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EDINBURGH CENTRE FOR ROBOTICS
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LEADERS IN IDEAS AND SOLUTIONS

Robots for Health

Professor Lynne Baillie

Department of Computer Science & Edinburgh Centre for Robotics

Background

Robotics:

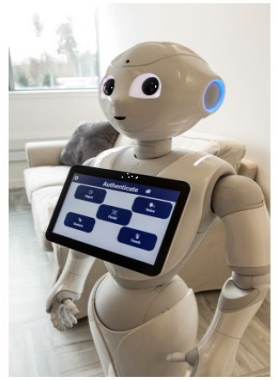
Source: https://www.metalworkingworldmagazine.com/files/2014/09/VW02357.jpg

HCI methodologies


Facial


Favourite object

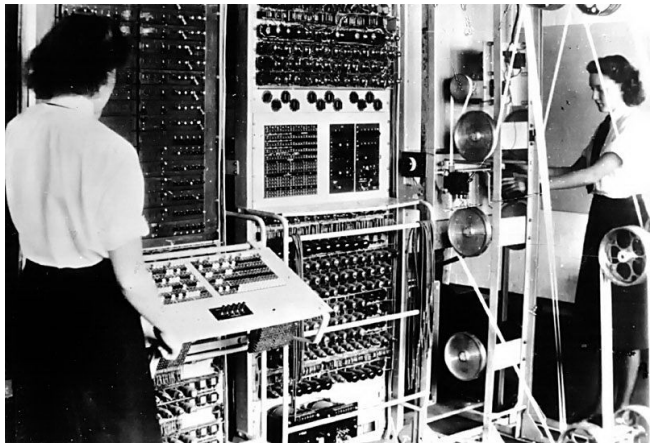

Voice




Gesture


Touch sequence

Computers:



Sources: https://www.computerhistory.org/timeline/computers/ http://www.righto.com/2016/06/y-combinators-xerox-alto-restoring.html http://idealtechnology.co.uk/

How can we involve all stakeholders in Human Robot Interaction?

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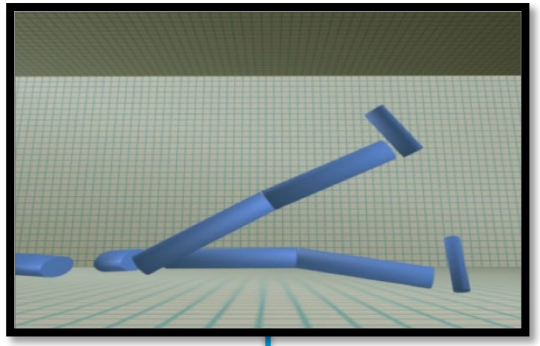
Method

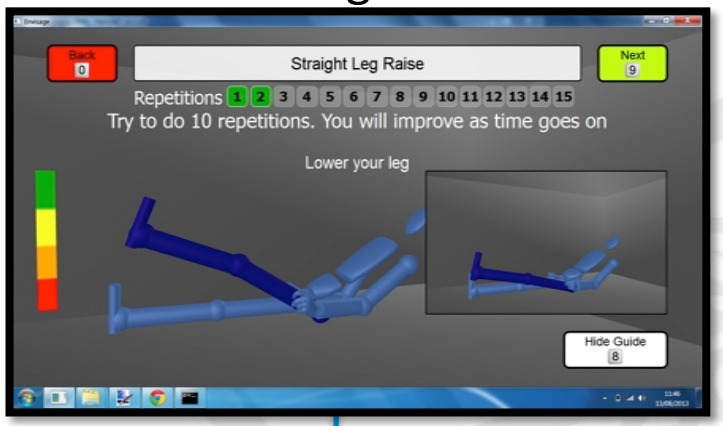
- User Centered Design workshops have been previously explored in healthcare by my group see [3][5]:
  - Brought to light some obstacles from health professionals and patients that the developers/designers did not know about.
  - Advantage of being user driven rather than designer/developer driven.
- Direct involvement of user group in a rehabilitation system design – has proven successful studies to assist stroke survivors, fallers and TKR patients with their rehabilitation needs [2][4].
- However, design with health professionals and patients considering robotic technologies has been limited to labs or highly controlled environments.

User Centered Design

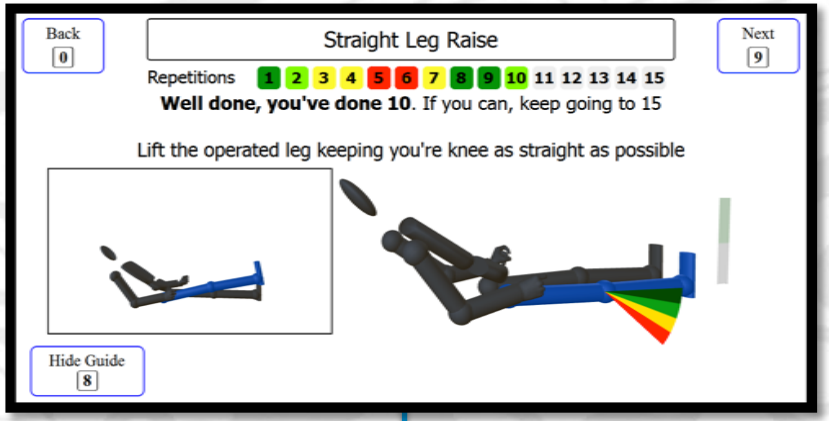
Basic Prototype



Design 1

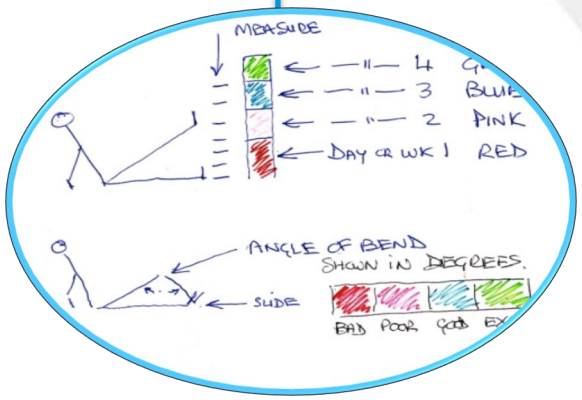


Design 2



Timeline

Interviews with experts



Design workshops

Usability studies

Clinical/Home studies

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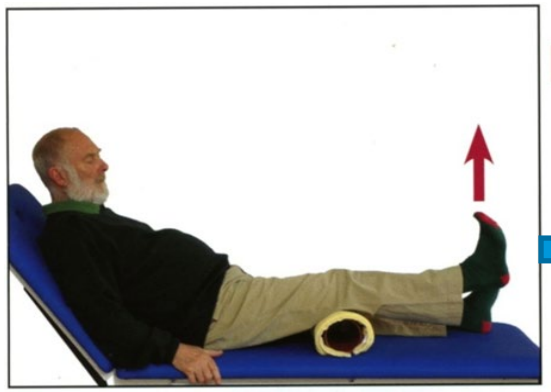
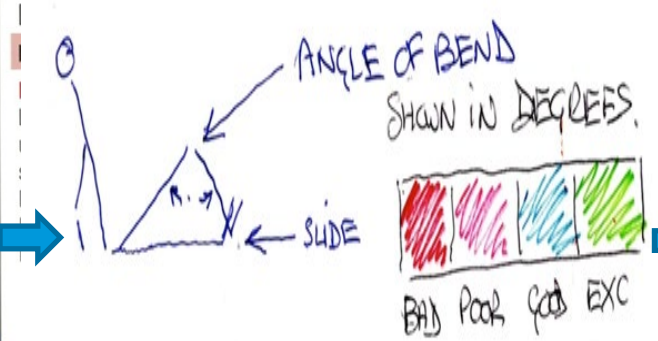
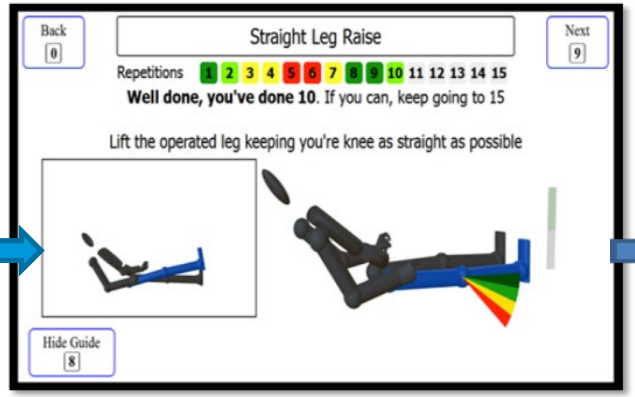
Rehabilitation assistance in the home through sensing and robotic solutions

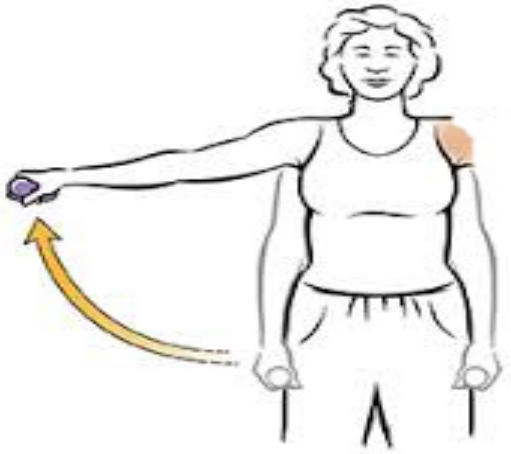
Previous Work





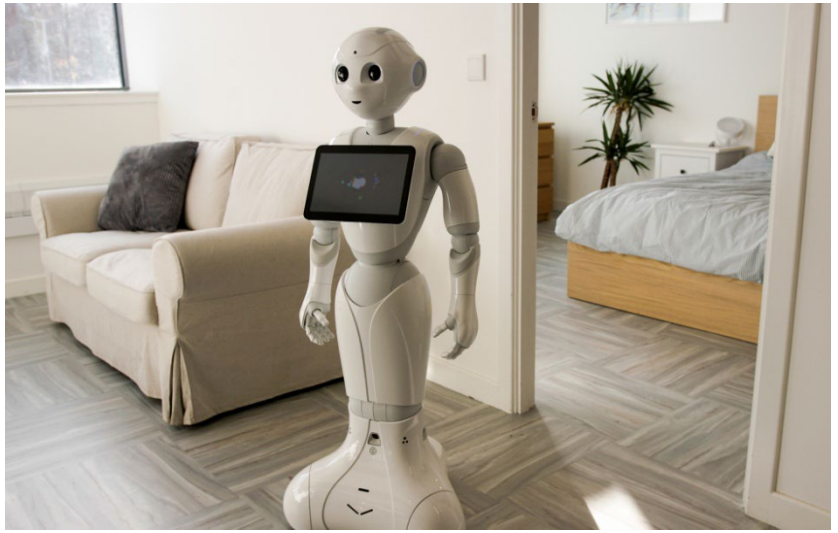


Current Work



User Centered Design Workshop

- We undertook recently a User Centered Design workshop with stroke survivors in Assisted Robotic Living Lab.
- Designed to look like an apartment, with kitchen, living room, bedroom and bathroom.
- Aim – to explore the design of new socially assistive robotic technologies for use in the home.



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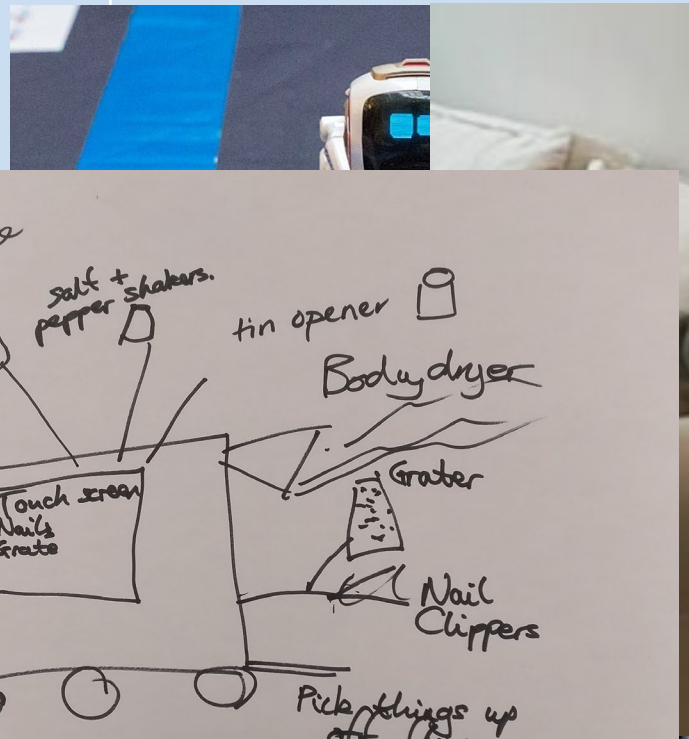
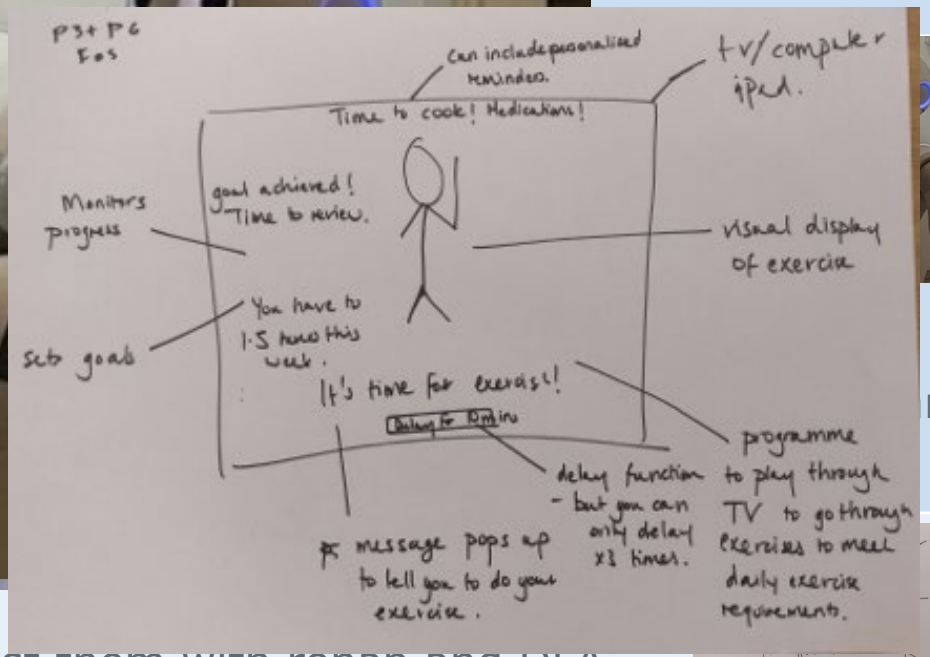
Objectives

1. Investigate what problems stroke survivors had in carrying out Daily Living Activities (DLA).
2. Identify end users' priorities for assistive robots to support independent home living post-stroke.
3. Identify priorities and limitations in HRIs during (1) and (2).
4. Generate new ideas from stroke survivors on interactions with technology in rehab and DLA.
5. Investigate whether a design workshop is an appropriate HRI tool.

Methodology

Phase	Rationale
1. *Living with stroke discussion*	rehab and DLA.
2. *Demos with S Assistive Robots our assistive lab*	
3. *Feedback and SARs demonstra*	nd
4. *User design s*	to interactions to assist them with rehab and DLA.



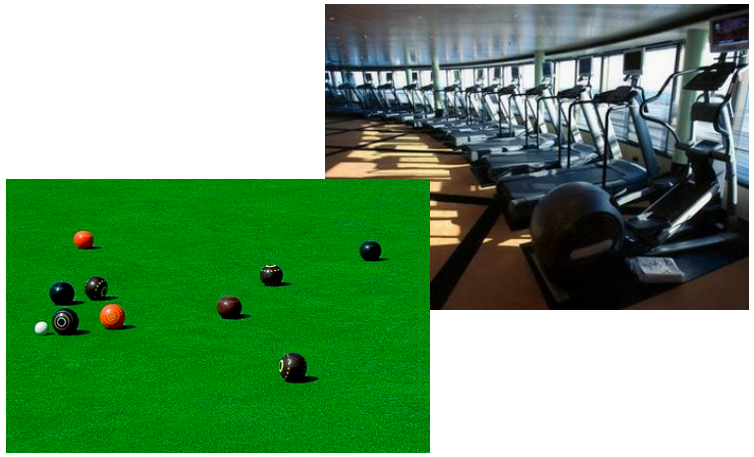


10 stroke survivors participated – 7 male, 3 female, mean age 58, time since stroke ranged from < 1 year to 19 years

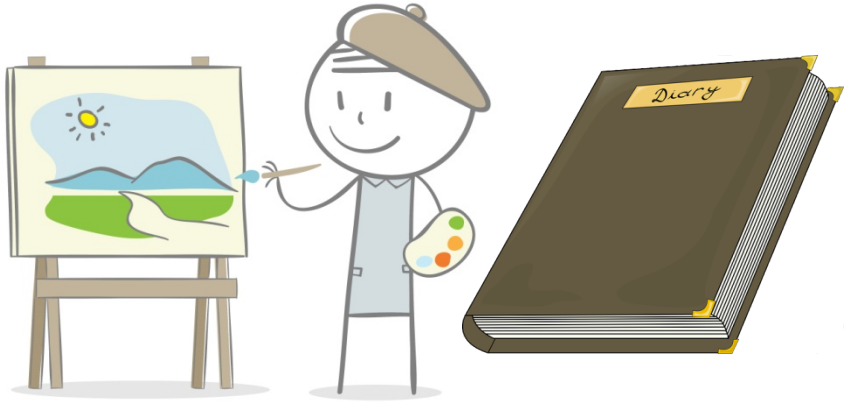
Results – Living with Stroke (Phase 1)

- Aphasia frequently mentioned as stopping participants fully engaging with technology.
- All participants reported an active lifestyle:

Physical activities



Mental activities



- Activities enjoyed before stroke, and new activities undertaken.

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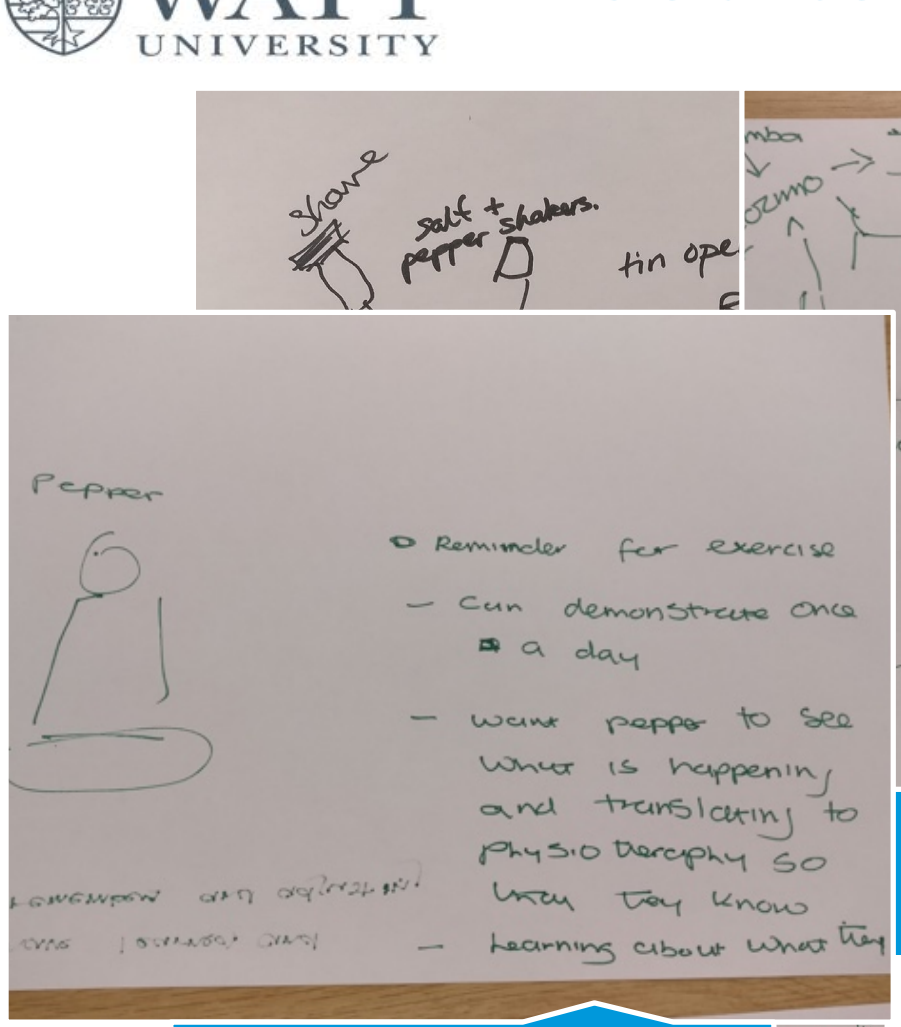
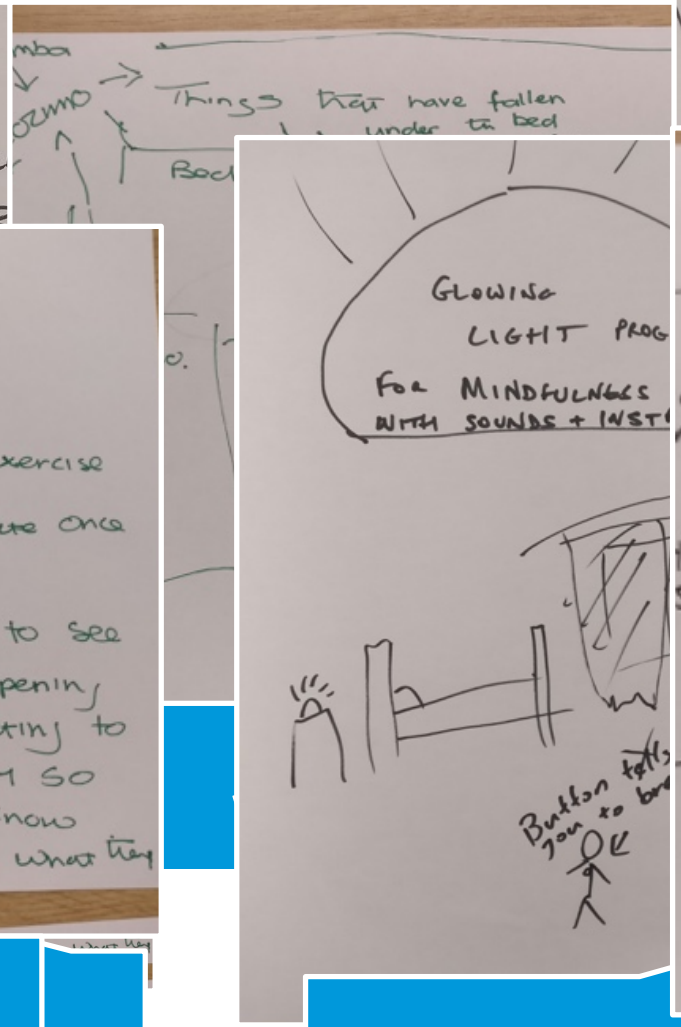
Results – Demonstrations (Phases 2&3)

- Participants expressed a strong dislike of the robot's speech.
  - Default voice of Pepper was **too fast** for this group
- One participant strongly disliked the look of Pepper, others didn't mind the appearance.

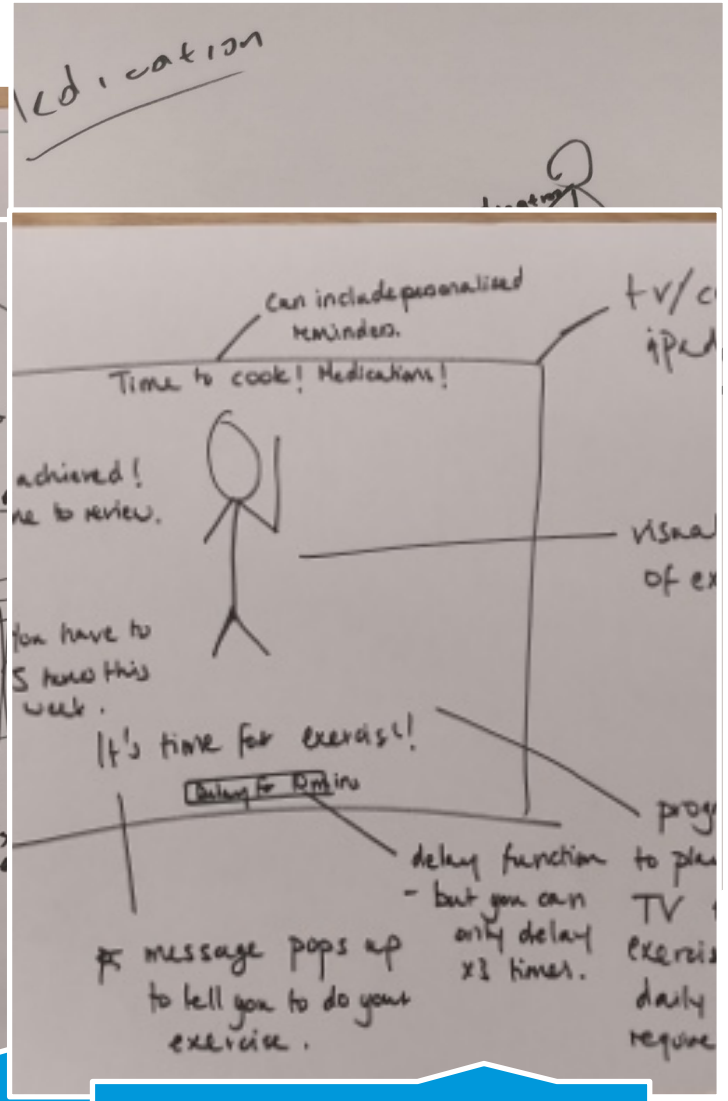
Results – User Sketches (Phase 4)



Rehab coach



Mindfulness coa



Design for Pepper's tablet screen

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Conclusions

Living with Stroke (Phase 1)

- **Communication** with devices is one of the biggest problems faced by stroke survivors when using technology.

Demonstrations (Phases 2&3)

- Assistive robot designs which use speech cannot just be re-used for stroke survivors.

User Sketches (Phase 4)

- A variety of human robot interactions were designed, from utilitarian robots to those with agency.
- No designs featured purely **social** interactions.

Socially Assistive Robots for Autism (SoCoRo Project) Professor R. Aylett, Dr Frank Broz

- Autism Spectrum Disorder (ASD) affects 695,000 people in the UK, and approx. 547,000 of these are 18 or over (1.3% of the adults in working age).
  - The unemployment rate among adults with ASD >85%, nearly double the unemployment rate of 48% for the wider disabled population.
  - One reason for this is that people with ASD struggle to interpret social signals e.g. expressive behavioural cues (facial expressions, vocalisations, gestures, etc.).
- The SoCoRo project is developing a Socially-Competent Robot Training Buddy that will help adults with ASD to better deal with social signals in work-related scenarios.
- The main technological challenge is the development of a novel affective architecture that makes a robot suitable for Behavioural Skills Training, in particular, behaviour rehearsal. The robot must reinforce the use of appropriate social signals by its human interaction partner while inhibiting the use of inappropriate ones.
- The team work with stakeholders involved with training for adults with an ASD to develop workplace-relevant scenarios

Robot Walking Group (Dr Christian Dondrup)

Interviews and stakeholder workshop to identify tasks for robot [9]:

- Support in Therapy:
  - Walking group companion, acoustic stimulation, visual stimulation, entertainment during rests
- Walking Groups:
  - Residents with progressed dementia, tours offered twice a week to obtain mobility, diversion, and as a group activity

Interview partners (10)	
Professions	Physician (1), therapist (1), resident-transporter (1), facility and medical technology (1), quality management (1), IT-support (1), IT-security (1), receptionist (1), PR-agent (1), secretary worker (1)
Gender	6 females, 4 males
Age (years)	26-48

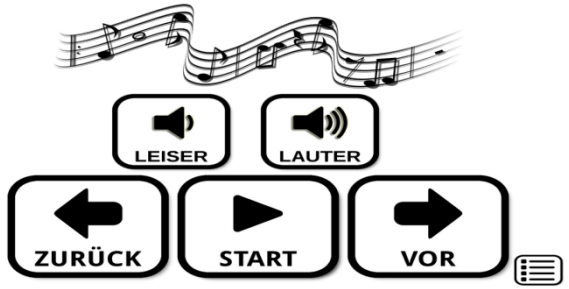
Focus group participants (13)	
Professions	Care-staff (4), clinical psychologist (2), physiotherapist (1), IT-support (2), PR-agent (1), resident-transporter (1), facility and medical technology (1), leader of food-supply (1)
Gender	7 females, 6 males
Age (years)	26-61

[9] Hebesberger et al. … Robot as Companion in Physical Therapy … for Older Adults with Dementia. In: HRI 2016

Walking Group

The robot would

- lead the group from resting point to resting point
- play music while doing so
- offer entertainment during rests



(A Few) Results [9]

Attitude:

- Therapists:
  - Positive attitude, “exciting”
- Older adults:
  - Neutral to interested
  - Singing, dancing, laughing, swaying

Interaction:

- Therapists:
  - Easy to handle
  - Tedious control card
- Older adults:
  - Help required
  - Not familiar with touch screen

[9] Hebesberger et al. … Robot as Companion in Physical Therapy … for Older Adults with Dementia. In: HRI 2016

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Future Work

- Creating more Social Assistive Robotic (SARS) concepts with end users
- Testing improvements of current HCI/HRI methodologies – exposing participants to deeper social elements of SARs in demo phase.
- Work with all stakeholders to test appropriate prototype concepts of SARs in real life and clinical settings.

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Any questions?