Band-it

Getting the Right Design

Daniel Luna, Mackenzie Miller, Saloni Parikh, Ben Tebbs

Meet the Team

- Mackenzie Miller: Project Manager
- Daniel Luna: Research Coordinator
- Saloni Parikh: User Interface Designer
- Ben Tebbs: Writer

Problem and Solution Overview

For an athlete, an injury can be career ending. However in practice it can be hard to pinpoint specific exercises that aggravate an injury or pose high risk. We aim to help people track those activities that cause them pain or injury. We focus on athletes, a group of people who are far more health conscious than the general population. Our proposed design involves a wearable band that will detect the amount of exertion in a specific area and warn the participant when they overexert by contracting gently. They can also track when they are experiencing pain in their work out in real time using voice commands. This will let the participant know what activity will cause injury and pain, and allow them to adjust their workout accordingly.

Contextual Inquiry Target, Stakeholders, and Participants

All of our participants were experienced dancers. We chose our participants for their range in training, age, and sex, which can all affect the kinds of injuries they receive or are at risk for. We chose dancers because they are a subset of athletes who experience joint pain and injury in multiple areas of the body. The participants we interviewed also mentioned cross-training in other sports or kinesthetic exercise such as yoga, pilates, tennis, running, and biking.

Sam

We interviewed and observed Sam, an MFA candidate in the UW Dance Department. Sam has decades of training in ballet and modern dance, and also does yoga and pilates. The contextual inquiry took place in Meany Hall in one of the spacious dance studios. We also learned about what sort of methods she used to track her pain (she uses a calendar and her memory) and

what sort of technology she brings to the studio. She leaves her phone on silent and only uses it for emergencies. Her focus is on movement when she steps into the studio. This means our design must be something that can be used in an non-intrusive way, probably used more for reflection before/after the workout than during the workout.

Kirk

Kirk is an undergraduate student at the UW Dance Department. The contextual inquiry took place at an IMA studio. We learned that Kirk relies on searching the internet for information regarding pain symptoms in order to self-diagnose himself. Kirk does a lot of his tracking by memory and does not currently use technology to track his activities. He would be interested in knowing how pressure and force is distributed throughout his body while dancing.

Sally

Sally is an undergraduate at the University of Washington who dances with an Indian classical dance team called Natya. She has been learning Indian classical dance for over twelve years and has suffered from back spasms in the past few years of her dancing career. We learned that Sally is a disciplined tracker when it comes to food intake and activity. She has been tracking her food for the past three years and her activity since July.

Contextual Inquiry Themes

All of our contextual inquiry participants tracked their pain and activity either by memorization or written record. They all mentioned avoiding anything intrusive during their exercises, and none currently used wearables. However, the participants did not discard wearables as long as their presence proved valuable and non-intrusive. The participants were social regarding their injuries, consulting with friends and doctors alike. All three presented a very diligent and focused mindset regarding their physical routines and schedule. Their health is important to their craft and would be open to using a product designed to contribute in this area. None of them were using any current technology solutions designed to track joint pain and activity.

In developing our tasks and designs, we increasingly confirmed our initial suspicion that there isn't room for a social component in the design. During the contextual inquiry we suspected that no one would want to share their pain level and weren't sure about sharing just activity data. After the inquiries we made a distinction that none of the participants logged or talked about their pain or activity online, and when they did share with one another it was an in-person conversation. Because of this we kept an open mind in the 3x4 design step, and explored how we might include a social component for teams or work-out buddies. This came from the inquiry with Sally where she would record video of the dance team's routine and post it online for the others to see. In the end, we did agree that this was probably the weakest of the designs we came up with and didn't see it fitting in as part of the final design.

Answers to Task Analysis Questions

1. Who is going to use the design?

Athletes who are concerned with pain management or recovering from an overuse injury. Athletes are very health conscious and typically physically fit and interested in preventing injury and pain. Most of our participants will probably be people who enjoy using technology in their daily life, which may mean a trend towards the younger half of the age spectrum.

2. What tasks do they now perform?

Sam records daily activity in a schedule, and keeps mental notes of pain instances and her recovery progress. Kirk keeps only mental notes and sees a doctor for pain that persists for especially long periods of time. Sally keeps a planner where she records instances of pain as well as her daily activity. She saw a chiropractor and a physical therapist when she had back issues. She also times how long each exercise in a warm up lasts for.

3. What tasks are desired?

Sam did not desire any additional tasks. Kirk mentioned that being able to see visualizations of his pain and activity data would be interesting, but did not think it would be incredibly useful for him. Sally was very receptive to the idea of graphs correlating pain and activity over time, and thought she would use them. She was also interested in goal planning.

4. How are the tasks learned?

Sally said that when she first began to track her food and activity she had trouble remembering, but that not long after starting it became a part of her nightly routine. She also said that when she initially struggled to remember to do daily physical therapy exercises for her back but these too soon became habit.

Sam records information about her activity but didn't speak of it like it was a learned task. She seemed to categorize it as normal day planning. Kirk did not mention doing any tasks that would require learning.

5. Where are the tasks performed?

All the participants seemed like they would not record data during the workout. Therefore, the tasks would be performed immediately before or after the workout, or at home. The user would probably input data before and after the workout, and at home would reflect on the data. Above all, the tasks need to be non-intrusive.

6. What is the relationship between the person and data?

The data itself would be strictly personal, with the exception of sharing the data with a doctor. None of the participants indicated that they would want to share the direct data with their friends. However, they did talk about having in-person discussions with a friend or fellow dancer where they talked about which activities cause and reduce pain. It would probably need to be accessible on multiple machines.

7. What other tools does the person have?

Participants currently use a calendar or day planner, Microsoft OneNote, and Kirk mentioned Googling his symptoms every time he was experiencing a new injury. Sally also uses her phone as a timer for her warms ups, and as a timer and pedometer during runs. She also uses her phone to record video of her dance practices which she uses as a learning tool and shares with other members of the dance team.

8. How do people communicate with each other?

In the few cases in which our participants mentioned discussing their pain or injury with another person it was always face to face. They asked advice from peers and instructors on how to treat pain or accommodate the part of the body that was injured.

9. How often are the tasks performed?

The tasks that involve input of data would probably be performed daily or very regularly. The tasks would be performed whenever the athlete works out, exercises, or experiences pain or injury, which all the people we spoke to do regularly. At home, the user would be able to check out their data on an irregular basis, depending on what works for them. Some users will want to see their data more or less than others. Sally mentioned reflecting on her data once a week.

10. What are the time constraints on the tasks?

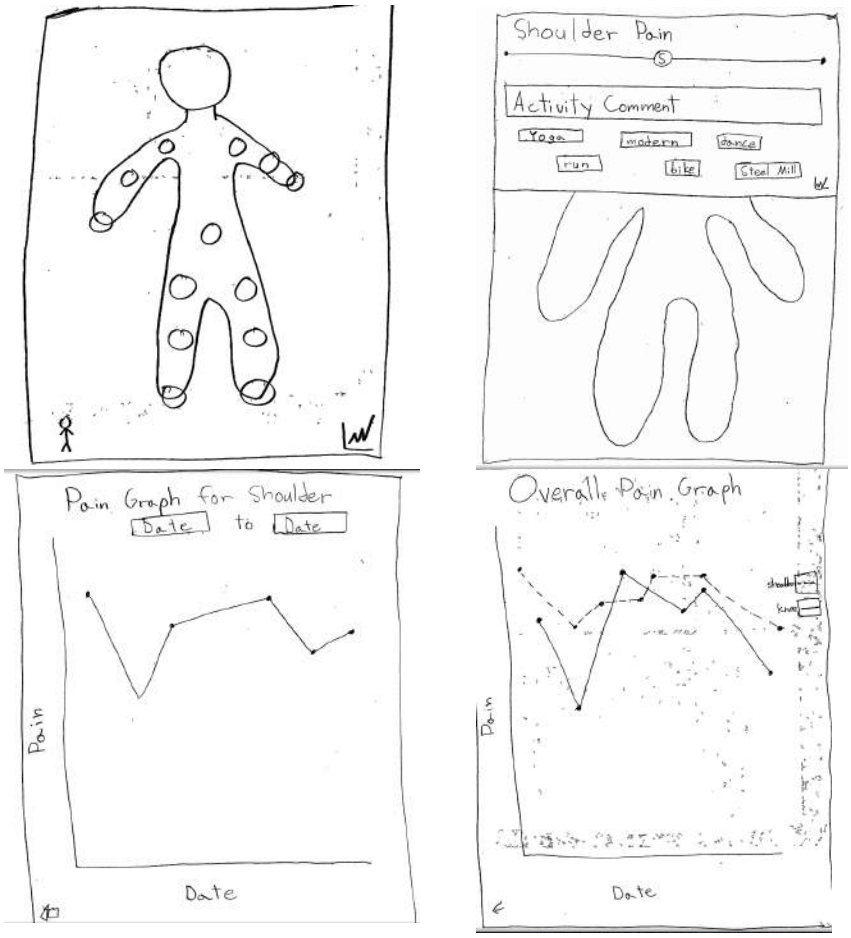
The participant should input data within hours or days of performing the activity or experiencing pain otherwise they risk forgetting about it before they get a chance to record it. Sally mentioned that she records her food and activity every night before bed and reflects on it at the end of each week. Sam was not specific about when she updates her calendar, but is reasonable to expect that she updates it on approximately a weekly basis.

11. What happens when things go wrong?

Sally mentioned that at the beginning of her physical therapy for her back spasms she had trouble remembering to do her therapeutic workouts. To address this problem, she kept a visual representation of her workout on the wall. This served the function of reminding her to work out. Our design could incorporate a similar sort of reminder system for the users to help them get over the practical difficulty of remembering to do work outs and record data every day.

Proposed Design Sketches - "3x4"

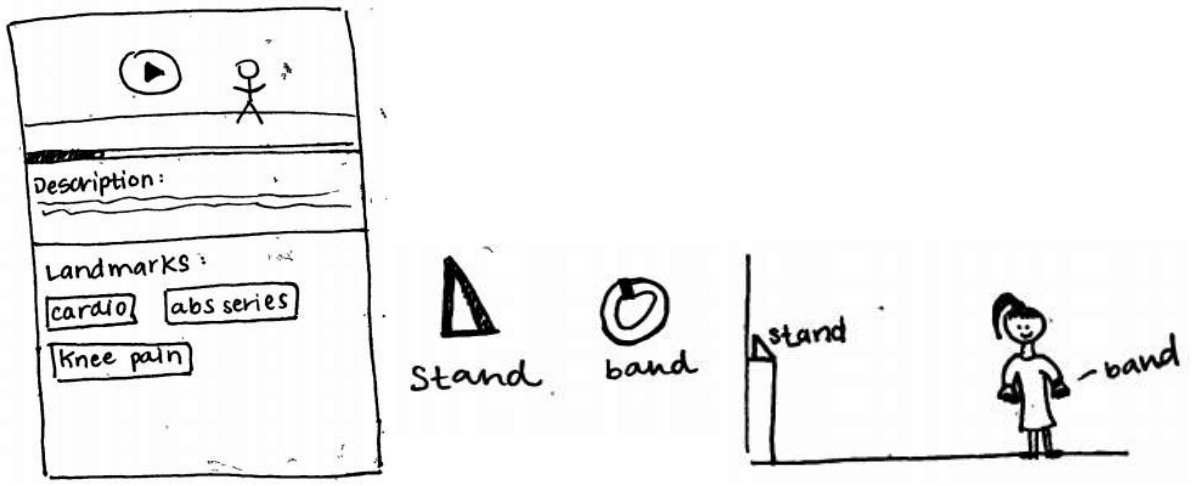
App for Preventative Tracking of Pain and Activity: Tasks 1, 2, 4, 5



This is an app whose first screen is a gender-neutral sketch of an anterior facing person. There are highlighted circles over each major pain area or joint. The other takes the participant to a new screen of their data over time. This is the "joint selection" screen. Clicking on one of the highlighted circles causes the icons and other highlights to disappear and the clicked one to

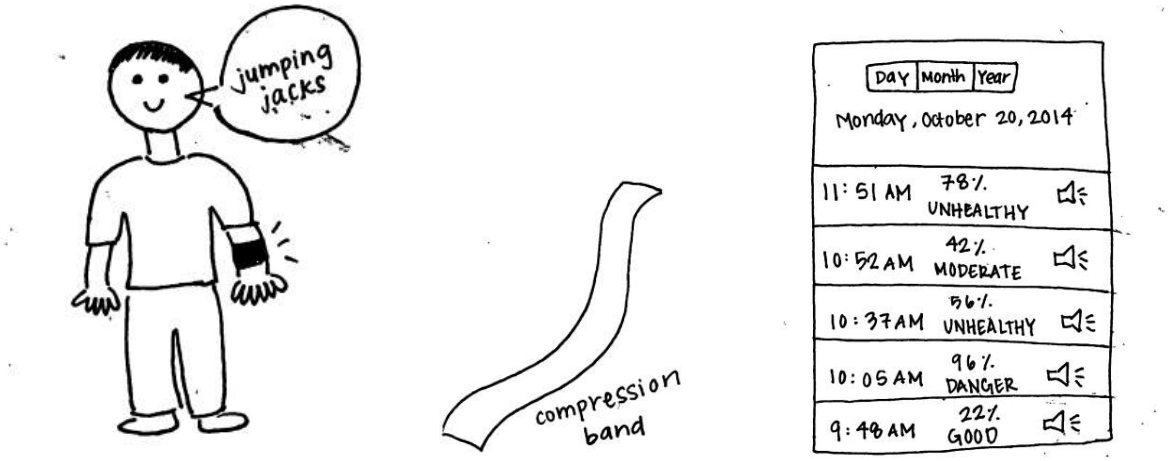
darken. A menu slides down from the top containing a pain level slider to rate from zero to ten is at the top, with a text entry “activity comment” zone below it. The comment has saved keywords as suggestions the user can press instead of typing. The pain slider is independent for each joint but the comment area carries over for all daily data. The app provides a way to present tracked data to a physician, and satisfies by the ability to track both pain and activity.

Phone Video Stand and Wristband Combo Social App: Tasks 1, 2, 3, 6



A phone app that films the user in their workout or activity, and interacts with the custom stand. It auto-uploads the footage to a server. The stand swivels to follow the wearer so they stay in frame. The video takes speech commands and translates them to labels for landmarks in the video. Participants can share uploaded videos with each other within groups, and members of a group can leave comments on the video. The landmarks can be used by the participant to record moments of pain or transitions in type of activity. Task one is completed by providing a means to record activity in video format and having the ability to share recorded content with others (in this case, physicians). Task two can be completed by making landmarks for each activity so a participant can see how long each one took. Task three is completed by providing video sharing of warm-ups that prevent injury. Task six is completed by creating a shared video space to keep track of each others tennis activity.

Rehabilitation/Prevention Wearable: Tasks 1, 3, 4, 5



A compression sleeve that attaches to the skin on the area of pain. The wearable collects information via an electromyogram (EMG) about the stress the muscles in the area are being put through. The device connects to a mobile/desktop app which stores the electromyographical data and your entered activity data. Every time you exceed a certain exertion level the band gently constricts as an indicator to you that what you pushed yourself too hard. After the compression the participant has several seconds to speak aloud what they are doing without having to discontinue the movement or workout. On the app you can see a history of past uses. Every time someone overexerts, a push notification is sent reporting the level of exertion that triggered the compression. The history contains these reports stating time, exertion percentage, and any speech recording as either text or audio. If a workout occurs with no overexertion incidents, the participant can go to the app to record what their activity was as text or audio. The band also has "button" that when pressed allows the user record any other activity information. The raw EMG data can be shared with a doctor, or an instructor who needs to provide modified exercises. Participants can see what exercises overwork areas that are currently or may later become a problem for them.

We have narrowed down our design to focus on two tasks:

Task 4: Michelle wants to track her pain in old injury that has recently been acting up again, to determine the activity causing the flare up.

Task 5: With a family history of osteoarthritis, Don wants to find exercises to prevent the condition.

We chose this design based on our contextual inquiries. The participants we inquired all talked about being able to use a non-invasive wearable device. The wearable would allow the athlete to track real-time workout data. This is important because it minimizes user input into a mobile device. We want to make the experience for the participant as simple as possible to motivate

the use of the product. We feel this is well suited to the people we are targeting because it comes directly from our contextual inquiries. The people we are targeting all want something that does not take too much effort to set up and use. We chose tasks 4 and 5 because they both incorporated both prevention and rehabilitation. They also created value for both people who were new to an active lifestyle and people who had been working out a long time. Both supported the design because they focus on specific problem areas that the person using the design knows ahead of time

Written Scenarios - "1x2"

Task 1: With a family history of osteoarthritis, Donald wants to find exercises to prevent the condition.

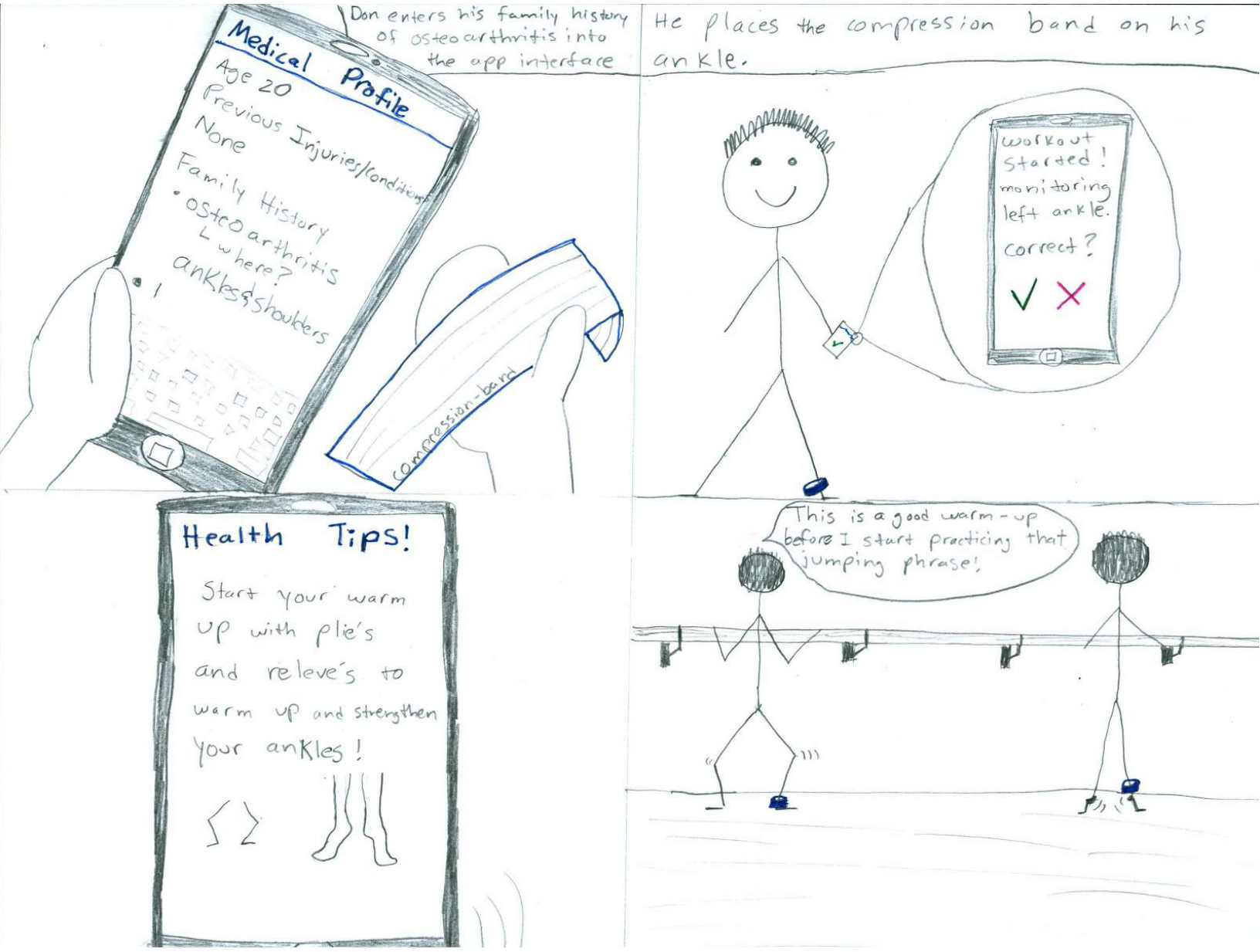
Don has a family history of osteoarthritis. He inputs his history into the app through a simple menu. He puts the band onto his problem area, and confirms his problem area with the band. He then looks at the screen to see workout tips that let him know what he should adjust to avoid aggravating his medical condition.

Task 2: Sally wants to track her pain in old injury that has recently been acting up again, to determine the activity causing the flare up.

Sally has patellar tendinitis. She puts the compression band on her affected area, her knee. On landing from her jump, she overexerts her knee, so the band gives her a gentle compression to let her know. Knowing that after the band compresses she has 10 seconds to record a voice memo, Sally says "jumping jacks" to record what caused the overexertion. After her workout, she can see how much she over-exerted her knee, and replay her voice memo by touching the speaker button.

Storyboards of the Selected Design

Task 1: With a family history of osteoarthritis, Donald wants to find exercises to prevent the condition.



Task 2: Sally wants to track her pain in old injury that has recently been acting up again, to determine the activity causing the flare up.