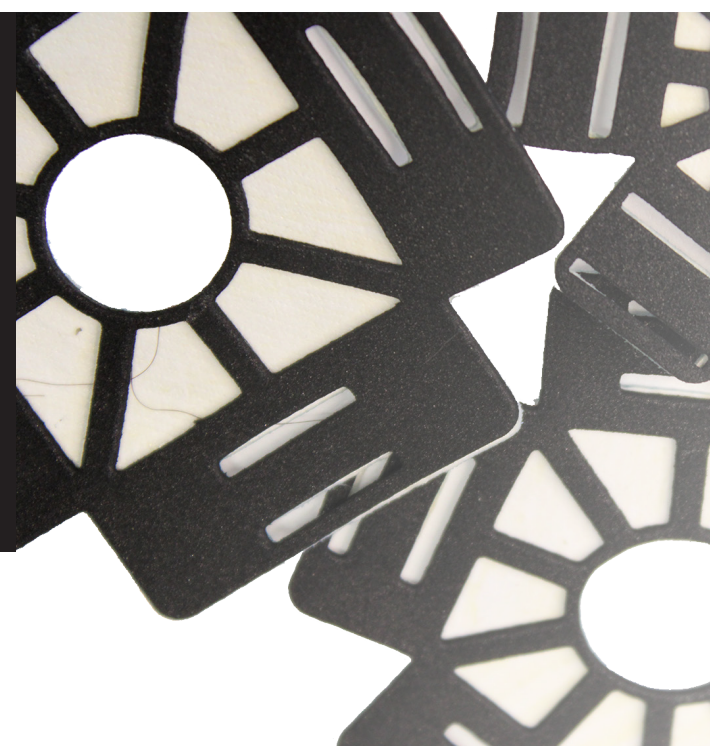


ACCESSIBLE HARNESSES FOR HAPTIC DEVICES



USC
Viterbi
School of Engineering
K-12 STEM Center



Katherine Robertson, HARVI Lab
Sage Hill School, Class of 2024
USC Viterbi Department of Computer Science, SHINE 2023

Introduction

- Body wearable haptic interface
- Developed harness solution for haptic

Objective and Impact of Professor's Research

- HARVI Lab researches touch & creates haptic devices
- Mentor aims to provide accessible haptic component ecosystem

Acknowledgements

- Thanks Prof. Culbertson, Sandeep, SHINE team & labmates

Citations

[1] Pacchierotti et. al (2017). Wearable Haptic Systems for the Fingertip and the Hand: Taxonomy, Review, and Perspectives. IEEE TOH

Advice for Future SHINE Students

- Learned beyond engineering
- Embrace everything

Research and Process

- Explored fields and design thinking
- Design principles:
 1. Easy and fast to produce
 2. Accessible
 3. Easy to don/dof
 4. Modular
 5. Minimal DOF loss
 6. Sanitary
- Simple harness solution for developers & users



(a) Uchiyama et al. [182]



(b) Kim et al. [183]

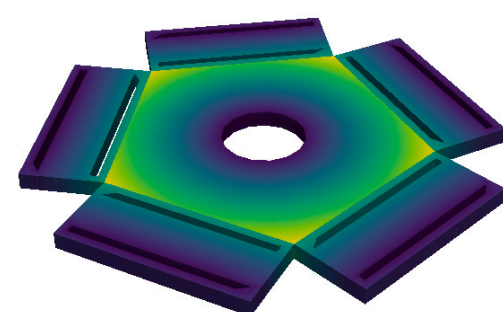


(c) Mazzoni and Bryan-Kinns [184]

Figure 1: Most wearables modify existing garments and aren't optimized

Future Works

- Future work on software suite
- Prototypes in Fusion 360
- Preliminary UI and arm model
- Tiles procedurally generated



Methods and Results

POLYGONAL TILES - PRIMARY METHOD

- Polygonal tiles connect via elastic straps for specific sizes, normal forces, and arrangements
- Tiles customized via parameters in Fusion 360

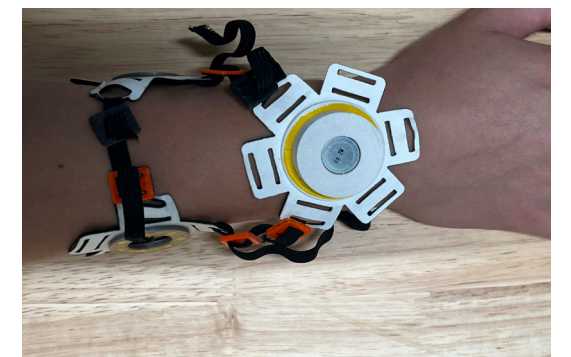
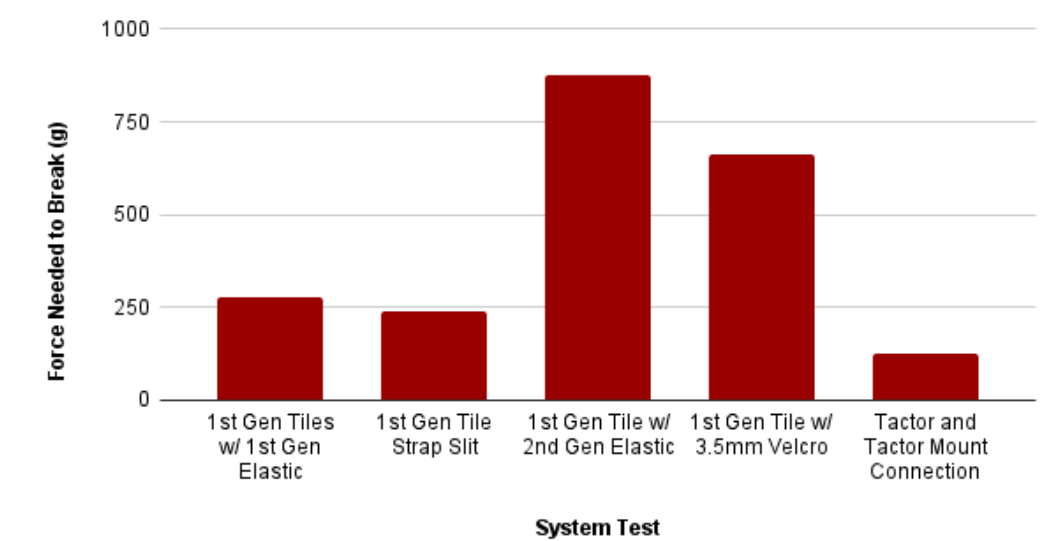
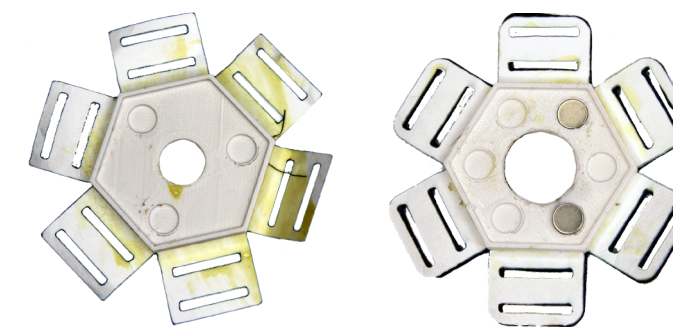


Figure 2: An example configuration

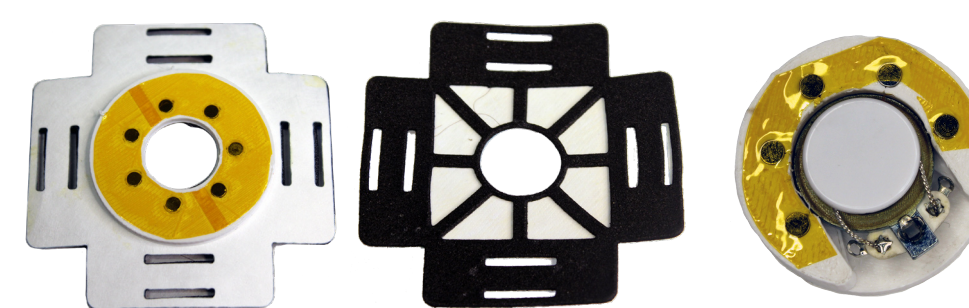
Destructive Tests on Tile System



- Tested fully 3D printed polygonal tile with diff. TPUs and infills

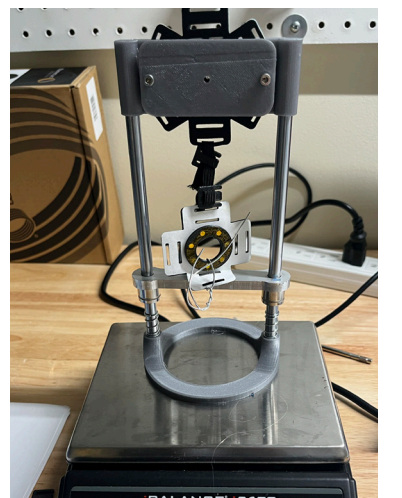


- Tested combinations of Tyvek, EVA foam, & PETG



- 1st gen included various tiles
- Actuators easily snapped onto tiles via magnets

- Tests to determine strength of tiles using custom apparatus (right)

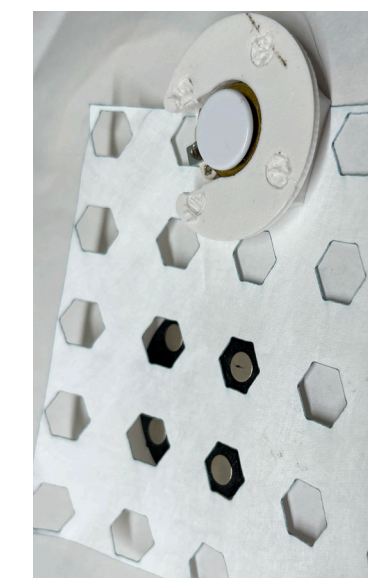
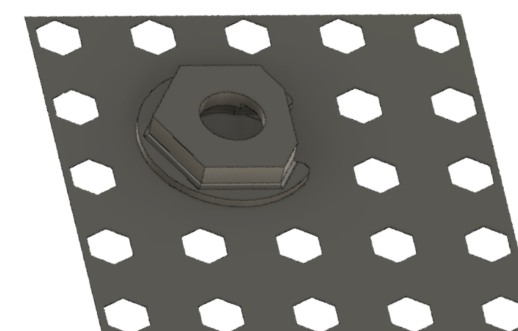


- 2nd gen simplifies geometry and increases strength
- Retaining magnetic ring reduces slop

GRID - SECONDARY METHOD

- Gridded sheet wraps around limb for easier don/dof
- Tactor mounts can be placed along grid

- 1st gen uses magnets to snap on actuator mounts
- Tyvek sheet too flimsy



- 2nd gen uses TPU band
- Screws secure tactor mount on various band positions