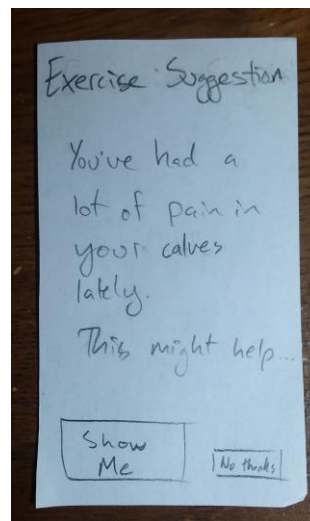
When they want to stop the run, they press the stop button (Figure 24) and confirm that they want to exit, taking them to the body part screen (Figure 25). Then, they select the body part that hurt on their run (Figure 26). The app analyses

recent data and sees a worrying trend in their pain, so it suggests a particular stretch to them (Figure 27). Clicking "show me" takes the user to a screen which instructs them on how to perform the stretch (Figure 28).
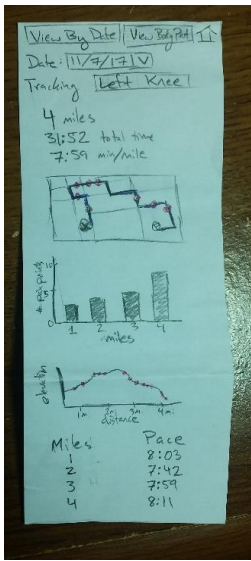
Figure 29. View Data

From there, they can view their data from the run (Figure 29).

DIGITAL MOCK-UP

OVERVIEW

View an interactive prototype here: https://invis.io/2YEG40I5U
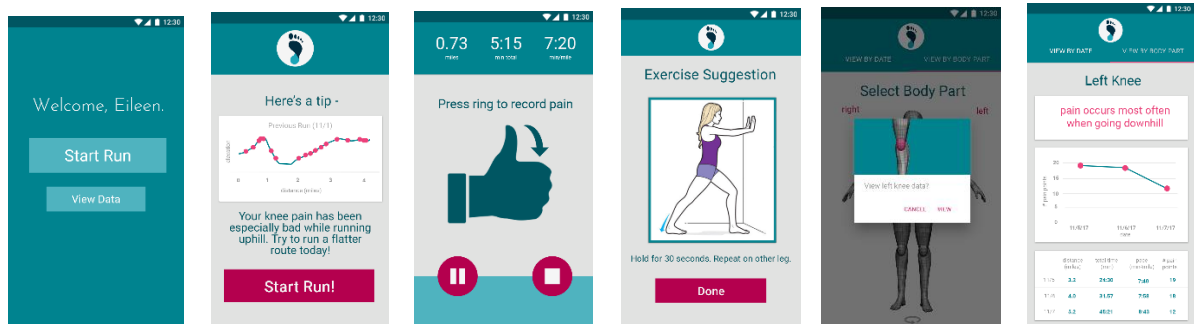
Hermes allows for users to track normal run data such as duration, distance, and route, as well as pain data. When a user starts a run in the app, pain data can be inputted by pressing a ring. The user can specify which body part they tracked after their run. Hermes also allows users to view their run data and draws intelligent insights between run data and pain data. Finally, Hermes gives users tips when they start their run regarding recent pain trends and suggests injury prevention exercises after runs have finished.
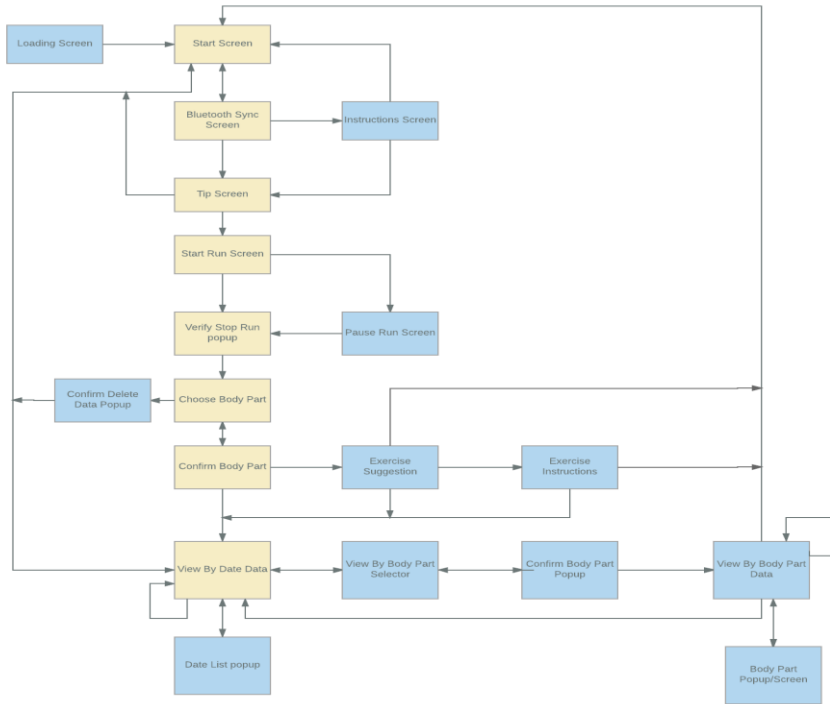
Figure 30. Site Map

TASK 1: STARTING A RUN, TRACKING PAIN IN LEFT KNEE
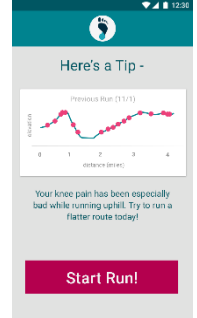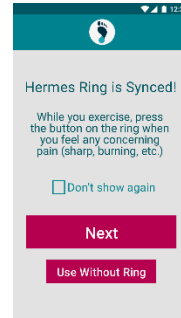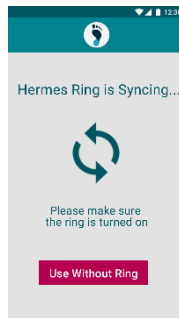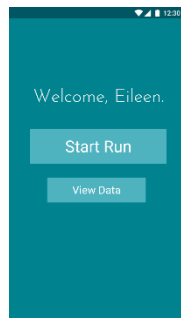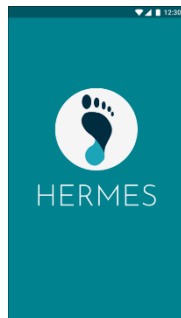
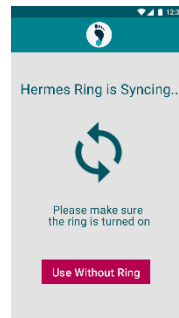Figure 31. Hermes Ring   Figure 32. Loading Screen   Figure 33. Home Screen   Figure 34. Ring Connecting   Figure 35. Ring Instructions   Figure 36. Tip
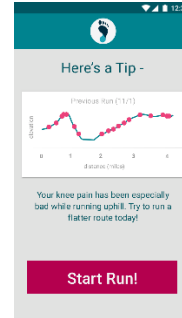
User opens the app and puts on and turns on the ring (Figure 31). It loads (Figure 32) and then the home screen appears (Figure 33). The user taps the "Start Run" button and a screen shows up, indicating that that the ring is syncing (Figure 34). Once the ring has synced, instructions for how to use it appear (Figure 35). Once the user taps "Next," the tip for that run appears, suggesting they try a flatter route due to pain in previous runs (Figure 36).
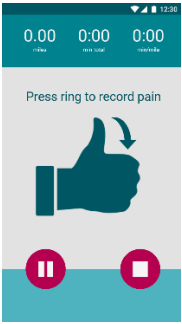
14
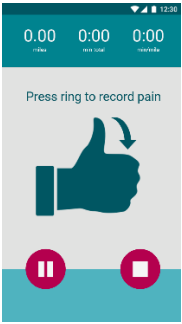
Figure 37. Running Screen

Figure 38. Hermes Ring
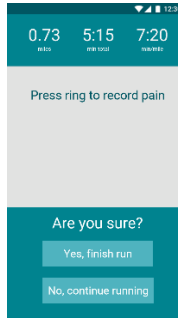
Figure 39. Finish Confirmation

Figure 40. Select Body Part

Figure 41. Selection Confirmation

Figure 42. View Data

When the user dismisses the pop-up, the run tracking begins, with their total time, distance, and pace seen on-screen (Figure 37). The user presses the ring's button when they feel pain (Figure 38). In response, the ring vibrates and button lights up. When the stop button is pressed, the app asks for them to confirm that they have finished their run (Figure 39). After the user confirms that they have finished their run, the app displays an anatomical map (Figure 40). The user selects and confirms the body area for which they tracked pain during their run, if any (Figure 41). After the body part is selected, the data view is displayed for the run (Figure 42).

TASK 2: STARTING A RUN, RECEIVING PAIN AND ALLEVIATION SUGGESTIONS

Figure 43. Hermes Ring

Figure 44. Loading Page
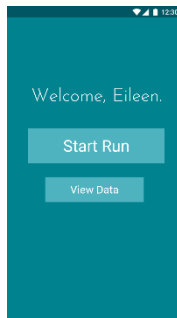
Figure 45. Home Screen

Figure 46. Ring Connecting

Figure 47. Tip

User opens the app and puts on and turns on the ring (Figure 43). It loads (Figure 44) and then the home screen appears (Figure 45). The user taps the "Start Run" button and a screen shows up, indicating that that the ring is syncing (Figure 46). Once the ring has been synced, the tip for that run appears, suggesting they try a flatter route due to pain in previous runs (Figure 47).

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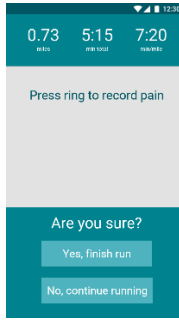Figure 48. Running Screen

Figure 49. Finish Confirmation

Figure 50. Select Body Part

Figure 51. Selection Confirmation
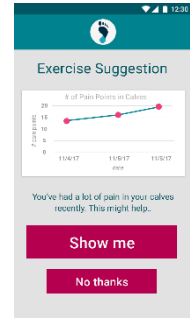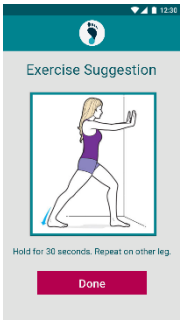

Figure 52. Exercise Suggestion
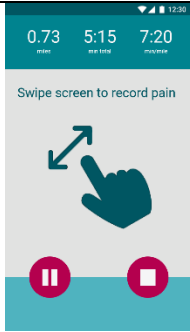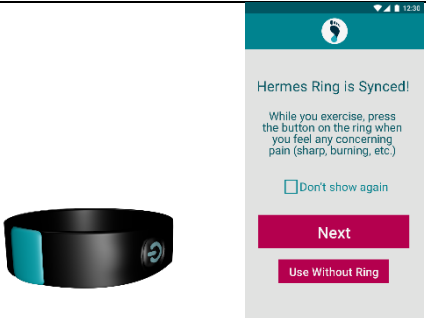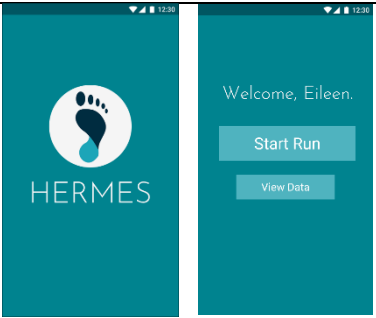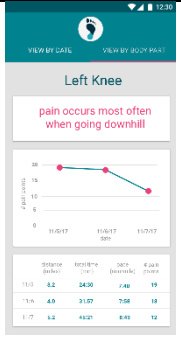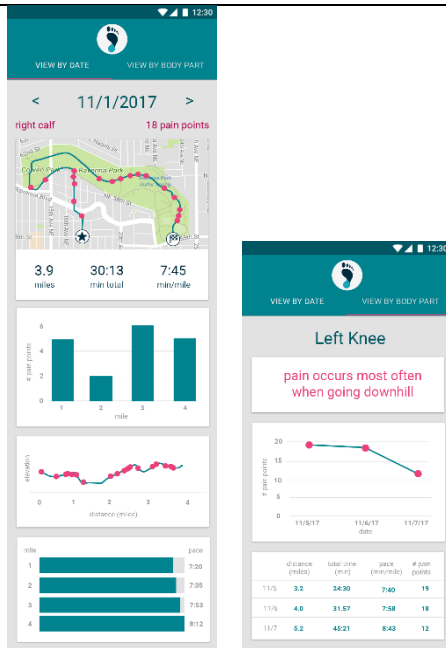

Figure 53. Exercise Instructions

Figure 54. View Data

When the user dismisses the pop-up, the run tracking begins, with their total time, distance, and pace seen on-screen (Figure 48). Once the run is done and the user presses the stop button, the app asks for them to confirm that they have finished their run (Figure 49). After the user confirms that they have finished their run, the app displays an anatomical map (Figure 50). The user selects and confirms the body area for which they tracked pain during their run, if any (Figure 51). A screen appears, informing the user that they have been experiencing a lot of pain in certain body parts recently. It offers the user an option to see an injury prevention exercise (Figure 52). Pressing on "Show Me" presents the instructions (Figure 53). The user taps "done" when they have finished the exercise, and they are brought to the data view screen (Figure 54).

CHANGES MOVING FROM PAPER TO DIGITAL

When working in a much higher fidelity medium (Photoshop vs. pencil and paper), we had to make decisions about specifics in our design – elements such as precise button placement, font sizing, and use of icons. We also had to make decisions about color and font type. The font (Roboto) is standard for Google Material Design, which we followed for our digital design (this also influenced decisions such as having tabs near the top of the screen and organizing data plots using cards). The logo font is Josefin Sans, which we chose because we wanted a font that felt strong and stable while still being relatively minimalist. We chose two contrasting color palettes for our color schema throughout the design. Our primary color is teal-blue because it is easy to view on a screen and has a steady/calm aesthetic. Our contrasting palette is based on strong, dark pinks because we wanted a color that would pop against the blue.

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	A swipe icon replaced the arrow for the swipe input to more clearly display the appropriate user input method.
	As discussed in the last assignment, we are now offering input of pain points through a ring (while retaining a "back-up" option of offering input through the phone's screen).
	We made slight aesthetic-related alterations to our home screen, including separating the logo into a separate Working a digital format allowed us to more easily compare various design options, which led us to make minor changes here.
	Additional data was added to the data view by body part, per requests from usability studies. This was confirmed to be possible (given screen real estate, etc.) when creating the digital mock-up.

The style of the "View by date" and "view by body part" sections was changed.

For both of them, data view is organized in a "card" style – each plot has a distinct container, to be consistent with Google's Material Design design guidelines.

For "View by date," in order to create a clear hierarchy (more attention to the date, and less so to the body part), we made the font larger and centered it. The two arrow marks on the sides help show that swiping side-to-side to change the date shown is possible. Bar graphs were also added to make the pace information more image-based, and to keep it consistent with the other cards.

Similarly, the title "Left Knee" was made larger in the "view by body part" tab in order to keep the screens consistent, and to draw more attention to the body part being shown.
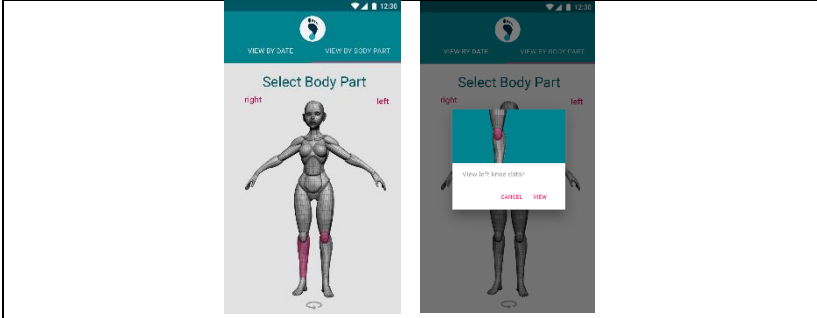
DESIGN CRITIQUES

Design critique came primarily from feedback on the digital mock-up, both from TAs and peers

New Screen	Critique
	Request to add a cartoon to describe the ring input system
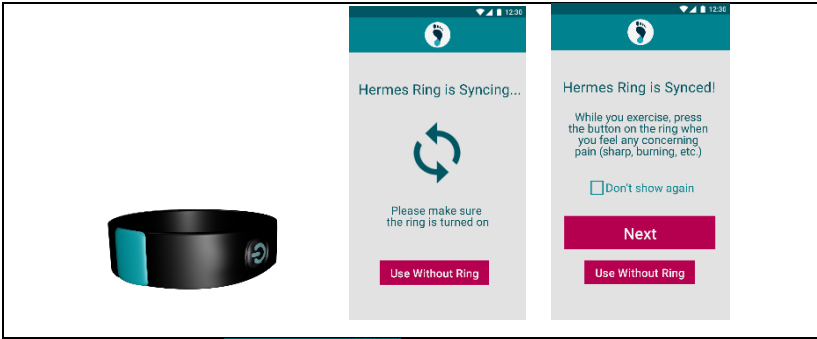
	Request to clarify Bluetooth connectivity status. This ended up changing the instructions screen as well (from a popup to a separate page)

	Suggestion to clarify which body parts currently have data stored (was originally fully colored)
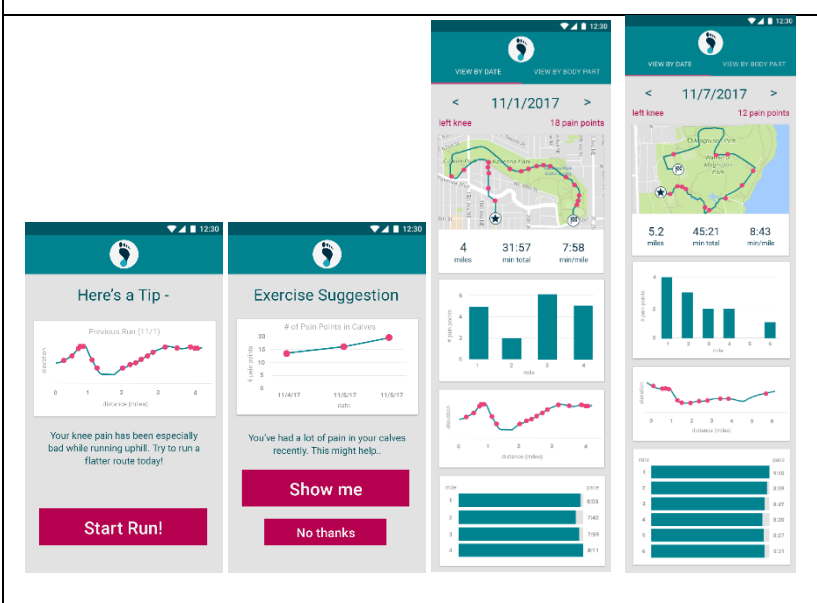
	Suggestion to make the data follow a more clear storyline (here, the user has been getting pain while running uphills, and so runs a flatter route on Nov 7th) Changes: - Added data to the tip and exercise suggestions screens to prove to the user that changes need to be made - Reversed 11/1 and 11/7 date, so the run with less pain came afterwards

DISCUSSION

The process of iterative design helped us greatly improve from our initial design. We learned that elements of our application were not always as clear to novices and unfamiliar users as they were to us, which is an obvious finding that is surprisingly easy to overlook without performing testing. Iterative design allowed us to move quickly and get feedback on new ideas nearly immediately, which in turn allowed us to create more significant improvements than if we had attempted to build a complete product first or had done fewer rounds of iteration. We gathered data and incorporated feedback from multiple sources, including other design groups, athletes unfamiliar with the product group, and athletes that had tried similar products. As the iterative design progressed, our tests became more fine-grained, since our earlier tests helped us expose and fix the biggest issues. This made it especially helpful to do the heuristic evaluations first, as the feedback from those two tests allowed us to greatly improve the usability and clarity of our application before putting it in front of usability testers.

There were a few major changes and several smaller tweaks in our design that resulted from testing. Both of our primary tasks underwent significant changes as a direct result of feedback from usability tests. Our first primary task, tracking a run and associated pain, had two major changes. First, we refined the design to only support tracking a single body part for each workout. Participants found our proposed flow of classifying entered pain points to specific body parts to be too burdensome, and other possible solutions discussed with participants were deemed too complex. As a result, we simplified the task while still allowing it to cover the vast majority of use cases. Second, we altered the method of input for recording a pain point during the run. Although our initial paper prototype indicated users should swipe the screen, we had several alternative methods of input that we considered and discussed with participants, eventually settling on a Bluetooth-paired ring which has a simple button. This was deemed the least intrusive of the possible methods of input, as it does not require the user to hold anything nor does it interrupt their natural running stride.

The second primary task, receiving injury prevention and alleviation suggestions, was also modified due to feedback from usability tests. A participant found the pre-run exercise suggestion to be an interruption to her desired workout, so we moved exercise and stretching suggestions to instead occur after the run has been completed. In their place at the start of the run, we added easily dismiss-able tips and insights that leverage the athlete's recently recorded pain and workout data. This adds to the task, giving the athlete multiple ways to get value from the insights that the application draws from their workout and pain data, while making it less of an interruption.

Beyond changes to the primary tasks, the usability tests and the rest of the iterative design process helped us greatly refine the clarity of our design. We added additional instructional text to bolster the user's understanding of how to navigate the application and work through the tasks. We made the language throughout the application more colloquial and consistent, so it was easier for users to understand. We refined what data we presented to users about their runs

and in what way the data was organized in response to feedback from usability tests. Finally, we changed some methods of interaction to better match the intuition of new users, based on what participants attempted when interacting with our application for the first time.

The iterative design process helped our application evolve and meet the needs of our target audience, shaping our primary tasks and the look and feel of the rest of the application. More design iterations would have likely been productive, as we ultimately decided to change our primary method of inputting pain points after most of our testing was completed. However, we did discuss this method with all participants, so we had some relevant feedback with regard to this input method.

APPENDIX

We did not have an exact script, but our usability tests followed a common process. Here is the detailed structure of what was discussed and which tasks we asked participants to perform:

1. Welcome participant, introduce ourselves
2. Explain the purpose of the usability test. Ask the participant to think out loud during the process, and explain that we are testing the prototype, not them.
3. Introduce the app and explain its purpose as a workout tracking application that helps athletes keep track of repetitive stress injuries.
4. Ask the participant to complete the first task, going for a run and tracking pain in their left shin
   a. While the participant is at the run screen, tell them that they have pain in their shin and see how they interact with the application
   b. While the participant is at the run screen, tell them their shoelace is untied and they need to stop for a moment, see how they interact
   c. Tell the participant when their run is completed, see how they interact to stop the run
5. Ask the participant to complete the second task by starting another run
   a. See how the user interacts and responds to the suggestion that pops up before/after the run
   b. For test 1 and 2, the suggestion was before the run, for test 3, there were suggestions before and after the run as a result of changes to the design.
6. Ask the participant to complete the third task, viewing data from a run which they did on November 1st.
7. (Tests 1 and 2): Ask the participant to complete the fourth task, going for a run and tracking pain in two body parts (left shin and right knee)
   a. While participant is at the run screen, tell them a few times that they have pain in either their left shin or right knee, see how they interact with the application.
   b. Tell the participant the run is completed to see how they interact with the application
   c. See how the participant navigates the post-run flow of classifying the given pain points to the correct body part.
8. Ask the participant how they felt about the method of interaction during the run
   a. How would they feel about using a smartwatch button rather than swiping a phone screen?
   b. How would they feel about using a ring-based input?
   c. How would they feel about using input on another body part (tapping shoulder, touching glasses, etc)
9. Ask the participant which parts of the application they found confusing
10. Ask the participant which parts of the application they especially liked, which parts they especially disliked
11. Ask the participants which data about their workouts and/or their pain they would like to see, but could not find in the application
12. Thank the participant for their time and feedback, concluding the test
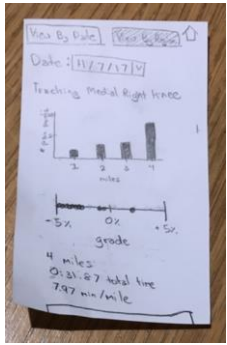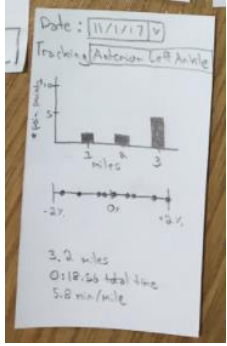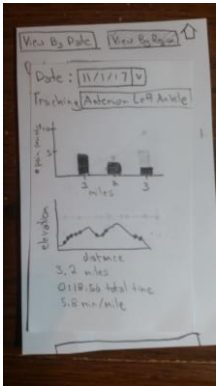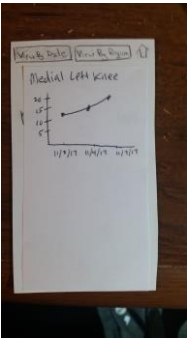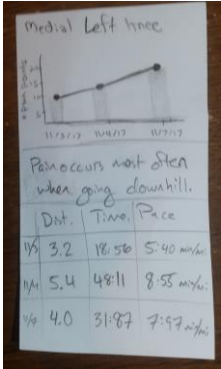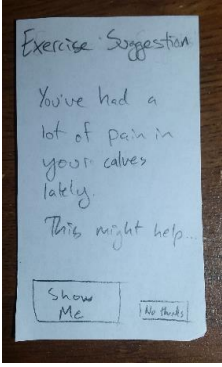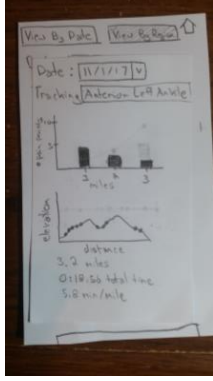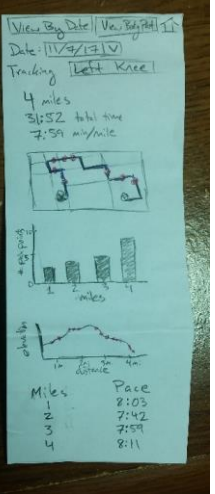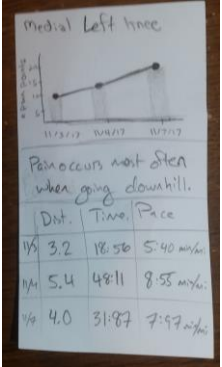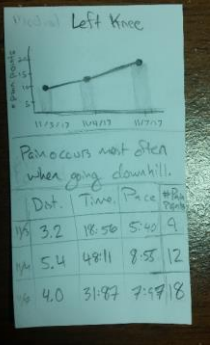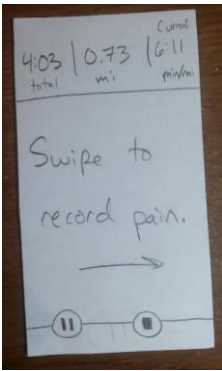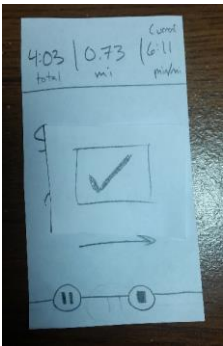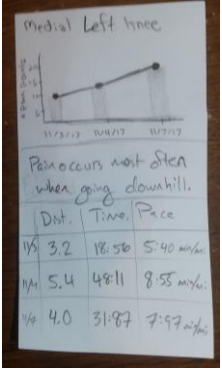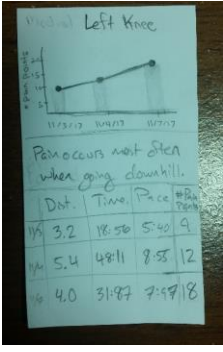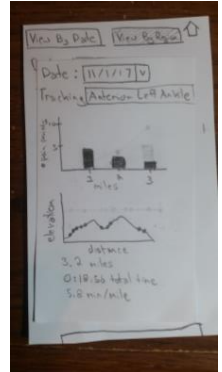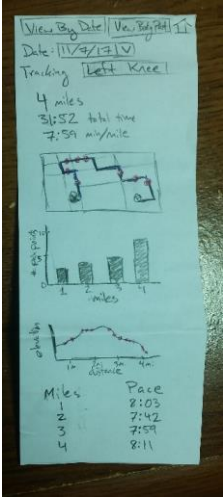
Image	Issue	Severity	Revision	Revision Image(s)
	Tried to swipe side by side to change the date in "view by date" section, but was told it was not supported	2	Is now supported	No change to the prototype for this issue (rather, a change to the behavior of the computer in future usability tests)
	Was confused by the way the data was presented (thought the pain point graph was continuous rather than per mile, did not understand the grade (%) graph)	2	Changed the pain point bar chart to be decreasing, changed the grade graph to be a more visual distance/elevation graph	
	Desired more information, such as summary information, in the "View by Region" section	4	Added a tip and chart of data over several runs	

Image	Issue	Severity	Revision	Revision Image(s)
	Felt that having the exercise suggestion before the run didn't flow well because runners may not want to spend time doing it when they are already in the mindset to run. Felt that giving a running tip before the run and then an exercise suggestion afterwards would make more sense	3	Added a tip pop-up after the start screen (shown on the right), moved the exercise suggestion to after the run.	
	Wanted pace data as a part of the workout data view	2	Added pace data to the "View By Date" screen, reordered the info so summary data was at the top, followed by maps, charts, and pace	
	Desired pain point data in the chart summary for the "View by Body Part" screens	2	Added a pain point column	

	Did not know whether a pain point was inputted successfully	4	Added a pop up screen that confirmed successful input, and made the phone "vibrate" (change in computer behavior)	
	Was confused by terminology like "medial" and "anterior"	3	Removed terms from all screens and replaced with simpler language	
	Was confused by "region" (also shown by our heuristic evaluators earlier)	3	Changed "region" to "body parts" on all screens (example on the right)	

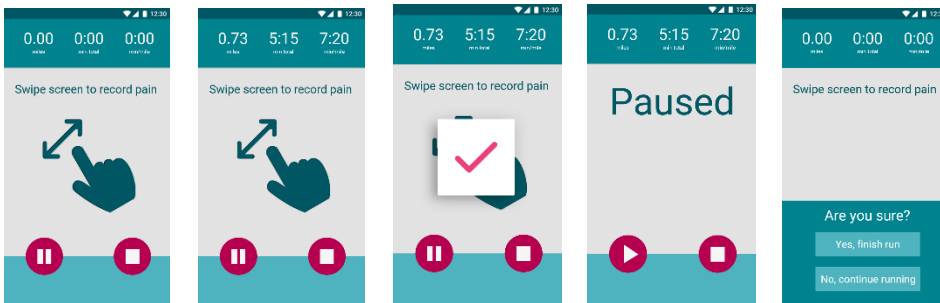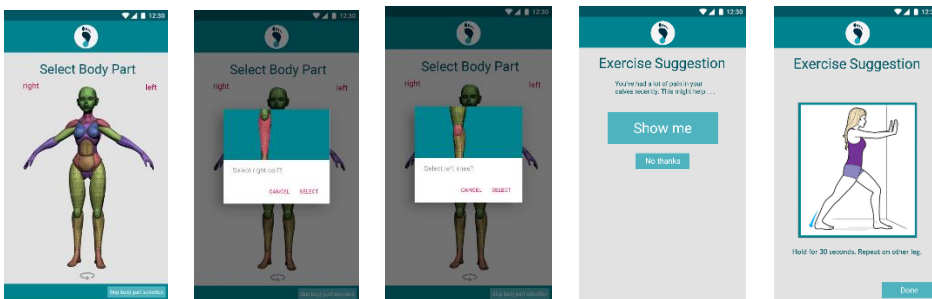| Image	Issue	Severity	Revision	Revision Image(s)
	Wanted an automatic pause/resume functionality that allowed the GPS to determine whether or not you have paused without manual input.	0	No revision made, because too many cons. GPS not always reliable, and slight inaccuracies can impact accuracy of time.	N/A
	Confused about the start/finish of the route on the map. Wasn't sure if flag image meant start or finish.	2	Modified map to be more clear (larger icons, changed flag icon to be a checkered flag).	

ALL DIGITAL MOCK-UP SCREENS

BEFORE RUN
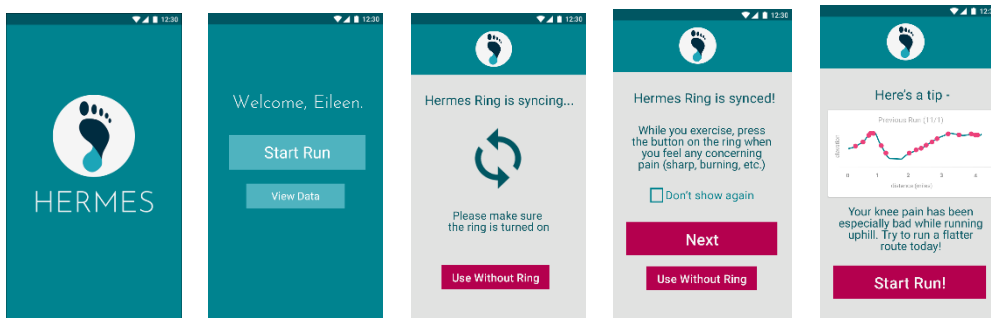
DURING RUN (WITH RING)
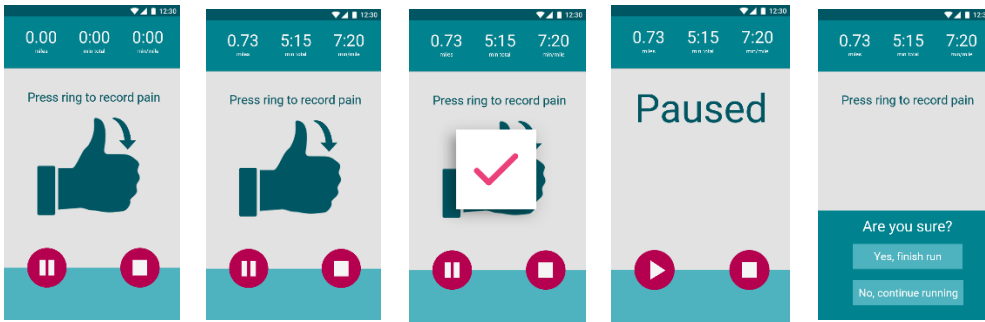
DURING RUN (WITHOUT RING)

AFTER RUN

VIEW DATA