

SMALLER AID:

EXPLORING SHAPE-CHANGING ASSISTIVE WEARABLES FOR PEOPLE WITH MOBILITY IMPAIRMENT

Amanda McLeod

Sara Nabil

Lee Jones

Audrey Girouard

School of Information Technology, Carleton University

amandamcleod@gmail.com

Introduction

Problem: Individuals with mobility impairments often discuss the challenges associated with donning and doffing shirts (i.e. putting them on and taking them off).

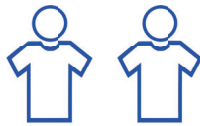
Solution: Limited previous work has tackled this issue, but the comfort and aesthetic integrity of the shirt is often forgotten. In this paper, we co-designed an adaptive shirt with individuals with mobility impairments and personal support workers. With the insights from these discussions, we developed an augmented top that transforms wide sizes (for the easy donning and doffing) into their preferred fit. The study resulted in the design of SMALLer Aid, which uses Shape Memory Alloy (SMA) springs to retract to a smaller size. The shirt adapts to their needs while retaining its aesthetic integrity to empower them with independence

User Study

- We ran a user study to engage and co-design with people with mobility impairments to understand their needs while designing for/with them.
- Participants included:



2 individuals with a mobility impairment



2 personal support workers (PSW)

Results

Aesthetic Compromise

- All MI participants mentioned their desired aesthetic choices being hindered due to their impairment

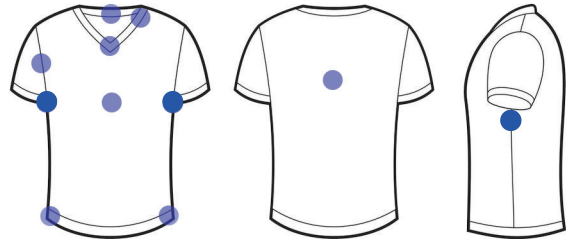
Feeling Frustrated

- All participants described their donning and doffing T-shirt process as being frustrating.

Material Matters

- During the study we engaged all participants in the design and materiality of their wearables.
- All participants described the Kevlar as "soft and comfortable".
- All participants mentioned that their T-shirt material of choice as 100% cotton

Common Restrictive Areas on a T-shirt



Every participant identified the underarm area as being the most restrictive area while donning and doffing a T-shirt

Prototyping SMALLer Aid

- SMALLer Aid, a plausible solution to the challenges associated to donning and doffing a T-shirt.
- The shirt consists of:
 - 100% cotton T-shirt with an embedded piece of SMA wire
 - An interior patch made of 100% Kevlar heat-resistant fabric which protects the exposed wire from the user's skin.
 - A detachable Arduino based circuit that serves as controller attached to a power supply.

Steps of creation

- We cut the SMA to 1.5 inches.
- Measure, mark, place, and pin in five areas of the SMA in a stretched position of 4 inches (1).
- Sew the spring at both extremities (2). Setting of sewing machine:
 - Type of stitch: **satin stitch** (tight zigzag)
 - Length of stitch: **smallest** (machine setting: 1)
 - Width of stitch: **medium** (machine setting: 3)
 - Tightness of stitch: **tight** (machine setting: 2)
- Cut holes on the outside of the shirt at the extremities of the spring.
- Next, clamp conductive beads to the outside extremities of the coil (3).
- Finally, sew a patch of Kevlar inside the shirt onto spring (4).



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