Ailie Turton & Sarah Manns, University of the West of England,

Luke Hampshire & Rory O'Connor, University of Leeds,

Tim Helps & Jonathan Rossiter, University of Bristol

Focus groups for co-design of robotic trousers for improving mobility in older people

UWE Bristol | University of the West of England

PRO active — Pain, Rehabilitation and Innovation

University of BRISTOL

UWE BRISTOL | University of the West of England

University of Strathclyde Glasgow

EPSRC

UNIVERSITY OF LEEDS

UNIVERSITY OF Southampton

The University of Nottingham

PREVALENCE IMPAIRED MOBILITY

- 11.6m disabled people live in Great Britain today

- 6.5 million of them have mobility impairments

- By 2039 more than one in twelve of the population is projected to be aged 80 or over

- Office for Disability Issues, (January 2014), Disability prevalence estimates 2011/12
- http://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2015-10-29

EXOSKELETONS – HARD SUPPORT

Endurance

Spinal Cord Injury

Softly-softly approach

A subtle suit could help rehabilitation, finds **Anna Nowogrodzki**

'A soft robotic suit has helped three people recovering from stroke to walk better
The suit developed by a team led by Conor Walsh at Harvard's Wyss Institute, is made of flexible fabric that attaches to the waist, thigh, calf and shoe. Cables fastened to the outside of the suit can contract in the same directions as muscles, helping to move the legs'.
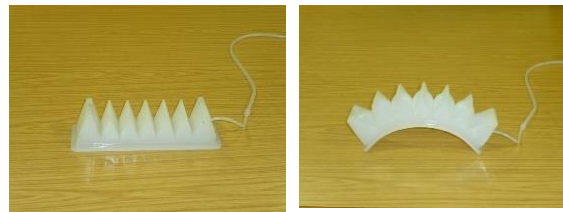
Project's overall Aim:

To develop wearable soft robotic technologies with sophisticated sensing, actuation and control and which can be fabricated into complete wearable assistive adaptive devices

multi-material additive layer fabrication – 3D printing

compliant active structures

Bending sensors

smart materials

OBJECTIVES OF THIS STUDY:

To determine the specific needs and perceptions of the target user groups for soft robotic assist devices.

Method

- Focus groups held at the Bristol Robotics Laboratory

- 11 Participants with impaired mobility, 5F:6M

- Research team - Engineers, Rehabilitation Physician, Medical Student, Occupational Therapist, Qualitative researcher

- Illustrator

- Analysis - Inductive thematic analysis using NVIVO software

- Impact check

Participants with impaired mobility

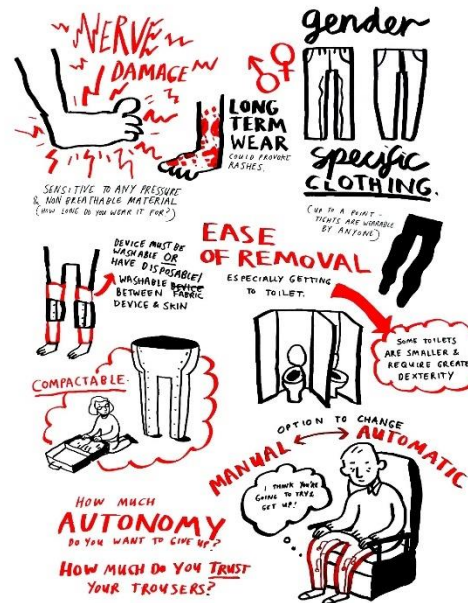|	F	M
20 -40	1	1
41-50	1	0
51-60	1	1
61-70	1	1
71-80	1	3

We discussed:

Current devices

wishes

tensions and compromises

trust/reliability of devices

Illustrations by Bethan Mure

USER REQUIREMENTS FOR WEARABLE SOFT ROBOTICS

Independence

Materials

Trade-offs

Ease of use

Thermal comfort

appearance

Reliability and support

care/ washing

power

Wishes for Independence

- To walk further
- walk faster, cross roads at crossings in time and keep up with family and friends
- walk outside alone

Ease of use:

'It's a deal breaker'

'_Speed is of the essence'_

Reliability and support

'Will there be technical support?'

Materials

Flexibility of material essential for putting garments on and off

Thermal comfort
- Ability to cool and warm in response to external temperature and body temperature
- breathable to avoid potential skin irritations

Care
- All users wanted to be able to wash the core part of the garment that has contact with the skin
- Proposal for dirt repellent fabrics was not positively received.

Trade offs

Function vs Appearance
- Assistive garments on display/inconspicuous
- Gendered clothing, appearance options and fit with everyday wear such as shoes.
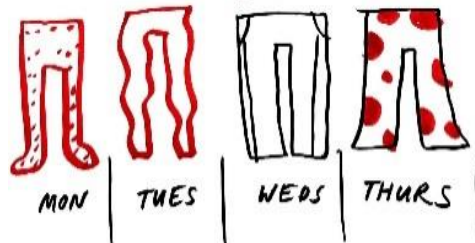
Power vs weight and bulk
- Heavier bulkier power supply for greater assistance
- Lighter smaller power supply for small assists ✓

PEO: REQUIREMENTS SOFT ROBOTIC GARMENTS

Person

Wanting to be able to walk faster and further

Independent in putting garments on and off and to toilet

Comfort

Autonomy of control vs release from cognitive effort of walking

Environment

Comfort in all environments – ambient temperatures

Capability to assist with different terrains, steps and kerbs

Occupation

Suitable for walking outside alone

All occasions – work to weddings

Power capability suitable for occupational performance – endurance, assistance required

IMPACT

In what ways did the information provided by the focus groups participants inform your work for this project?

We have to demonstrate a solution for each of the challenges, but they should not necessarily be merged in a single garment, because the requirements vary from person to person

A large number of possible devices could be developed that could improve the lives of people with reduced mobility, particularly lower power devices, which could 'guide' and stiffen and which, because of their lower power requirements, could be thinner, lighter and more comfortable.'

OVERALL FINDINGS AND CONCLUSIONS

- Participants were interested in garments to provide little assists to their mobility for daily living

- Personalisation important for engagement with robotic garments as either rehabilitation or assistive devices

- *Collaborative* focus groups ensured detailed exploration of requirements for devices.

- The voices of potential users were heard by the engineers and provided information important for their work

- The artist's record provided visual notes that made it easier to remember the points discussed during the meeting.
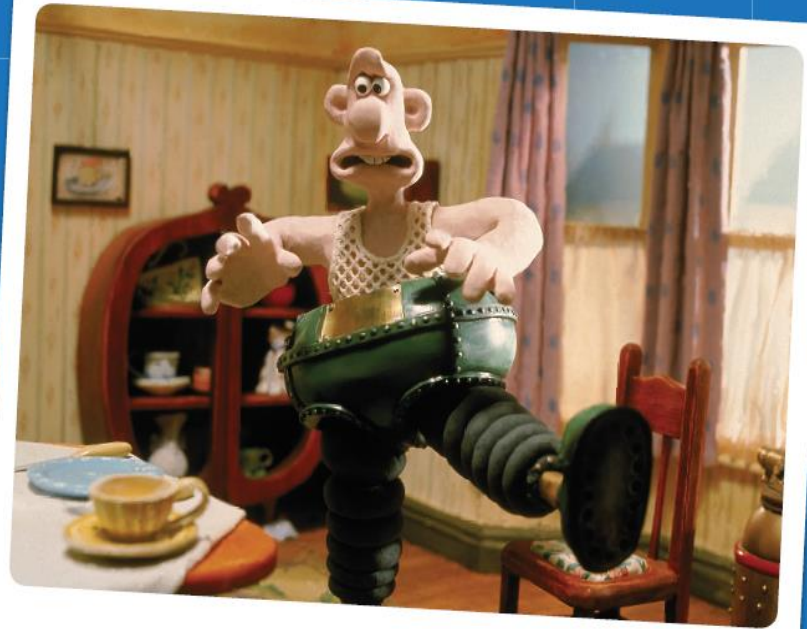
Wearable Soft Robotics for Independent Living

THE RIGHT TROUSERS

https://therighttrousers.com

© Aardman Animations Ltd/ Wallace & Gromit Ltd 1993

With thanks to our participants, Illustrator - Bethan Mure, And to the Right Trousers team:

Ailie.Turton@uwe.ac.uk