# HACKLES: A Case Study on Using Data to Create Experiences with Wearables

**Sydney Pratte**
University of Calgary
Calgary, Canada
sapratte@ucalgary.ca

**Anthony Tang**
Singapore Management University
Singapore
tonyt@smu.edu.sg

**Lora Oehlberg**
University of Calgary
Calgary, Canada
lora.oehlberg@ucalgary.ca

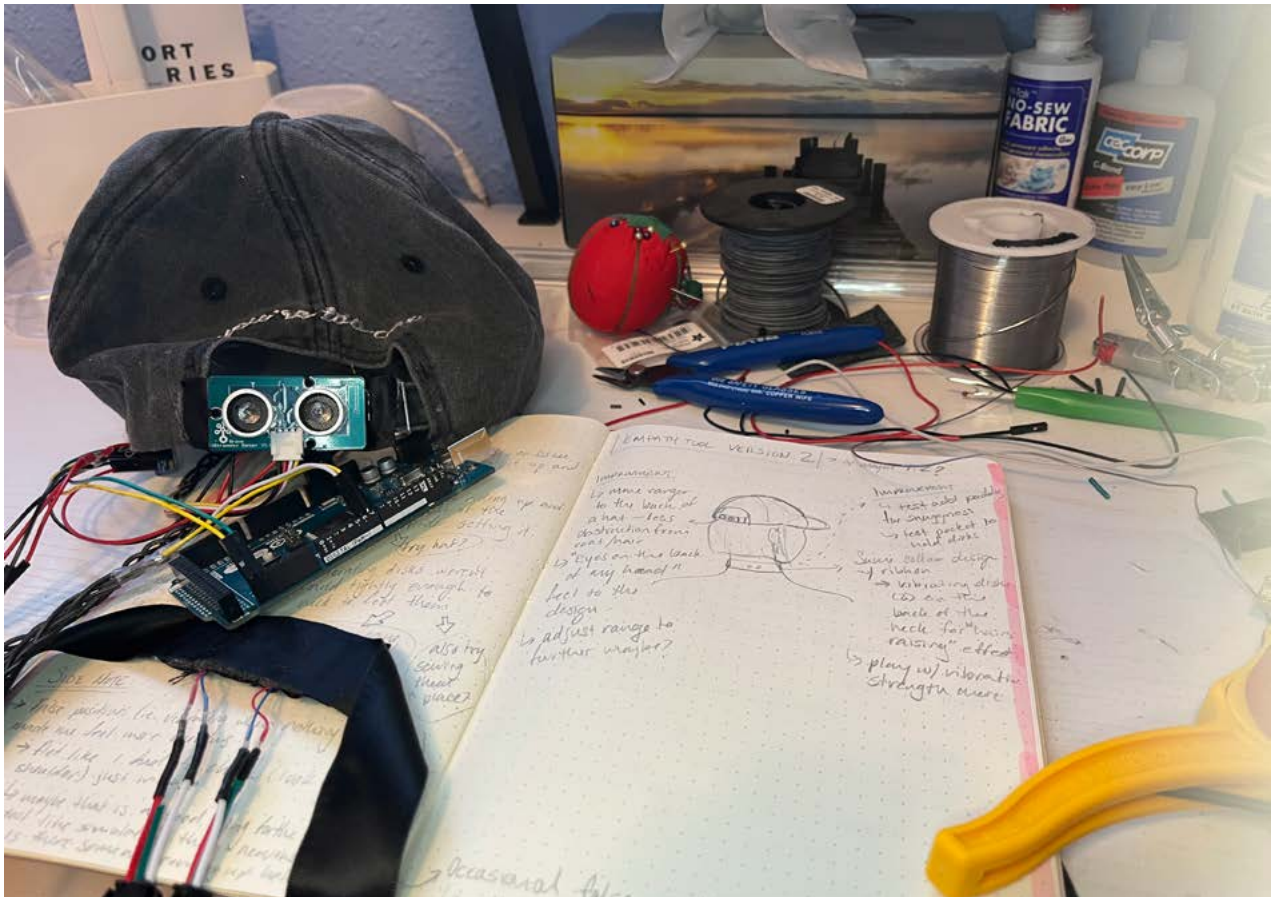
**ABSTRACT**
Wearable empathy tools are physical artifacts designed to help the wearer understand the lived experience of another. Designers often use data as an essential material in the creation of these tools. This work presents a case study on designing a wearable empathy tool driven by a narrative. HACKLES uses sensor data to simulate the experience of anxiety women feel when walking alone at night. We then briefly discuss engaging topics from our experience creating the design.

**Authors Keywords**
Empathy tools; wearable empathy tools; data; materials; empathy; social issues;

**CSS Concepts**
•Human-centered computing~Human computer interaction (HCI)

•Human-centered computing~Visualization~Visualization application domains



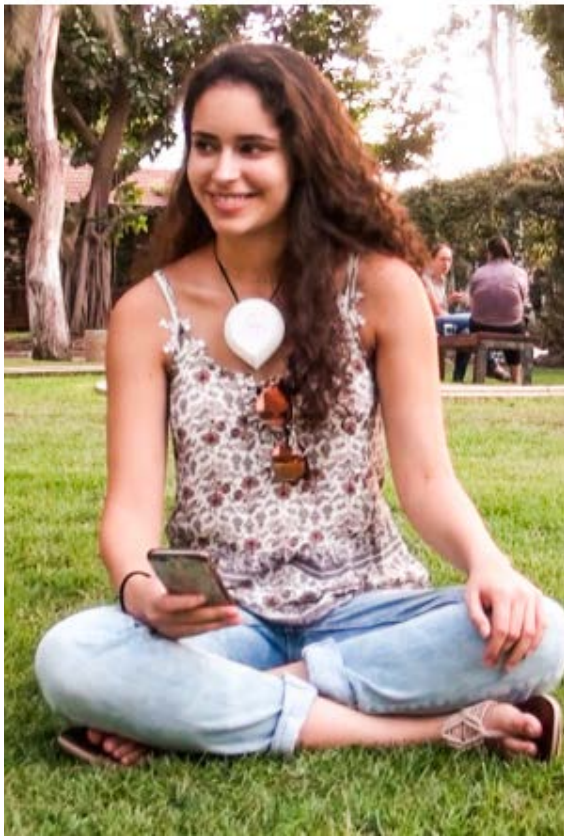


## CASE STUDY: HACKLES

Wearable empathy tools aim to create understanding and empathy by placing the wearer in the physical sensations and experiences of another [5]. Designers of wearable empathy tools often use sensor data to create or simulate the experience of another. For example, in the Breeze project by Frey et al. [1], the authors created a wearable pendant that measures breathing patterns and sends biofeedback to another user. The idea is to evoke empathy for another's emotional state and create a sense of connectedness between people over a distance. They show that the user's breathing rate will change to match the biofeedback pace without instruction to the user to do so; creating a shared reaction can help the user understand the other person's feelings. Designers use data to create new insights and cognition, but it is not typical of data science methods.

In this work, we present the design of a wearable empathy tool, HACKLES, that takes in data from the environment, creating an experience for the wearer in the hope of generating empathetic cognition. We used Research Through Design methods to create a wearable empathy tool that simulates the physiological experience of women's anxiety from being approached from behind when walking alone at night.

The empathy tool unconventionally uses data to create insights. It takes in environmental data from the ranger and thermal camera and triggers the vibration motors when a person is detected behind the wearer. The feeling from the motors simulates the 'hair-raising' sensation of fear.



Breeze by Frey et al. [1]


GERT by Moll [4]

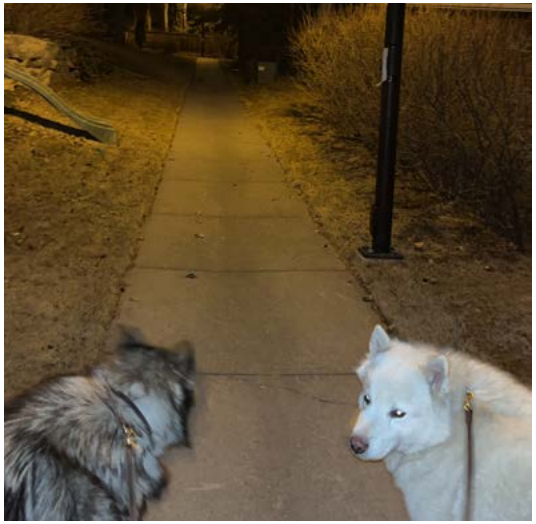
Haptic Hand Tremor by Rosati et al. [6]

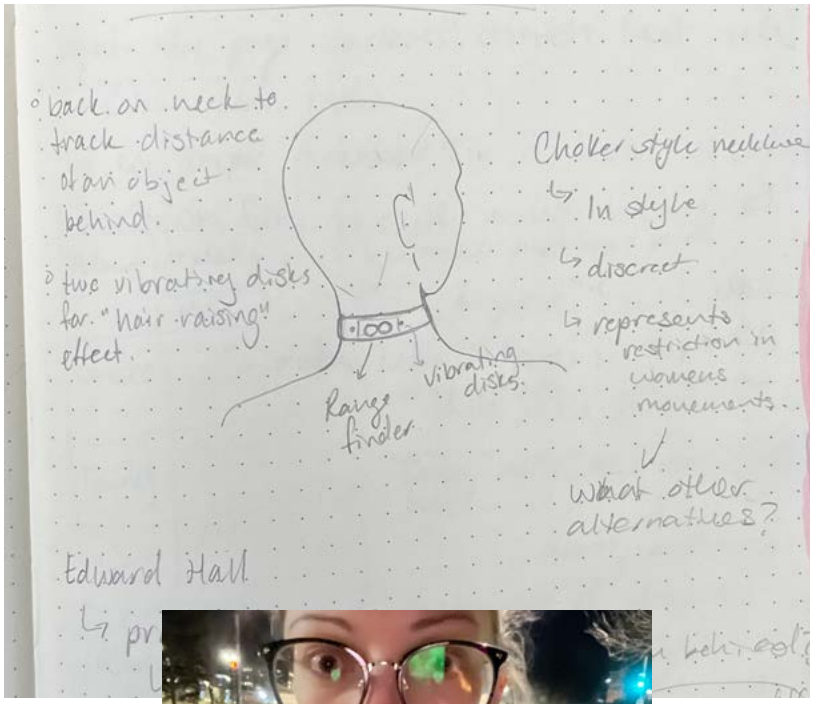
A Breath Taking Journey by Kors et al. [3]

## HACKLES: The Story

This project started from prior work [5]. We conducted a literature review of current empathy tools in the HCI proceedings. The goal was to arrive at a list of design strategies for empathy tools that future research projects can use as a guide. We then decided to go through the process of creating an empathy tool ourselves.

A conversation between two of our co-authors decided the story driving the design of the empathy tool. Our male coauthor was surprised during a conversation to discover a female coauthor felt slightly anxious about walking her dogs at night. The male coauthor was surprised the female coauthor still felt anxious even though she walks two large dogs. The conversation led to gender norms, how women are raised to be cautious when walking alone, and the steps women take to protect themselves. We decided to create an empathy tool to simulate women's anxiety to help raise awareness for what women face.





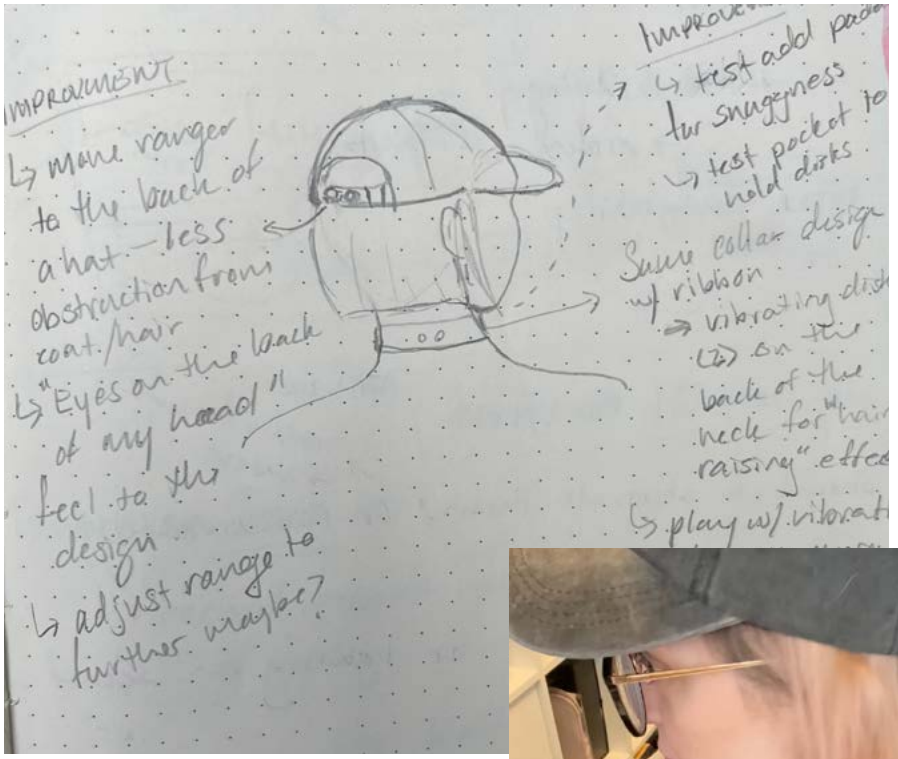

## HACKLES VERSION 1: Setting the Stage

Version 1 of HACKLES explored combining the ranger with vibration motors. We used a Grove ultrasonic ranger to convey the story of being approached from behind, sensing motion behind the wearer. We placed the ranger in a choker-style necklace positioned at the back of the wearer's neck to detect movement behind. We chose the choker style because it is uncomfortable and represents the restrictions in women's movements. The ranger triggered two vibration motors on the back of the neck, touching the wearer's skin to create the "hair-raising" effect of fear. We tested the ranger at different distances. Ultimately, we set the ranger to trigger at objects less than 3 meters based on Edward Hall's proxemic zones [2]. Hall found that the acceptable distance between people in public is 4 meters during a conversation. We chose to use less than 4 meters since the story does not relate to a face-to-face exchange but a stranger approaching from behind in a public setting.

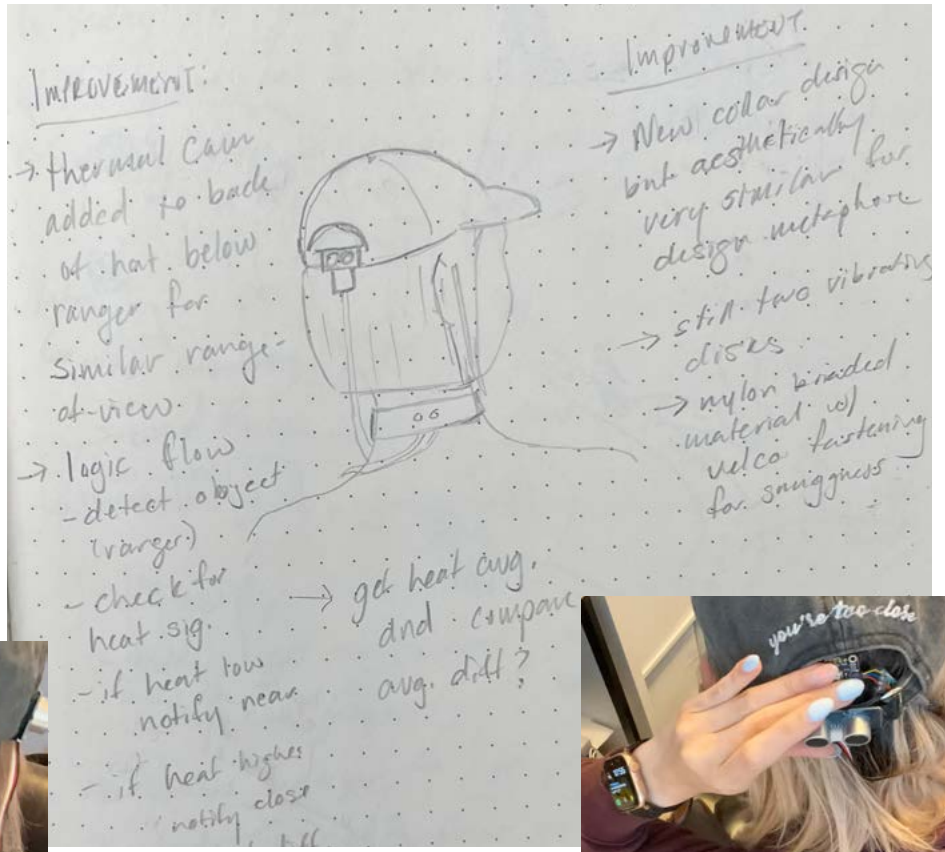
### ISSUES

The ranger is imperfect and not the best method for detecting human presence. It will activate when anything behind it intersects with the signal pulse, detecting inanimate objects and people behind the wearer. However, it is a low-cost, simple method to detect something behind the wearer and convey the story during a short experience. In version 1, we found the ranger would trigger too much because of hair and clothing covering the sensor and the vibration needed to be stronger for the desired effect.

## HACKLES VERSION 2: Fixing Bugs




Version 2 of HACKLES attempted to fix the issues found with version 1. First, we moved the ranger to the back of a hat to limit false positives. We added padding to the choker to push the vibration motors against the skin. This version improved on version 1, but the ranger would still trigger for walls, trees and cars.




We added an AMG8833 Grid-EYE sensor by Panasonic as an additional data source. The Grid-EYE is a small 8x8-pixel thermal camera. We programmed our empathy tool to check the thermal camera data when the ranger is triggered. The vibration motors are activated if the thermal camera finds a warm cluster of pixels.

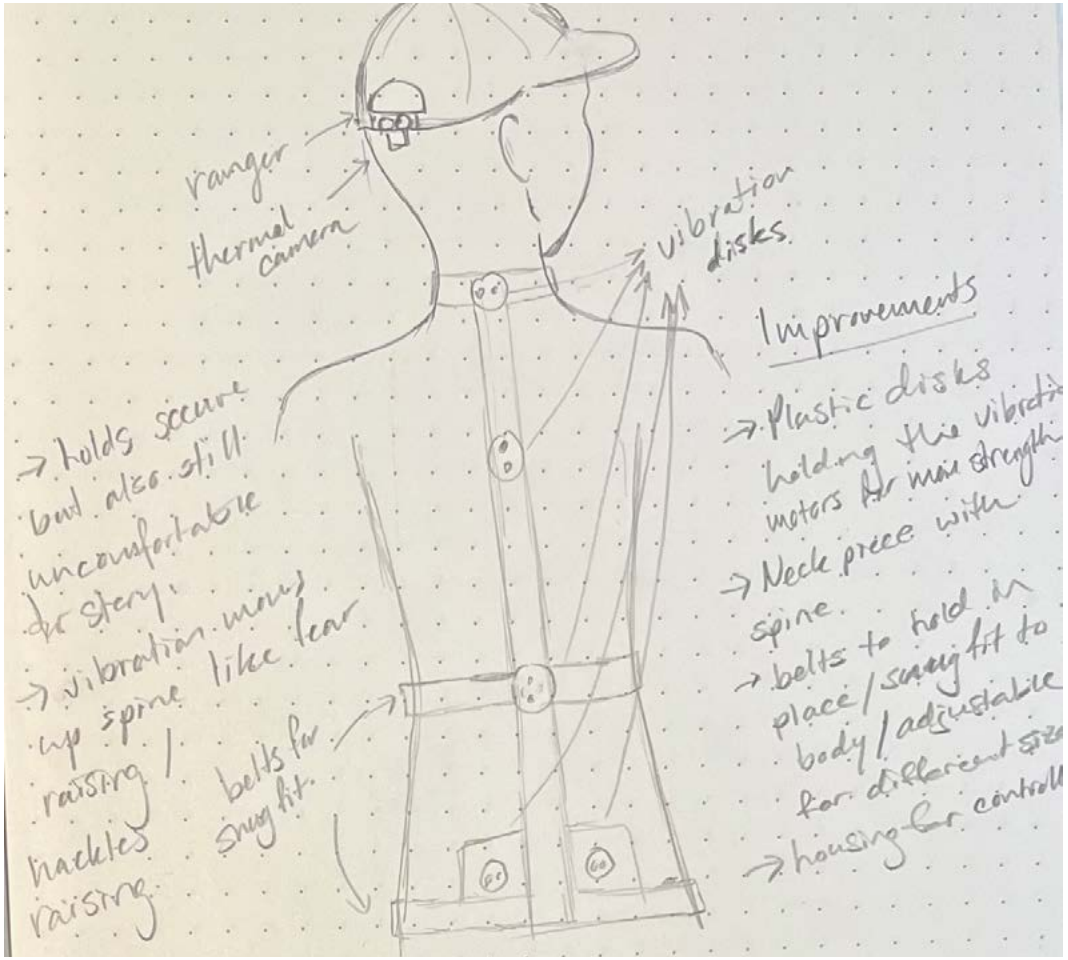



**ISSUES**

This version technically worked well, but the overall experience we aimed for was different from what we wanted. The vibration motors were still not strong enough and didn't give the "fear" feeling we desired.

## HACKLES VERSION 3: Fine Tuning the Final Experience

Version 3 focused on creating the desired experience from the data for the wearer we originally envisioned. We made a harness of 10 vibration motors that run down the back of the spine and neck. We placed two vibration motors in small plastic containers to increase their strength. One vibration point is at the back of the neck, the upper back, the mid back, and two on the lower back. When the vibration is triggered, it starts at the base of the spine and then moves upwards to the neck.




## DISCUSSION

### Performative Data

Data is important in creating wearable empathy tools; however, wearable empathy tools do not use typical data science methods. The data is not analyzed and visualized for the user to gain insights from the data itself. Instead, empathy tools use the data to create an experience for the wearer to gain insights into another's life. The data becomes an essential material of the empathy tool and, therefore, in the experience created by the tool.

Empathy tools create a performative experience, but only for the wearer. Others viewing the tool do not get the same insights as the wearer. How would the design of the empathy tool change as a performative piece for viewers, for example, as a runway design?

### Fake Data

Since empathy tools are performative, designers do not create them to be functional and worn daily. Designers intend for empathy tools to be worn for a short period in a controlled environment to create an experience for the wearer. Our empathy tool manufactures fake data by creating a presence behind the wearer to trigger the experience. Faking data is essential to the purpose of the empathy tool but creates tension in the data science community. Is this an effective method of using data? Do the benefits outweigh the drawbacks of using fake data?

### False Positives

One interesting incident we experienced when testing the various versions of HACKLES was false positives. Typically, we would expect false positives to take away from the narrative of the empathy tool. However, when testing the tool and a false positive occurred, we found that it added to the overall experience. We found it made us more anxious when walking alone, enhancing the tool's goal of stimulating what women feel when walking alone. Too many false positives did have a negative effect by annoying the wearer and pulling us out of the intended experience. However, occasional false positives created the experience of hearing a noise and looking over your shoulder to see nothing. Can false positives have the same effect in other empathy tool designs?

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