

# Stroke Imprint: Knitting Reassurance into Anxious Moments

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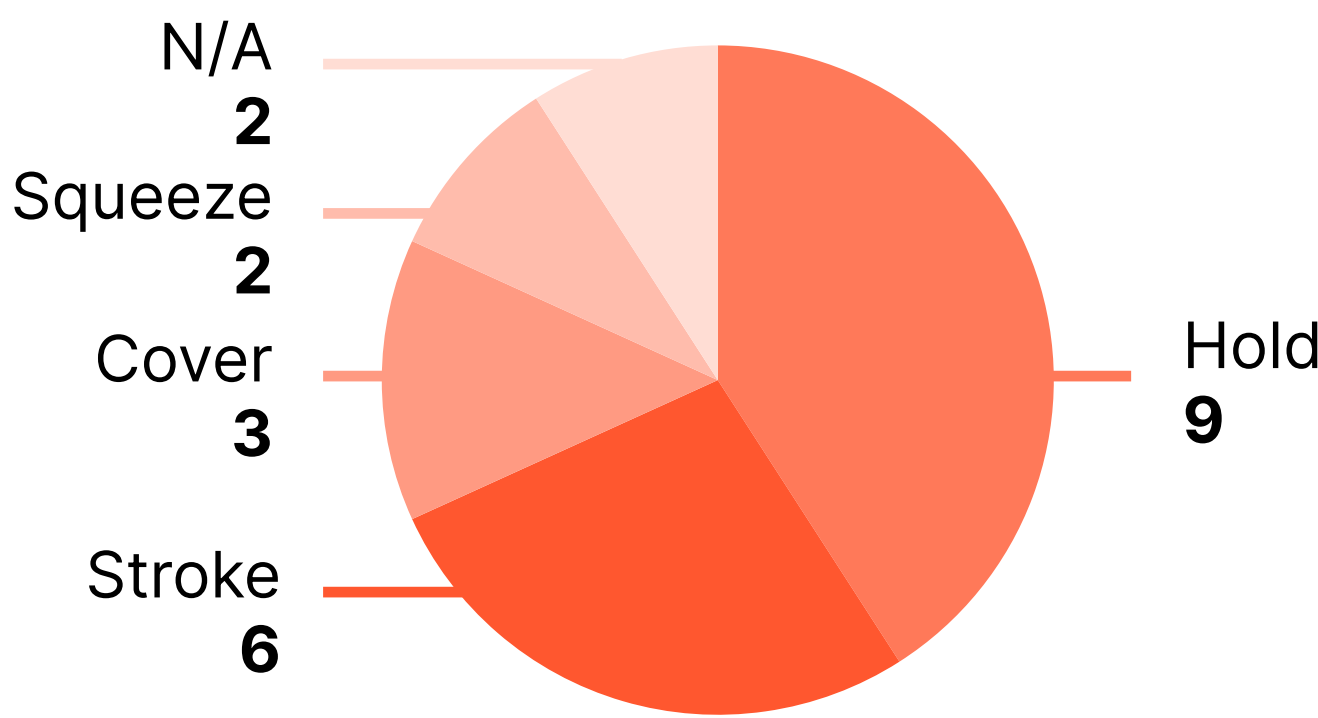
## 1 Problem

Anxiety Disorders are the most common mental health condition among adults, yet evaluation often relies on biased self-reporting. Combining biometric data—especially Heart Rate Variability—with contextual self-reporting enables more accurate detection of anxiety onset.

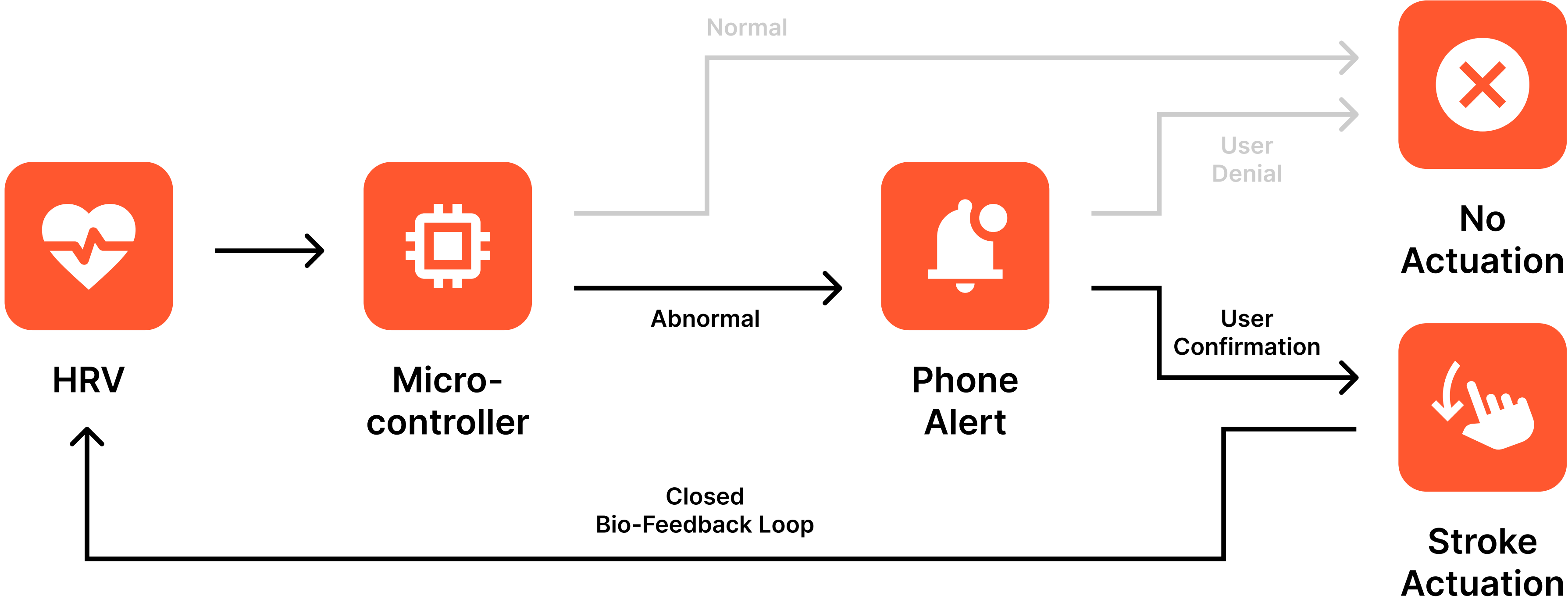
Meanwhile, affective touch, such as hand-holding and stroking, has been shown to reduce anxiety. Yet during moments of heightened anxiety, physical touch may be unavailable.

## 2 Primary Research

We asked 17 volunteers: “How would you comfort someone close to you who is feeling anxious by interacting with their hand?”



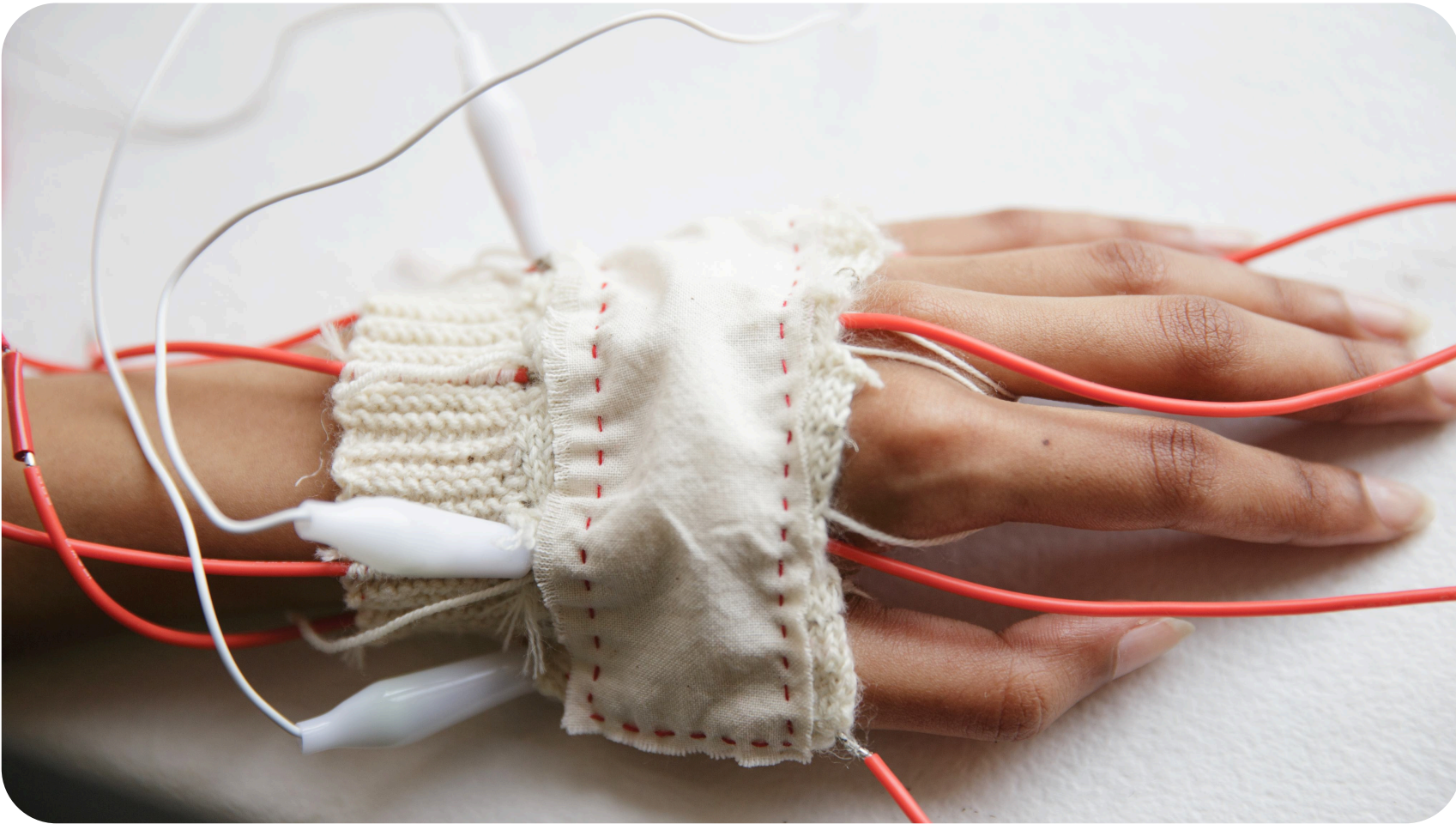
## 3 User Flow



## 4 Speculative Use Case

Our research targets young women prone to anxiety with limited social support. We propose the following speculative narrative: “Adia longs for independence, but being away from loved ones triggers anxiety that can strike anytime. She finds comfort in the all-day knitted glove—it feels intimate and warm, like the way her loved ones would stroke her hand to ease her anxiety.”

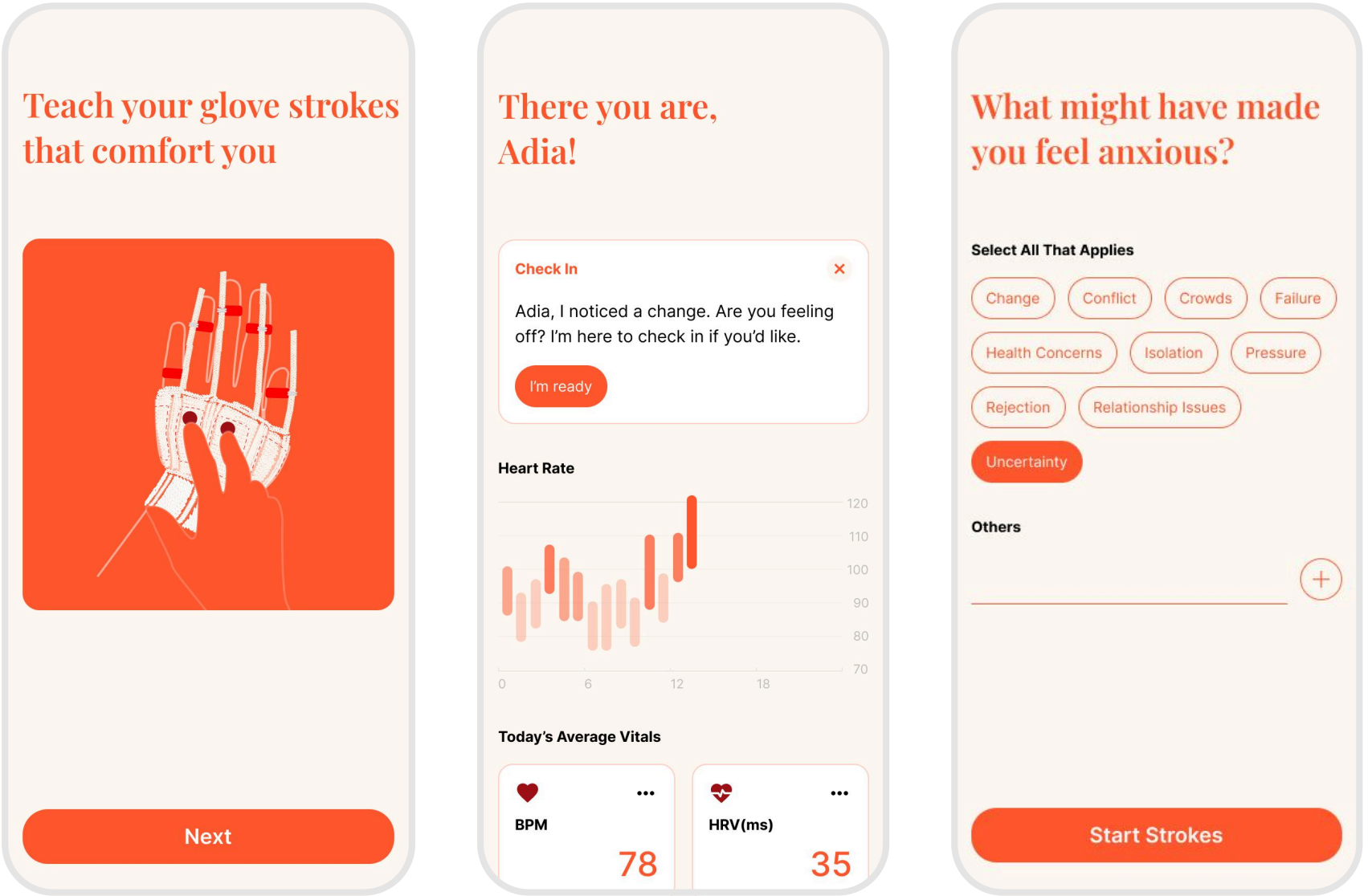
## 5 Initial Prototype



Due to the impractical nature of finger gloves, mittens, or mitts for the speculative all-day wear use scenario that calls for breathability, elasticity, and durability, we strategically

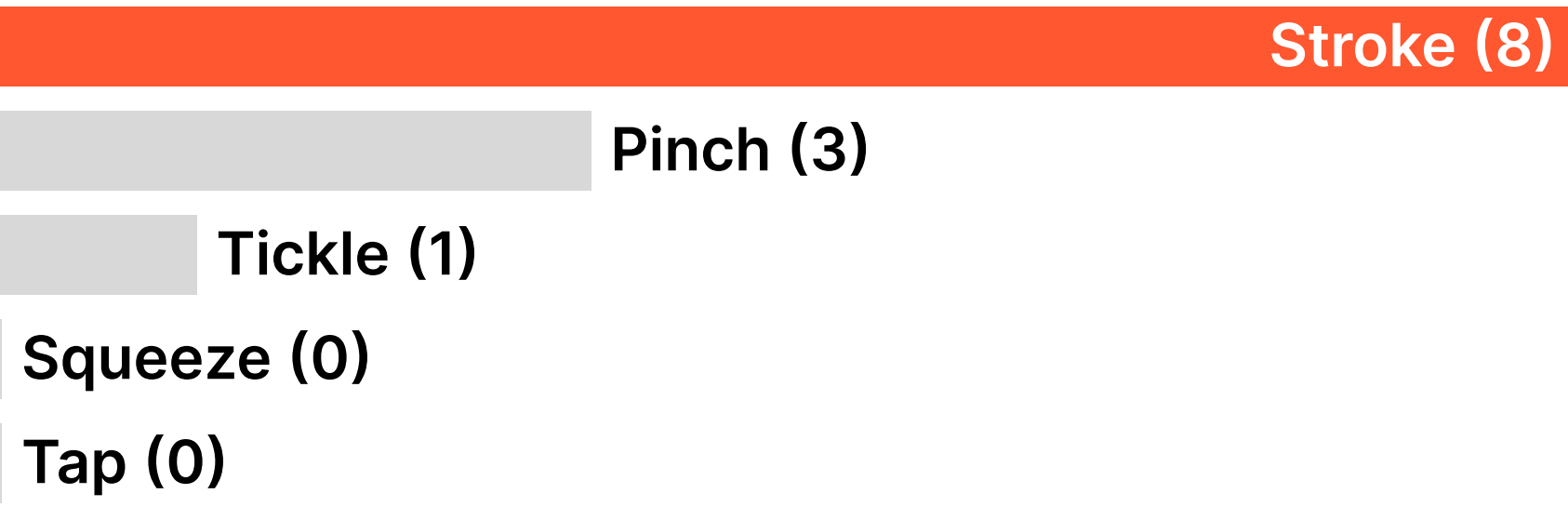
- 1) designed an open-palm, fingerless glove with wrist cuff and adjustable finger straps, and
- 2) focused on stroking the back of the hand—the second most common affective touch during Primary Research.

## 6 User Interface



## 7 User Testing Results

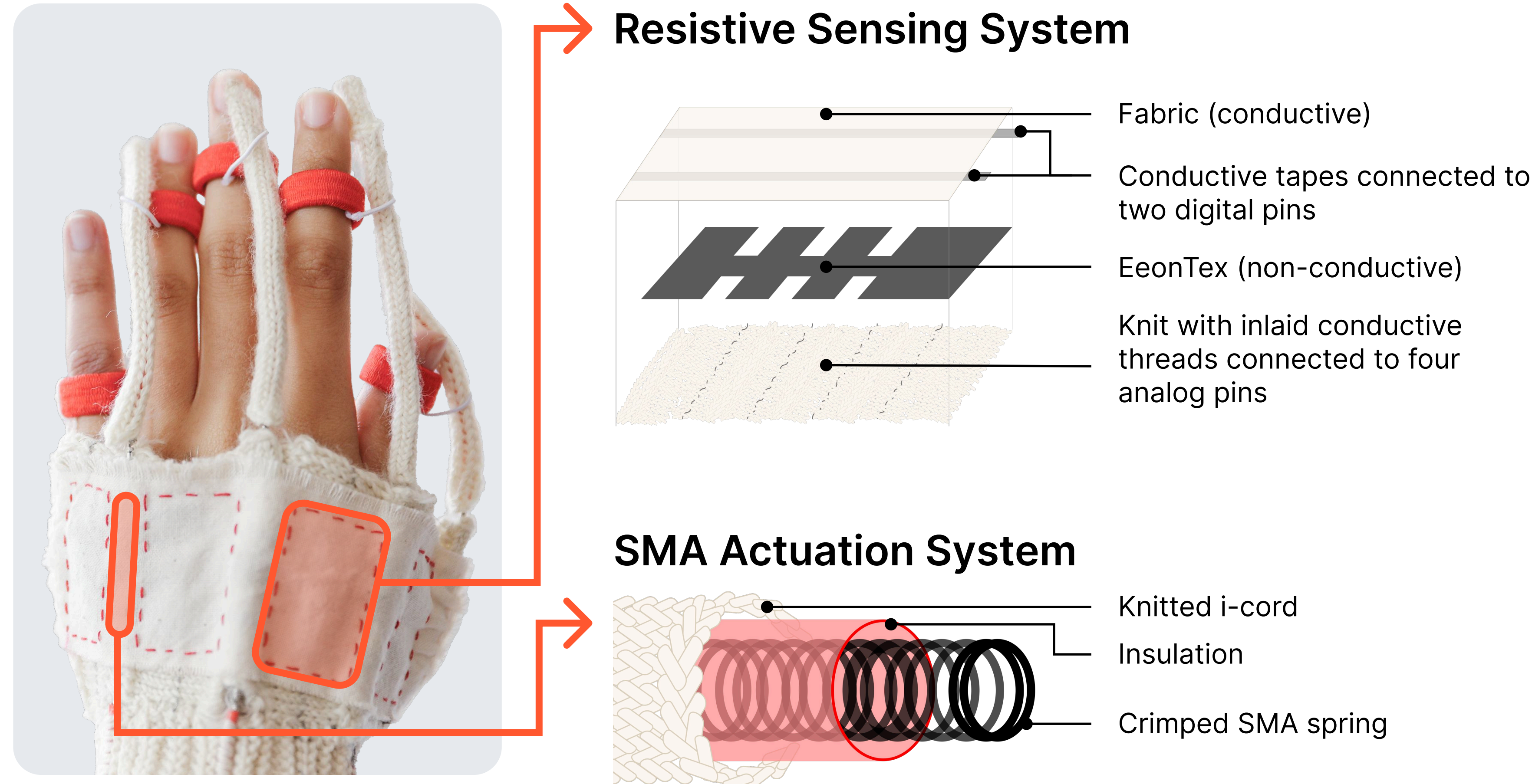
We asked 10 female participants to describe the sensation and choose the human touch it most resembled.



The most commonly mentioned adjectives for describing the SMA-spring-actuated sensation were **warm**, **strange** and **pleasant**.

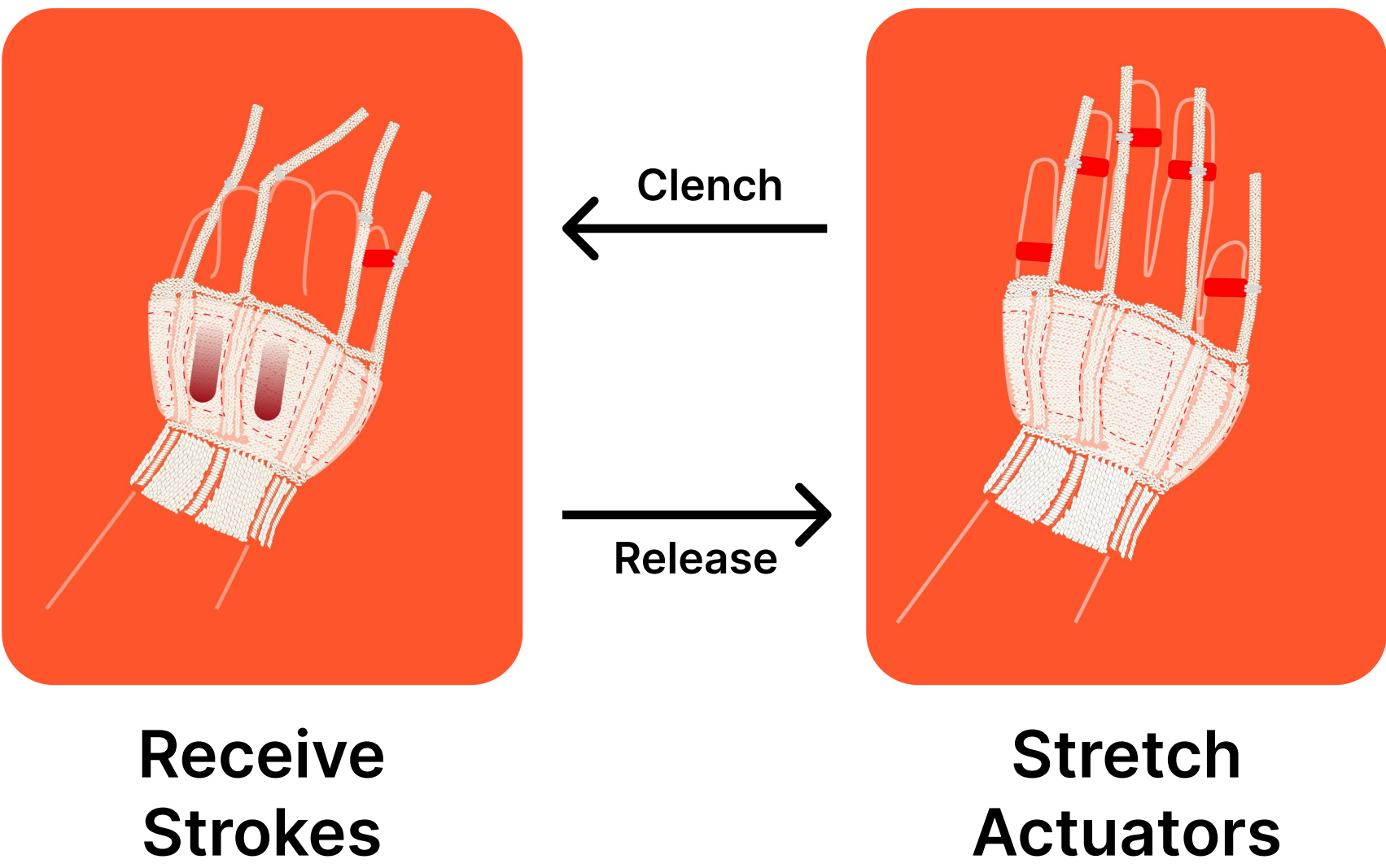
Some described the tightening of the finger straps as “gripping,” while others reported that the visual shape change of the glove influenced their perception.

## 8 Final Design



## 9 Improved Interaction

Based on user feedback, we switched to smaller-diameter SMA springs, reducing cooling time from nine to two seconds. The rhythmic actuation, paired with clenched-fist interaction, supports stroke patterns to unbuild users’ anxiety.



## 10 Conclusion

We confirmed the soothing and pleasant qualities of SMA-spring actuated sensation. Rather than replacing human touch, Stroke Imprint glove intends to serve as a therapeutic tool that allows young women to self soothe anxiety and a reminder of the tangible presence of their support system in their absence. By framing biometric sensing as care from loved ones, privacy concerns may be softened.

Future iterations will explore more localized actuation for personalized stroke patterns with varying rhythms, pressure, and locations. While further testing is needed to assess sustained calming effects, we see promising opportunities in anxiety regulation training through a bio-feedback loop that blends tactile memory, physiological sensing, and emotional design.

## 11 References

Rochelle Ackerley, Ida Carlsson, HenricWester, Håkan Olausson, and Helena Backlund Wasling. 2014. Touch perceptions across skin sites: differences between sensitivity, direction discrimination and pleasantness. *Frontiers in Behavioral Neuroscience* 8 (February 2014). doi:10.3389/fnbeh.2014.00054

Feier Cao, Mhd Yamen Sarajli, and Kouta Minamizawa. 2018. Skin+: programmable skin as a visuo-tactile interface. In *ACM SIGGRAPH 2018 Posters*. ACM, Vancouver British Columbia Canada, 1–2. doi:10.1145/3230744.3230772

Monika Eckstein, Iliashat Mamaev, Beate Ditzgen, and Uta Sailer. 2020. Calming Effects of Touch in Human, Animal, and Robotic Interaction—Scientific State-of-the-Art and Technical Advances. *Frontiers in Psychiatry* 11 (November 2020). doi:10.3389/fpsyt.2020.555058

Blake Anthony Hickey, Taryn Chalmers, Phillip Newton, Chin-Teng Lin, David Sibbritt, Craig S. McLachlan, Roderick Clifton-Bligh, John Morley, and Sara Lal. 2021. Smart Devices and Wearable Technologies to Detect and Monitor Mental Health Conditions and Stress: A Systematic Review. *Sensors* 21, 10 (2021). doi:10.3390/s21103461

Jin Hee (Heather) Kim, Kunpeng Huang, Simone White, Melissa Conroy, and Cindy Hsin-Liu Kao. 2021. KnitDermis: Fabricating Tactile On-Body Interfaces Through Machine Knitting. In *Proceedings of the 2021 ACM Designing Interactive Systems Conference (DIS '21)*. Association for Computing Machinery, New York, NY, USA, 1183–1200. doi:10.1145/3461778.3462007

Gin S. Malhi, Amber Hamilton, Grace Morris, Zola Mannie, Pritha Das, and Tim Outhred. 2017. The promise of digital mood tracking technologies: are we heading on the right track? *Evidence Based Mental Health* 20, 4 (October 2017). doi:10.1136/eb-2017-102757

Keisuke Ono, Shinichiro Iwamura, Akira Ogie, Tetsuaki Baba, and Paul Haines. 2017. Textile+: low cost textile interface using the principle of resistive touch sensing. In *ACM SIGGRAPH 2017 Studio*. ACM, Los Angeles California, 1–2. doi:10.1145/3084863.3084868

U.S. Food and Drug Administration. 2025. Women and Anxiety. Retrieved June 7, 2005 from <https://www.fda.gov/consumers/womens-health-topics/women-and-anxiety>