PROJECT 2: ReactRelief - Designing for Anxious Pets

“He’s stressed, anxious, and irritable, but I can’t help him.”

PROBLEM

Reactivity is a behavioral pattern in certain dogs characterized by heightened and unpredictable responses to stimuli, often causing distress for them and their owners [1]. This can be excessive barking, violent tendencies, or anxieties. Managing reactivity is challenging and it also has serious implications on pets, their owners, and even neighbors.

GOAL

My goal is to speak to owners of reactive dogs and learn what current strategies already exist, and what solutions they might benefit from.

I aim to iteratively develop a practical solution for reactive and anxious pets, easing the emotional distress experienced by owners and their animals.

1. Focus Group

I recruited 5 participants, ages 24-60 years and each reactive dog owners for a semi-structured focus group. The focus group was designed to collaboratively discuss experiences, challenges, problem-solving attempts, and desired solutions. This format allowed participants to draw inspiration from, and build on, other participants’ ideas, resulting in well-rounded and universal solution ideas that accommodate different levels and presentations of reactivity. Notable comments were extracted and organized into overarching themes through affinity diagramming.

2. Affinity Diagramming

Emotional Challenges

- “I always feel anxious on walks because I don’t know how my dog will act
- “It’s embarrassing, people hear him barking from the window all day”
- “I feel guilty. He’s stressed, anxious, and irritable, but I can’t help him”

Help Seeking

- “I’ve considered getting him a sort of heart rate monitor”
- “Sense a trigger and send a quick alert to me”
- “Give my walkers or sitters info on his triggers and what to do”
- “tracks where he has issues in the neighborhood”

Tech Concerns

- “I avoid chemicals and medicine, and anything that will hurt him”
- “I’ve seen collars with calming effects, but my dog wears a harness”

Behavioral Triggers

- “Scooters, bikes, electric cars...”
- “Other dogs and animals”
- “We can’t take him to dog parks because he reacts differently to different breeds”

Solutions & Strategies

- “We play music for him when he’s alone in the house”
- “She wears a thunder shirt during storms”
- “Just take a mental note of what triggers him”

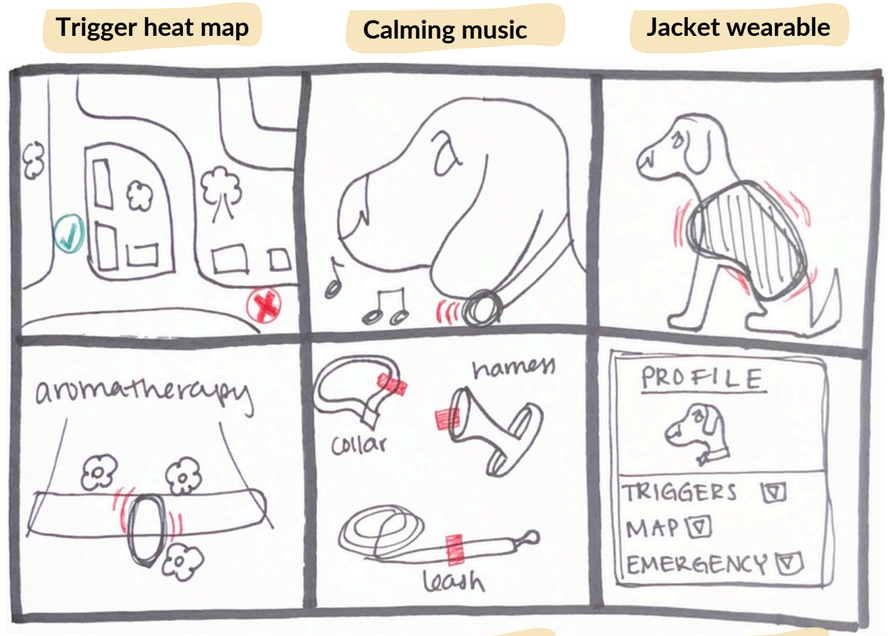
REQUIREMENTS & FEATURES

Using the categories that emerged from the affinity diagram, I outlined the following functional, technical, and user requirements for a solution:

- Durable to weather conditions and to activity levels of the pet
- Cater to different behavioral triggers
- Help owners prevent reactions in real-time
- Ease anxiety for both owners and pets
- Log of triggers and trigger information for future reference

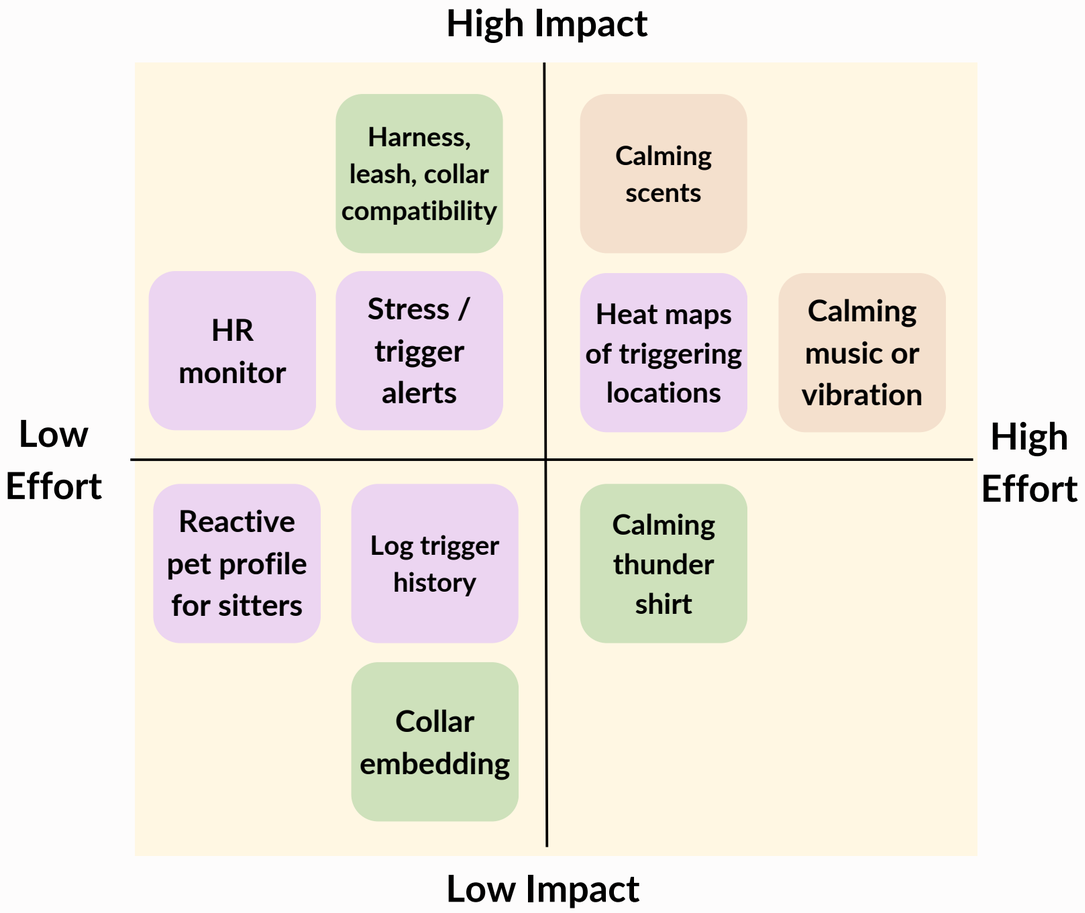
3. Ideation Sketches

Next, I followed the Crazy 8's design sprint to visualize interesting and novel features or configurations that could address these requirements:



4. 2x2 Evaluation Matrix

To decide which designs were plausible and which to eliminate, I plotted them on a 2x2 evaluation matrix measuring impact and effort. This allowed me to ensure that the solution would be feasible and still address all outlined requirements for the users. **The more impactful configuration (the attachable device) was selected** over the embedding and wearables. Additionally, the **calming features and a trigger heat map would be more efficient for real-time** problem-solving compared to storing and listing trigger information in profile format.



5. Paper Prototype Development and Testing

I created and tested a paper prototype of the device with the reactive pet of one of the focus group participants to evaluate the physical appeal and comfort of the device, and collected feedback from the owner as well.

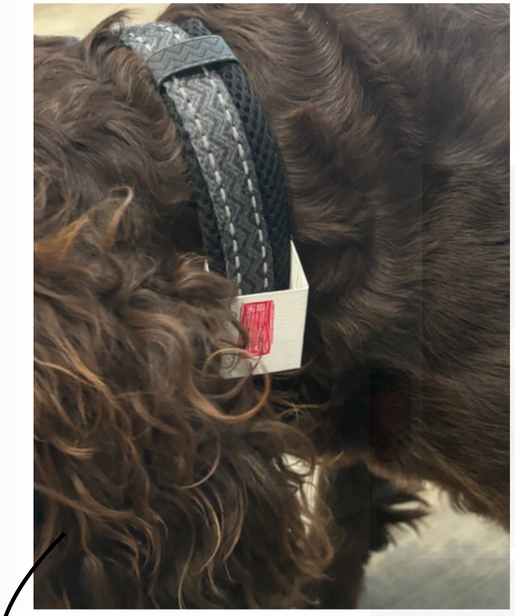
To accomplish this, the pet wore their collar with the attachment for 24 hours, both inside the house and outside on a routine walk. This allowed me to assess if the product can be integrated into the pets' daily/overnight routines.

TEST OBSERVATIONS:

- The pet did not change behavior or seem bothered by the device attached to the collar, both inside and outside the home or while asleep
- Attachment was a suitable size and shape for most common dog walking accessories (tested on harness, collar, and leash)
- Red light is visible on the collar
- Proximity of device to pet's body and nose allow for the olfactory or vibratory mechanisms to work efficiently

FEEDBACK:

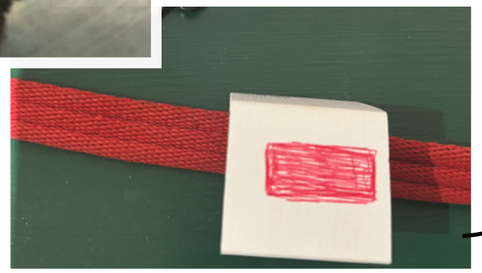
- Compatibility with leash has limited functionality - incapable of detecting triggers through HR or calming through vibrations
- *Prioritize control for the owner*; device should be compatible with an app or remote to control the calming mechanism or be informed of the trigger if they are away from their pet
- Owner found the device intuitive and did not notice discomfort in their pet



During trigger, it will release calming vibrations or scents

Red light will blink to alert owner of elevated HR, indicating stress or trigger

Small and compact, suitable for smaller dogs as well as larger breeds

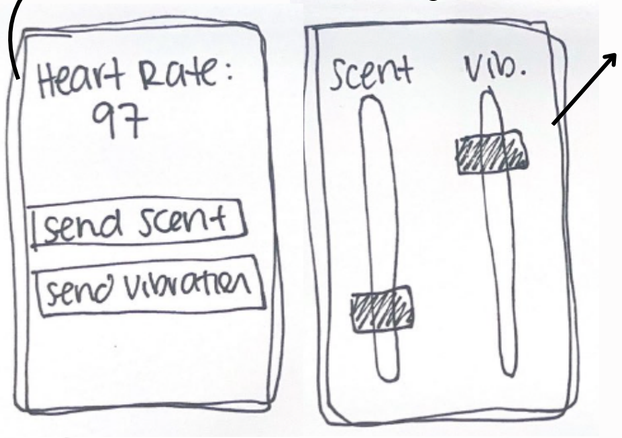


Compatible with leash, harness, and collars

6. Wireframing Design Ideas

To address feedback, I drew from the 'human-in-the-loop' approach to integrate the owner with the technology. Through a mobile app that serves as a remote control for the physical attachment, the owner can be granted full control over the system and their pet's care.

Owner receives alerts when HR exceeds threshold and can control calming mechanism



Sliders to control level of each mechanism to accommodate different pet sensitivity levels

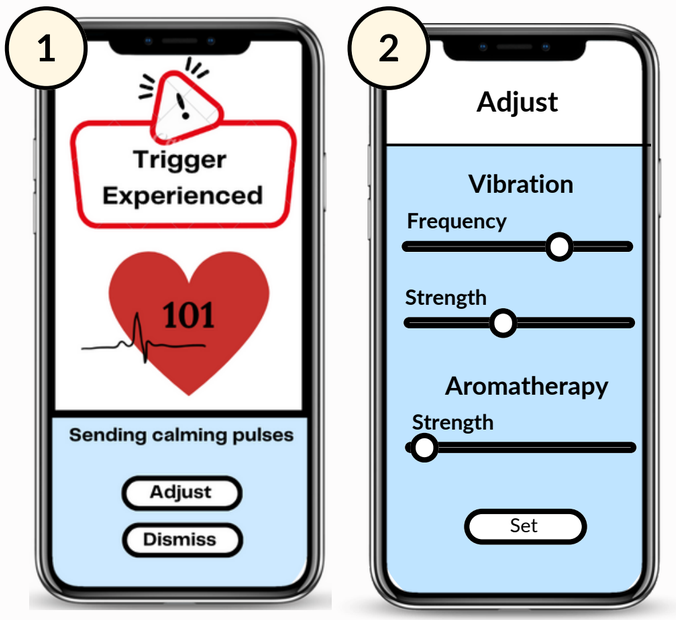
I returned to the initial focus group participants for feedback on the remote control application:

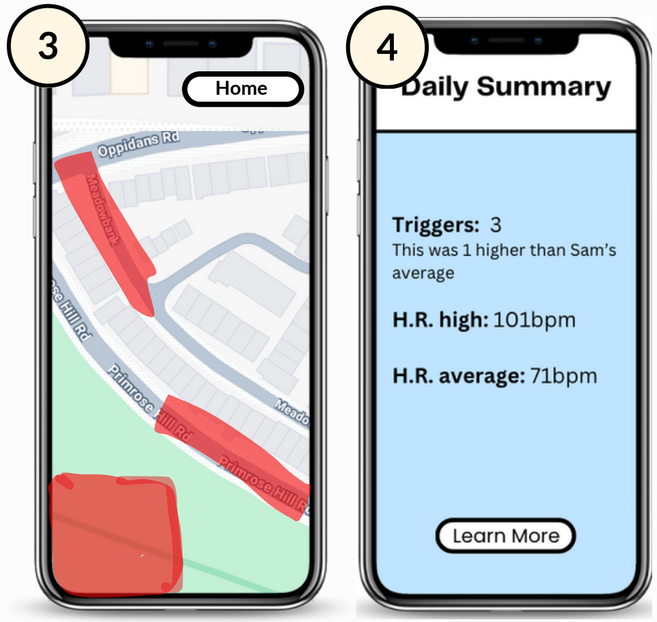
- Include more visual data
- Sliders could have more control or ability
- More detail on the alert and what the HR indicates
- Ability to dismiss the alert if they don't want to take action

Locations of triggers logged for future reference

Daily summary for the owner to review data and learn patterns

7. Final Prototype

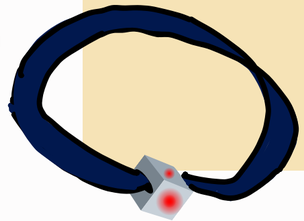




ReactRelief is a solution that helps owners manage and prevent reactivity in real-time with non-invasive mechanisms and full control via the app.

Key Features:

1. When the dog's HR exceeds a threshold, the phone alert is high contrast and stark to get the owner's attention and provide simple follow-up actions.
2. The sliders are easy to control and can be used from afar in case the pet experiences separation anxiety.
3. Rather than listing triggers, this data is provided as a heat map, where owners can view locations that have caused triggers before and avoid them on walks.
4. The attachment has a blinking light to match the dog's HR, providing the owner real-time feedback of pet stress levels



5. Digital mockup of ReactRelief attachable device

Reflections and Learnings

The biggest challenge for this project was to create a product that incorporated both pet and owner needs. Not only did it need to be durable and comfortable for the pet, but the mechanisms needed to be non-invasive and fully controllable by the owner.

Upon reflection, an improvement I would make when testing ReactRelief would be to test it on several dogs of varying sizes, ages, breeds, and activity levels. This would allow me to ensure its physical compatibility with a wide demographic. Additionally, I would conduct user testing on the app to ensure its usability in a high-stress situation to simulate managing a trigger in real-time.

[1] Hart, C. J., & King, T. (2023). "It's Okay He's Friendly": Understanding the Experience of Owning and Walking a Reactive Dog Using a Qualitative Online Survey. Anthrozoös, 37(2), 379–400. https://doi.org/10.1080/08927936.2023.2287314

PROJECT 3: Fitness Wearable Mini-Project: InSole

Project Overview

Personal informatics devices are used to monitor and improve physical health, particularly in wearable device format. These devices are used to collect internal metrics (e.g. heart rate, blood pressure) or external metrics related to performance (e.g. step count, speed). However, form, foot-strike, and shoe-fit are critical for athletes that do frequent running [1], [2]. Common fitness wearables, such as watches and chest straps can't capture accurate data on these, as they require specific measurements related to the foot. The goal of this project is to identify, design, and evaluate a product that can collect data relevant to foot-form and athlete shoes to improve form and prevent form-related injuries.

1. Ideation: Rapid Sketches

2. Evaluation: Harris Profile

I used the Harris Profile method to systematically measure and compare key feasibility metrics. This revealed the **Shoe Insert and Insole** as the **most effective choice** and the Wrap-Around Band as the least effective.

	Shoe				Sock				Shoe Insert				Shoe Insole				Wrap-Around Ankle Band			
	-2	-1	1	2	-2	-1	1	2	-2	-1	1	2	-2	-1	1	2	-2	-1	1	2
Comfort																				
Investment																				
Durability																				
Aesthetic																				

3. Feedback: Survey

To narrow down specific product requirements and ensure usability of the insole or insert, I conducted semi-structured interviews with members of a high school cross country team, allowing me to collect information on user needs and wants. Using the structure of an affinity diagram, I organized feedback into two overarching themes: the product and the data.

Usability Feedback

"The insole would be compatible with all my different shoes"

"I like hiking, so being able to fit it into a boot would help"

"I use insoles for arch support so I don't know if it would interfere"

Data Collection & Display Feedback

"I'd want the data on my Apple Watch"

"If it connected to Strava or Apple Health, I could see the data there"

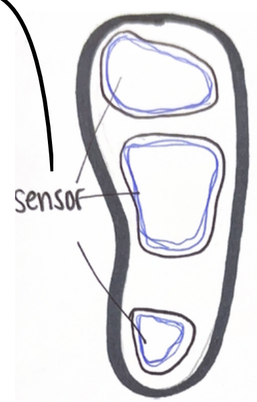
Requirements

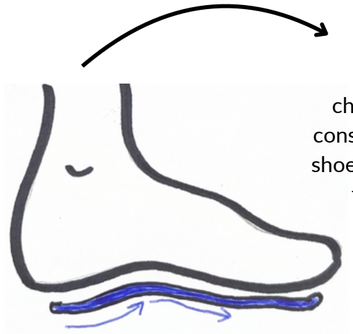
Based on the feedback collected through the survey, I outlined the following product and user requirements to better design the insole and ideate critical features

1. Slimmer than an insole and adapts to foot shape
    a. Not too bulky to cause interference with physio insoles
    b. Compatible with different shoes
2. Collect data on important variables
    a. The embedded sensors will include ([3]):
        i. **Accelerometer** (measures acceleration of runner)
        ii. **Gyroscope** (measures foot rotations)
        iii. **Heat sensors** (measures foot weight and placement)
3. Interface with visualizations of data collected

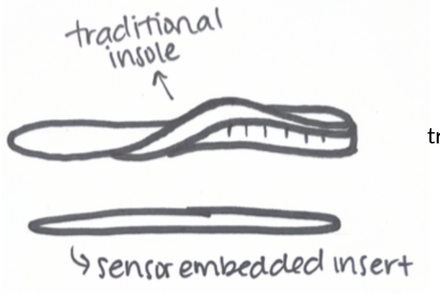
4. Iteration & Updated Prototype Sketches

Functionality:
foot and heat mapping sensors located along the foot surface for foot strike, weight distribution, and pronation data

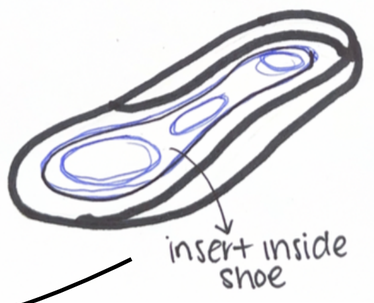




Comfort:
choice of **cork materia**l is consistent with most existing shoe insoles - it is adaptive to the shape of the foot



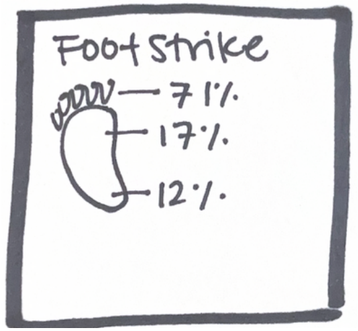
Compatibility:
slimmer and smaller than a traditional insole, so it can be worn with different shoes and won't interfere with other insoles



5. Data Display Sketches and User Testing

In addition to sketching data display ideas, it was critical to ensure user comprehension of the data. I conducted user testing with initial interview participants and noted feedback to create and implement the most effective, comprehensive, and overall beneficial data visualizations.

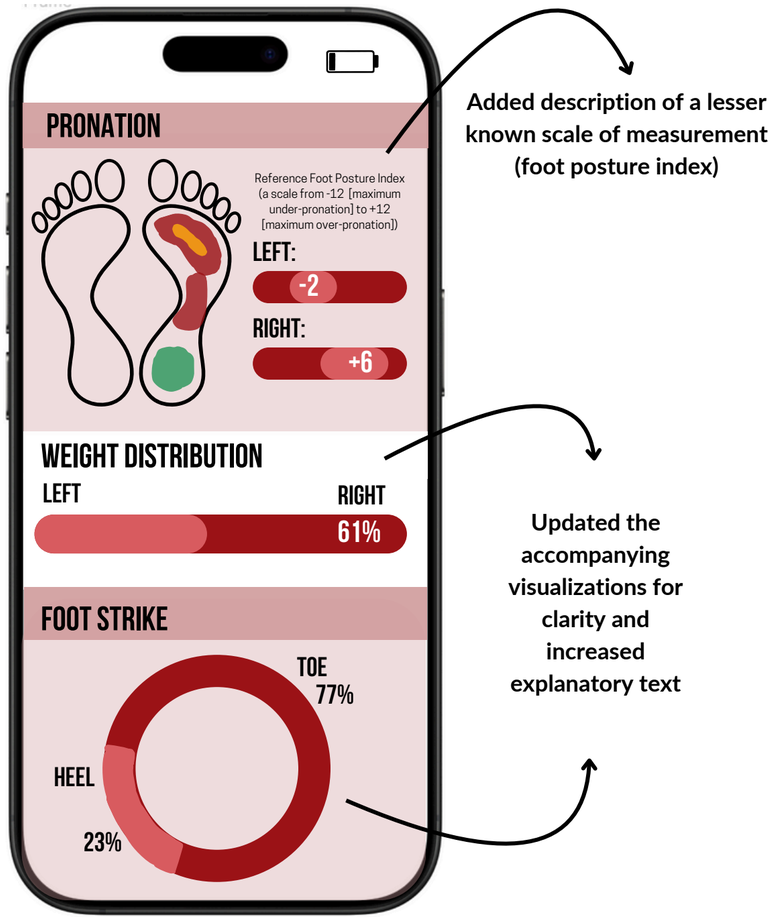
User Test:
Task: accurately describing the data presented in each sketch.
Success criteria: ability to demonstrate an understanding of what the data means or how it can be used to fix/improve running form.



Data Display	Result	Feedback
Foot Strike	2/3 participants succeeded	• Where the line is pointing to on the foot can be misinterpreted • Use a different type of visual (chart or graph) to easier visualize the proportions and differences in location
Pronation	0/3 participants succeeded	• Needs definition of pronation • Needs description of the rating scale
Weight Distribution	3/3 participants succeeded	

6. Data Display Wireframe

Given feedback and observations from the user-testing, I implemented the following changes when developing the higher-fidelity wireframe of each data display on a mobile phone:

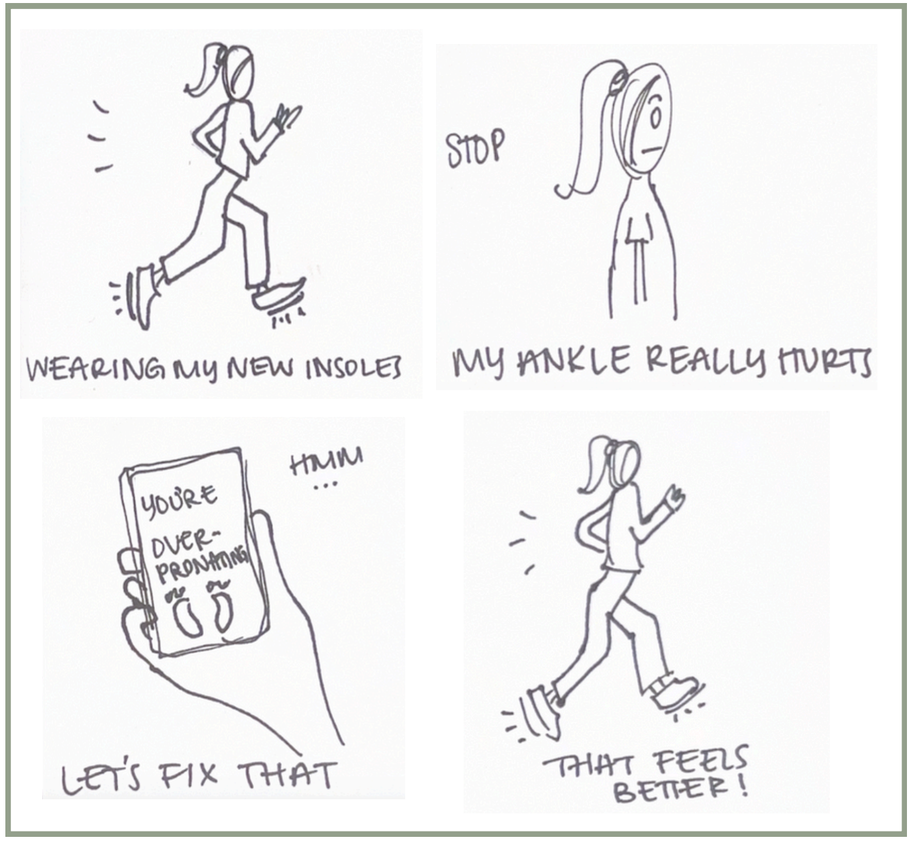


Added description of a lesser known scale of measurement (foot posture index)

Updated the accompanying visualizations for clarity and increased explanatory text

7. Storyboard of Demonstrated Use

In this demonstration, the gyroscope and heat sensor monitors collected data and communicating to this runner that they were over-pronating, causing ankle pain during their run. The runner realized the pain, opened the InSole app, noticed the data on their over-pronation, and was able to keep this in mind on their next run to improve their form and reduce risk of injury from over-pronating.



Reflections and Learnings

InSole is a shoe insert for any athlete or recreational user. Although inspired by running analysis technology, it can benefit a diverse audience, from walkers and hikers to professional athletes. Through embedded sensor technology, the insert collects thorough data on gait, strike, and weight. This is converted into meaningful visualizations located in the InSole mobile application, allowing users to make informed decisions regarding their form and prevent injuries.

The biggest challenge in this project was ensuring that the data visualizations communicated to users with limited data backgrounds, so that they still benefitted from the product. Addressing this reiterated the importance and need for user-testing during the product development lifecycle. If I were to redo this project, I would conduct a focus group or co-design. Given the product's potential to cater to a wide audience, collaborative idea generation and discussion would have been an effective way to gather and combine ideas. Additionally, with a larger scope and more funding resources, I would create a silicone or 3D printed adaptation of the insert to physically test in different user shoes. Lastly, several users in the interview mentioned using a fitness watch to keep track of relevant data, so creating a data display compatible with a watch would be a plausible next step.

[1] Daoud, A. I., Geissler, G. J., Wang, F., Saretsky, J., Daoud, Y. A., & Lieberman, D. E. (2012). Foot strike and injury rates in endurance runners: a retrospective study. Medicine and science in sports and exercise, 44(7), 1325–1334. https://doi.org/10.1249/MSS.0b013e3182465115
[2] Xu, Y., Yuan, P., Wang, R., Wang, D., Liu, J., & Zhou, H. (2021). Effects of foot strike techniques on running biomechanics: a systematic review and meta-analysis. Sports Health, 13(1), 71-77.
[3] Strohrmann, C., Rossi, M., Arnrich, B., and Troster, G. 2012. A Data-Driven Approach to Kinematic Analysis in Running Using Wearable Technology. Proceedings of the 2012 Ninth International Conference on Wearable and Implantable Body Sensor Networks (BSN), London, UK, 118–123. DOI:https://doi.org/10.1109/BSN.2012.1.

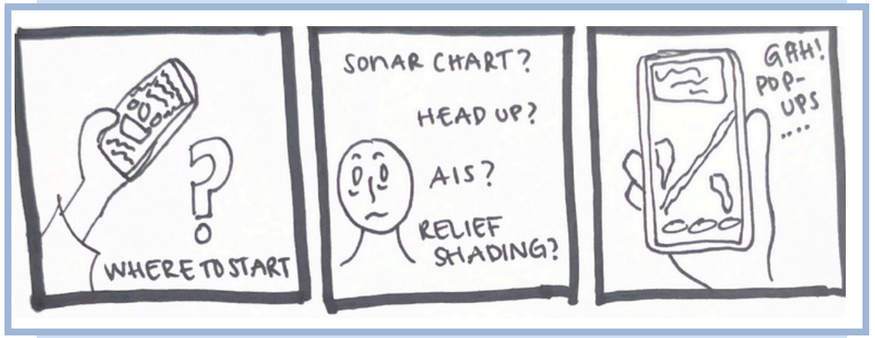
END

PROJECT 1: Navionics Interface Evaluation & Redesign

Overview

Sailing is an inaccessible sport, requiring significant time, resources, and knowledge to participate. The steep learning curve, coupled with limited beginner-friendly resources, makes it challenging for newcomers to involve themselves in the community.

Navionics, a popular sailing navigation app, is an app developed by Garmin, providing it name-brand recognition. However, it falls short of addressing novice and expert user needs through challenging interactions and a chaotic interface. This project aims to evaluate the pain points of Navionics and redesign it to better meet the needs of both expert and beginner users. I use a user-centered design process to ensure feedback across iterations and create an accessible interface for all users.



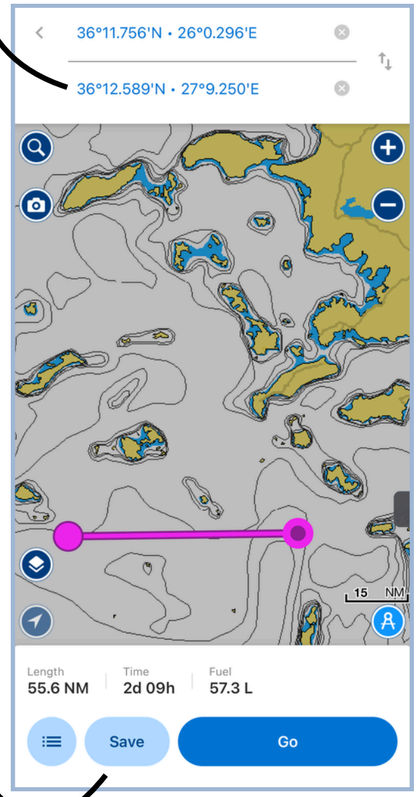
1. Interface Critique

I conducted a heuristic evaluation of Navionics following Nielsen's 10 Usability Heuristics [1], which revealed significant pain points with aesthetics, error prevention, information overload, and meeting general user needs.

Error Prevention & User Control:
easy to make mistakes or unwanted interactions (e.g. creating a manual route with hazards)

Match to Real World:
excessive sailing-specific jargon and inconsistent alphabet (locations of the area's language are not spelled correctly / use English alphabet)

Documentation:
icons, symbols, and jargon are not defined or explained



Visibility:
user is not informed of system status (e.g. page/route load progress, errors, internet connectivity issues)

Flexibility / Efficiency
no shortcuts to speed up interactions of expert users (e.g. saved routes or previously traveled routes)

Aesthetic:
clutter of icons and text, information overload, low contrast, illegible text, small buttons

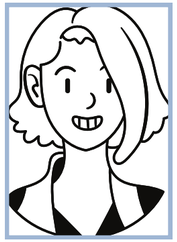
2. User Interviews

To corroborate the critique findings and gather user experiences, user interviews were an integral next-step prior to re-designing. I interviewed current users of Navionics with varying backgrounds and sailing expertise levels to understand experiences, pain points, motivations, and desired solutions.

Two personas emerged, referred to as **Aaron** (an older, more experienced sailor) and **Eileen** (a novice looking to learn more about the sport).

AARON - 53

About: Retiree and captain with 5 years of experience.
Motivations: Intuitive navigation to establish safe routes and reduce technical work
Pain Points: Trouble navigating the clunky interface and translating local languages



EILEEN - 25

About: Taken courses and wants more practice
Motivations: Finding educational resources to get advice during navigation to avoid mistakes
Pain Points: The app is not beginner friendly and uses complex jargon

Findings & Outlining User Requirements

Quotes

"You have to put your cursor in the right spot. I use an iPad making it even harder."

"I have to do a lot of translating. The locations are always spelled wrong, since they use English-ized versions."

"There's nothing to tell you how to make routes. There isn't any information on what icons mean. I had to Google to find out that there were submerged rocks ahead."

Requirements

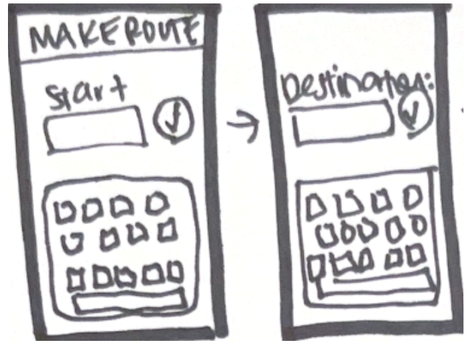
- Beginner friendly & educational
- Consistent language & spelling
- Accessible buttons & navigation
- Shortcuts for frequent actions
- Minimalistic interface with only relevant information

Potential Features

- Guided route creation
- Pop-up screens for more information to reduce clutter on primary interface
- Notifications of coming hazards
- Confirmation of routes to fix errors or change the route

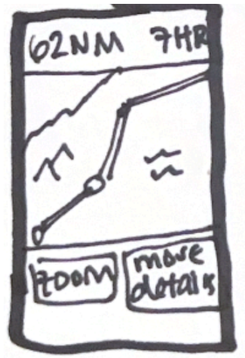
3. Sketches and SWOT Evaluation

Based on the requirements, I sketched mobile app pages during a design sprint. I evaluated these sketches using a SWOT analysis to assess differences in parallel prototypes (e.g. the Hazard Notifications) and also reveal limitations or possible pain points that require further thought.



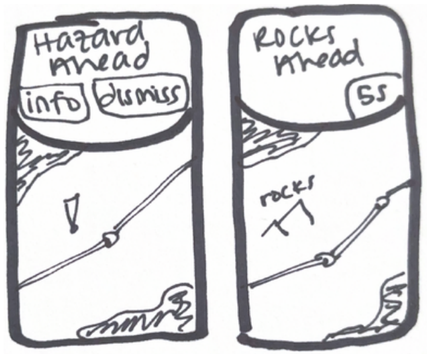
Route Creation

STRENGTH	WEAKNESS
simple, intuitive, guided by interface	multi-step process may feel tedious
OPPORTUNITY	**THREAT**
more chances to correct mistakes	screen change may cause missed mistakes



Navigation

STRENGTH	WEAKNESS
less clutter, relevant info only	zoom inconsistent with typical pinch-to-zoom
OPPORTUNITY	**THREAT**
less distraction from information overload	confusion when searching for more info



Hazard Notifications

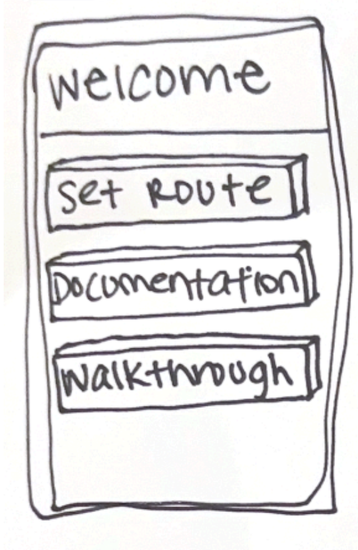
STRENGTH	WEAKNESS
attention to hazard & relevant info given	may be distracting
OPPORTUNITY	**THREAT**
educational but dismissable if needed	missing the pop-up can be risky

4. Wireframes

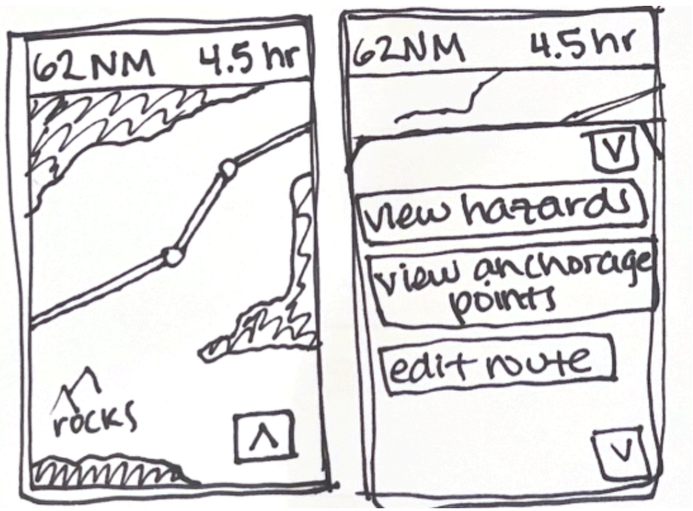
Key takeaways from the SWOT included: room for consistency with other SatNav interfaces and removal of potential distractions.
I made the following changes:

1. A home page to display common features and reduce search effort
2. Documentation
3. Guided route creation with a final check
4. No distracting pop-ups and consistency with arrow button to Google/Apple Maps to access more information

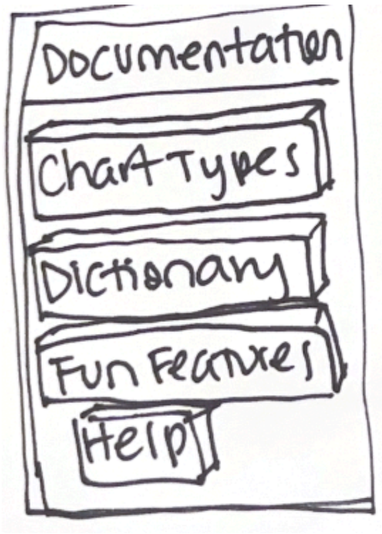
1.Home Page



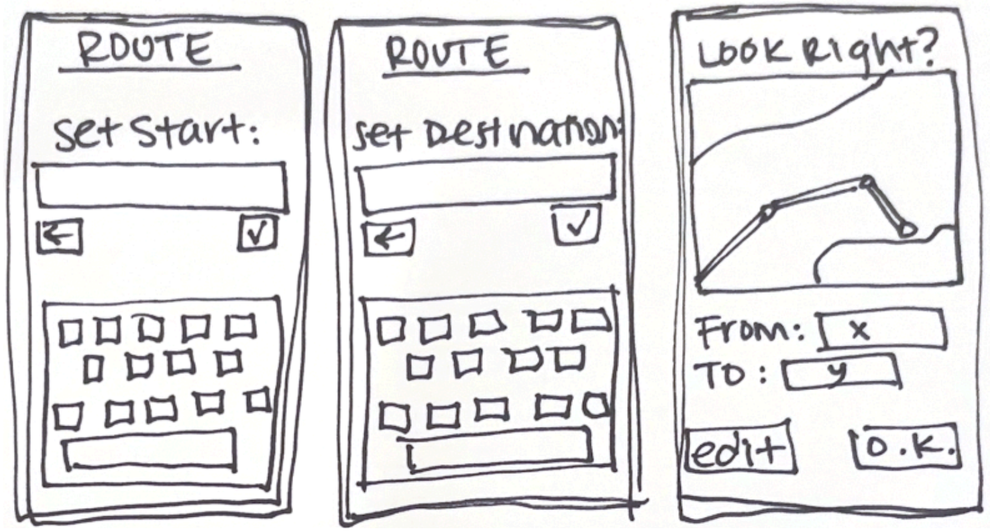
4. Navigation Screen



2. Documentation



3. Route Creation & Check



5. User Feedback on Wireframes

Prior to creating further iterations, I returned to the original focus group participants for feedback on the wireframes to incorporate user feedback into the final prototype. Using a Microsoft Forms survey, I evaluated the wireframes and general features.

Questions

What features do you like the most?

What feature would you not use?

What other features would you like?

Key Feedback

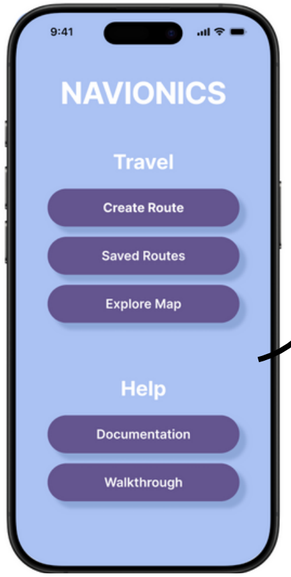
- "It would be nice to receive **route recommendations** and save them for later"
- "When I'm on autopilot I won't pay attention so getting **audio messages** would be good. Maybe when hazards pop up on the navigation screen."
- "I would definitely refer to the dictionary and walkthrough, especially since I don't know a lot of the terms yet"

Changes

- **Recommendation feature for exploration**
- **More visual feedback when creating routes**
- **Audio notification (instead of visual) for upcoming hazards**
- **'Save for Later' button during route creation**

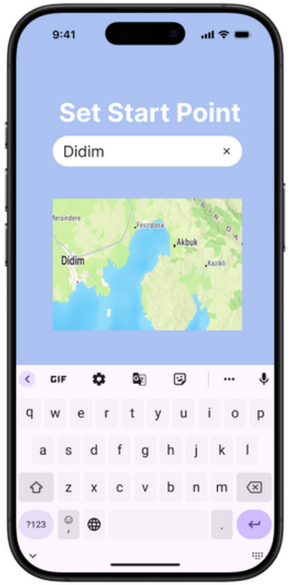
6. Final Re-Design Prototype

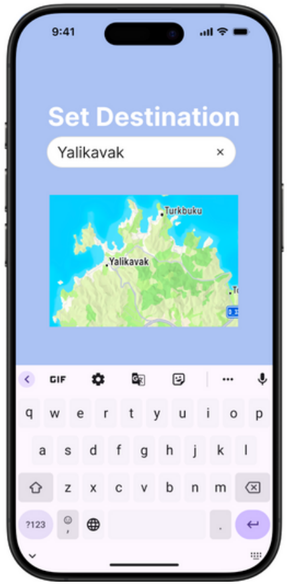
With significant design changes, Navionics can be more beginner friendly and accessible. Simple adaptations, including consistency with other SatNav apps, minimizing information overload, and increasing educational features resulted in overwhelmingly positive feedback from current users.

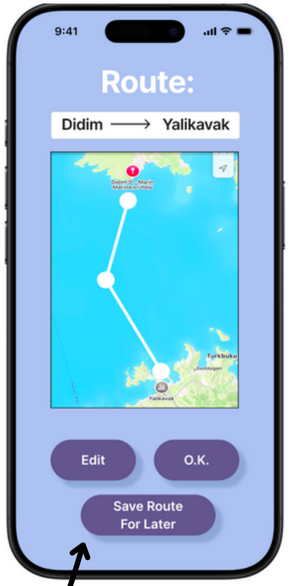


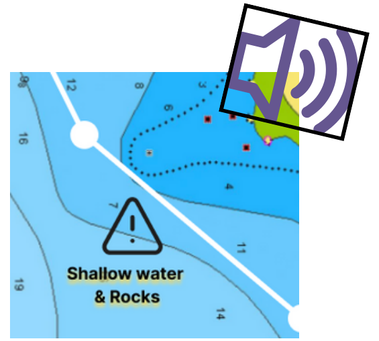
User Control:
Home page navigation options alleviates search efforts

Error Recovery:
Helps users recognize and diagnose errors through the guided route creation and final check page

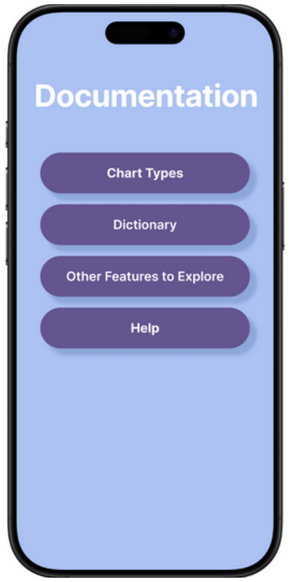






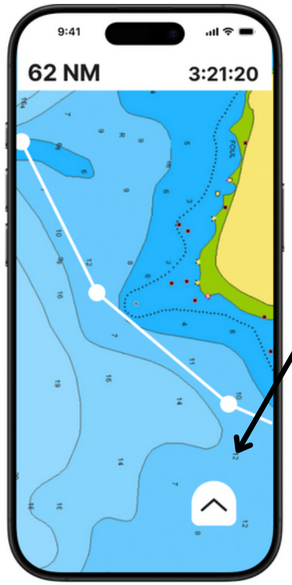


Beginner Friendly & Minimal Design:
Audio alerts reduce visual clutter and distractions, but still notify the captain of hazards



Help & Documentation:
Documentation page & recommendations for routes and popular destinations to help beginners

Aesthetic & Minimal Design:
No unnecessary information or clutter through a more minimalistic water depth chart



Consistency & Standards:
Consistent with Google and Apple Maps design for expanding arrow & more information access

User Control & Freedom:
Option to undo/redo and edit routes both during and after route creation

Reflections and Learnings

This redesign aligns with usability heuristics by reducing cognitive load and increasing accessibility to the sport of sailing. The biggest challenge was balancing seamless and quick interactions for expert users with informative, simple interactions for beginners, requiring diplomacy in design.

This project emphasized the importance of inclusive design for tech with users of different expertise levels. If I were to redo this project, I would conduct user testing on the application, rather than relying on verbal feedback to assess for pain points. Additionally, I would include EdTech features (e.g. quizzes or studying features) to support users with the sailing learning curve.

[1] Nielsen, J. 1994. 10 Usability Heuristics for User Interface Design. Nielsen Norman Group. Retrieved January 11, 2025 from https://www.nngroup.com/articles/ten-usability-heuristics/