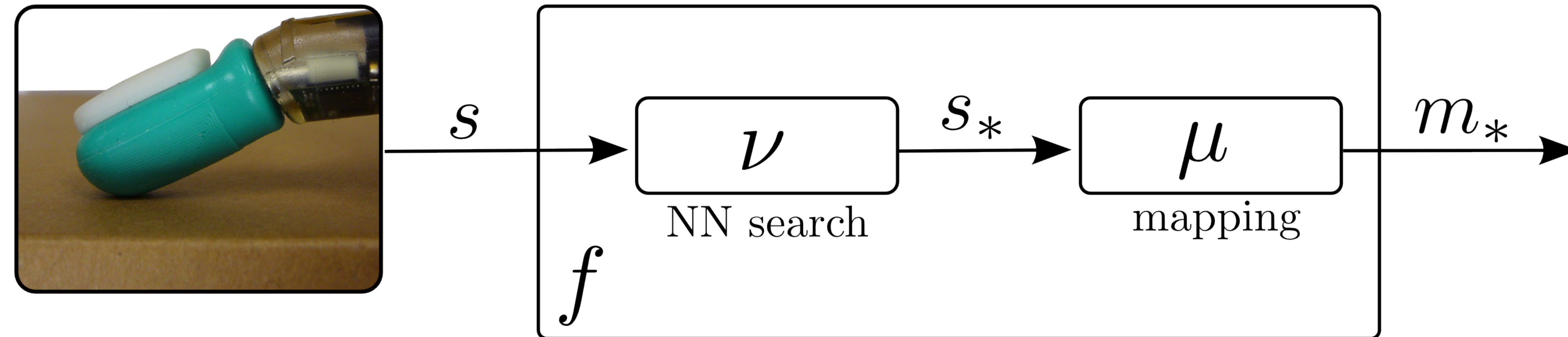
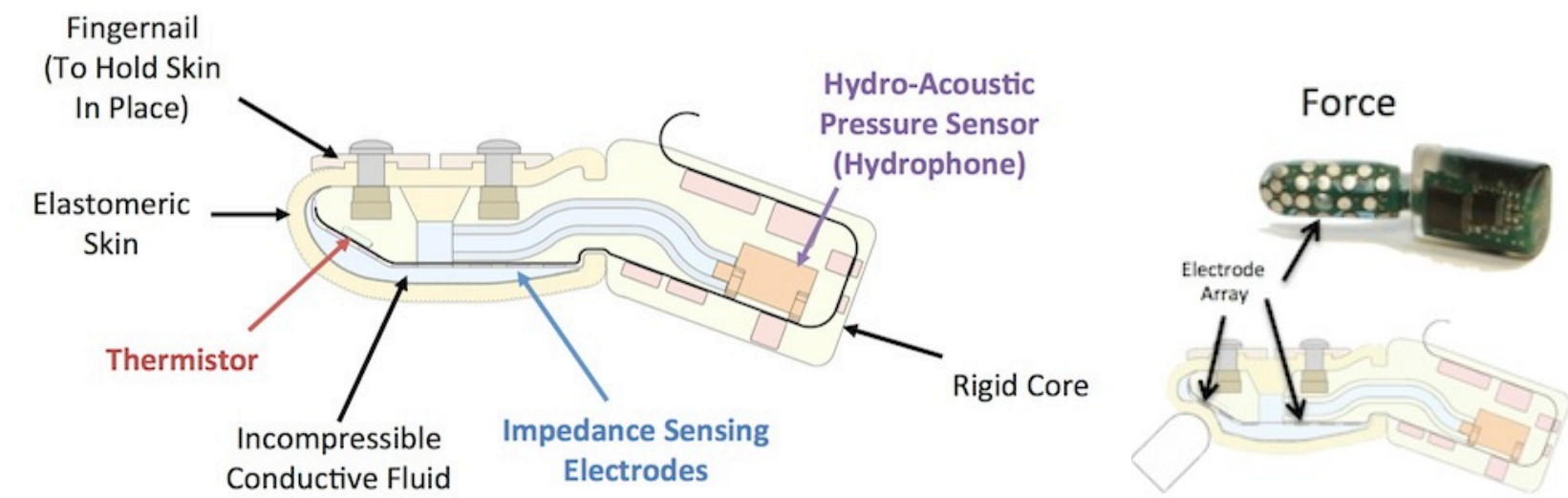


One Sensor, Three Displays: A Comparison of Tactile Rendering from a BioTac Sensor



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One Sensor: SynTouch BioTac

This biomimetic tactile sensor mimics the physical and sensory capabilities of the human fingertip.

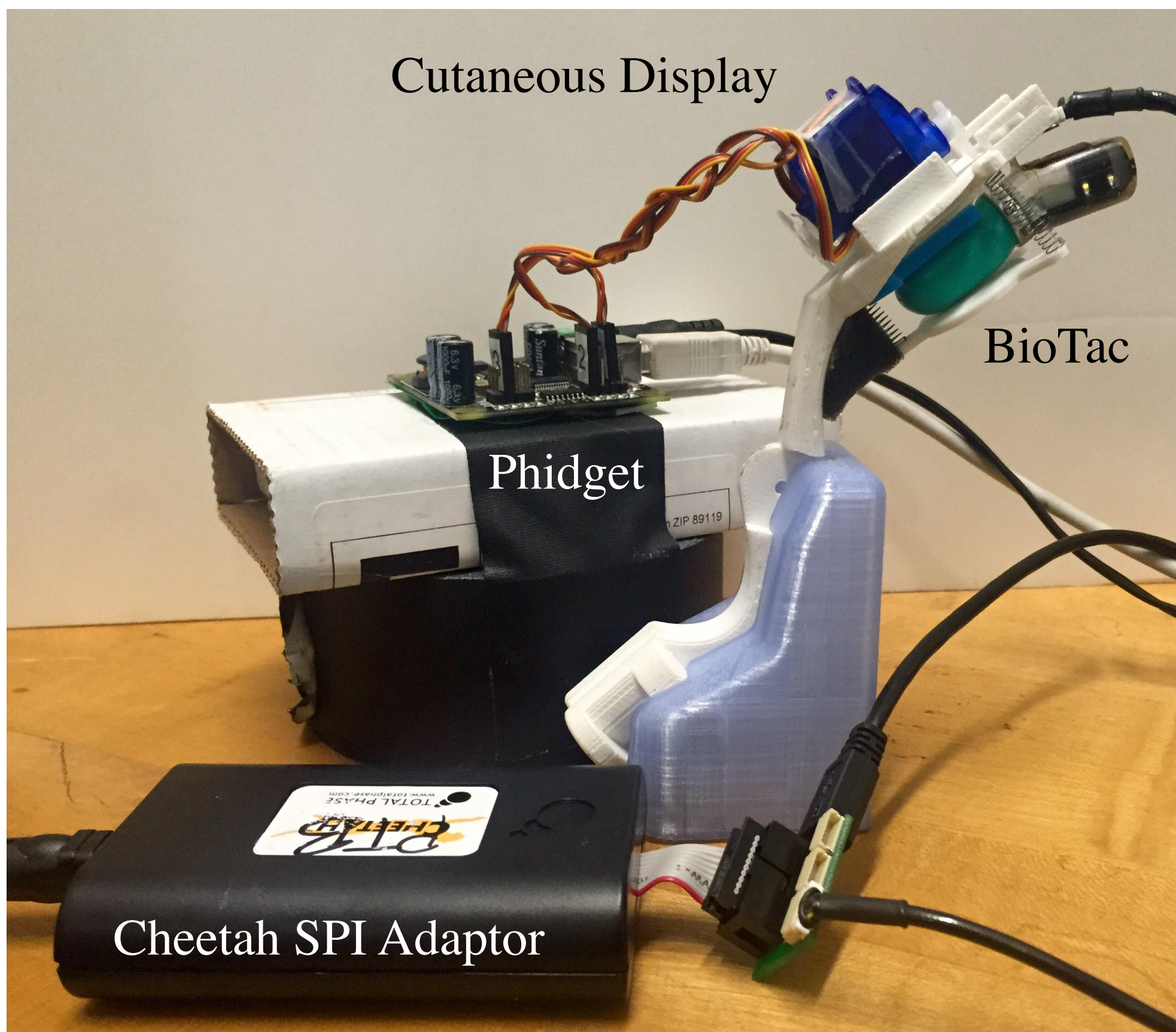
Developed for prosthetics, it includes:

- Rigid core patterned with electrodes.
- Flexible rubber skin filled with conductive fluid.
- Internal pressure sensor
- Temperature and vibration sensors (not used here)

Rendering System Overview

Rather than a physical or kinematic model, we use a data-driven algorithm to allow the user to feel what the BioTac is feeling in real time.

- The *BioTac* sensor, which measures fingertip deformations and pressure.
- The *Cutaneous Displays*, which apply deformations to the user's finger.
- An algorithm that maps measured BioTac sensations to appropriate motor commands for the selected cutaneous display by finding the closest sensation that occurred during calibration.

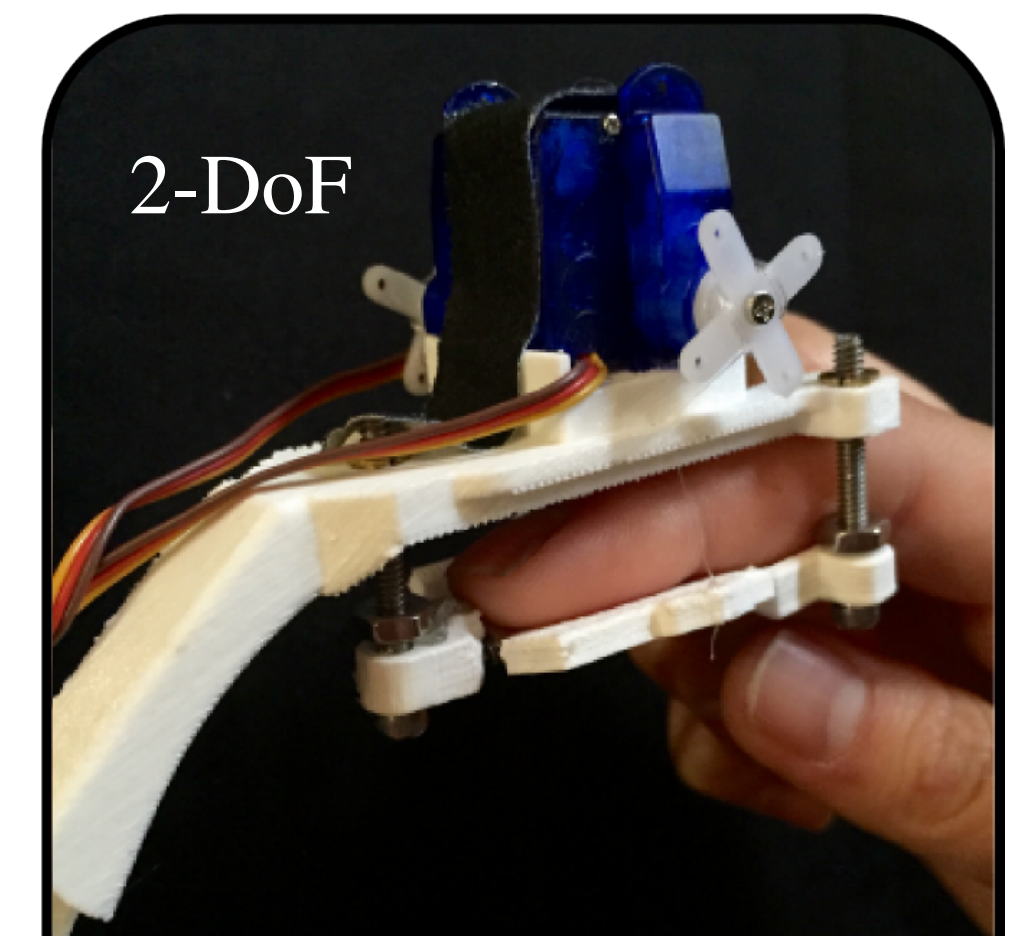


Calibration Setup

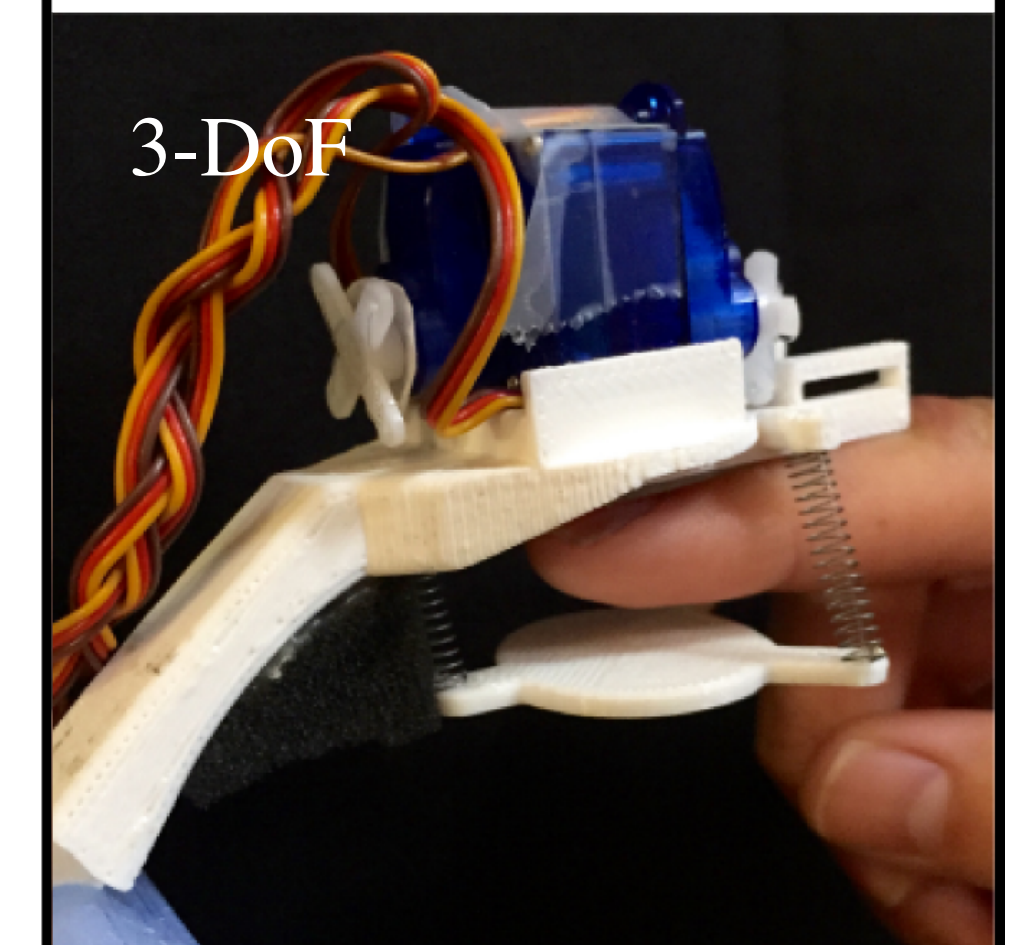
The BioTac is mounted inside the Rigid Platform cutaneous display. It is connected to the computer via the Cheetah high-speed SPI adaptor. The sub-micro servos on the device are powered and controlled by the Phidget board, which is also connected to the computer. While in this configuration, the display was moved to all possible configurations (as allowed and regulated by the servos). Data from the BioTac was recorded along with the corresponding motor angles to characterize the sensations this device can create.

Three Displays

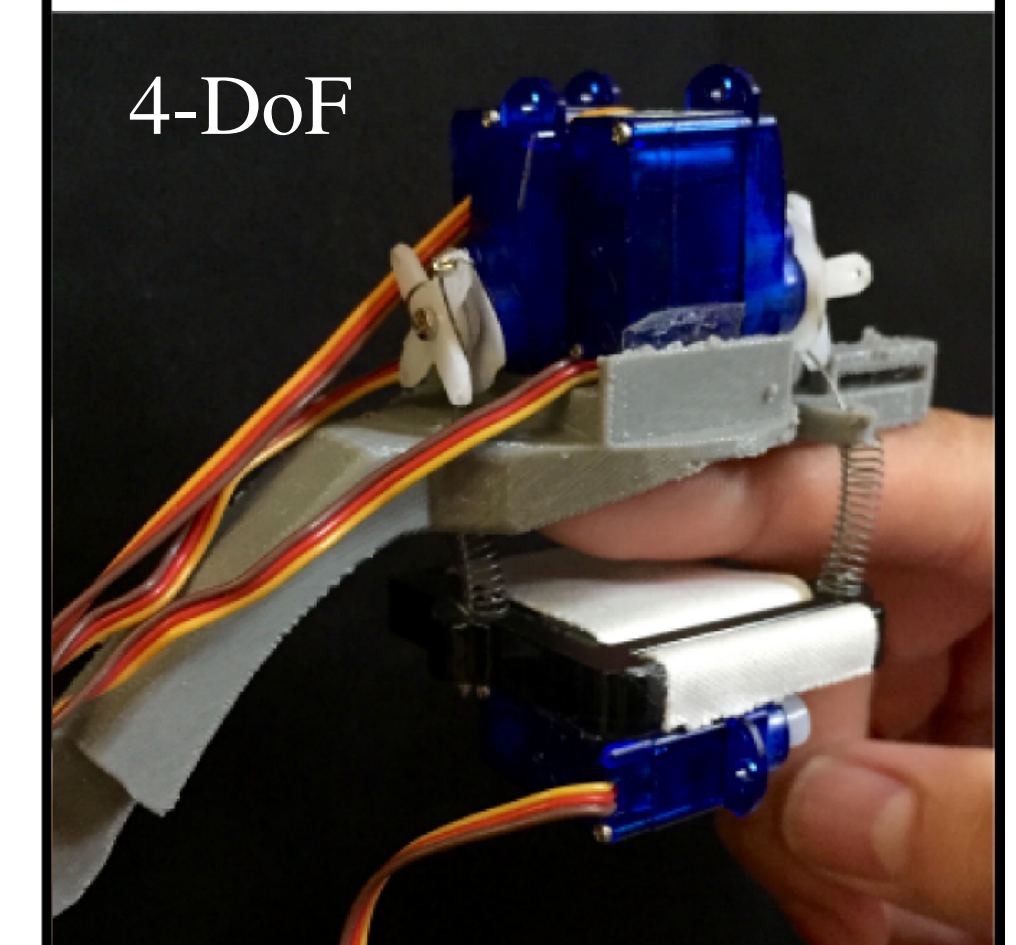
We constructed the three fingertip displays shown at right based on other designs reported in the literature. They are all constructed from 3D-printed plastic, common mechanical components, and sub-micro servos. They vary in the number and type of degrees of freedom (DoF) available for creating tactile sensations on the user's fingertip. Which feels best to you?



2-DoF
Tilting Plates (TP)



3-DoF
Rigid Platform (RP)



4-DoF
Variable Compliance Platform (VCP)

Acknowledgments

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