

# MODULE 3-P4: Assistive technologies for functional recovery in persons after stroke

Natalie Tanczak<sup>1,2</sup>, Christoph M. Kanzler<sup>1,2</sup>, Roger Gassert<sup>1,2</sup>, Olivier Lambercy<sup>1,2</sup>

<sup>1</sup> Singapore-ETH Centre, Future Health Technologies Programme, CREATE Campus, Singapore

<sup>2</sup> Rehabilitation Engineering Lab, Department of Health Sciences and Technology, ETH Zurich, Switzerland

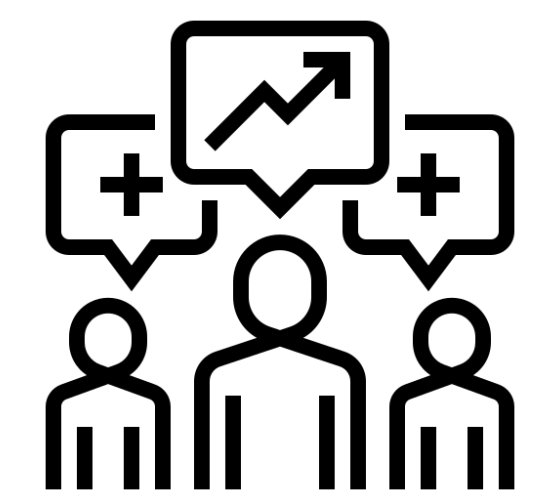
## 1 Introduction

- Many persons in the chronic phase after stroke have **persisting upper limb impairments** which affect their abilities to perform activities of daily living (ADL)
- Assistive technologies (AT) are able to support individuals with such tasks
- Specifically, robotic hand orthoses (RHO) can help **support with grasping tasks** in ADL
- Further, through promoted usage of the impaired limb, the individual may harness any **remaining potential for recovery** even long after stroke

## 2 Research aims

1. **Optimisation** of a RHO for assistance in grasping tasks for persons after stroke
2. **Validation** of this device within stroke therapy in clinic
3. **Extension** of this device as an assistive tool in home for daily assistance

## 3 Preliminary results <sup>[1]</sup>



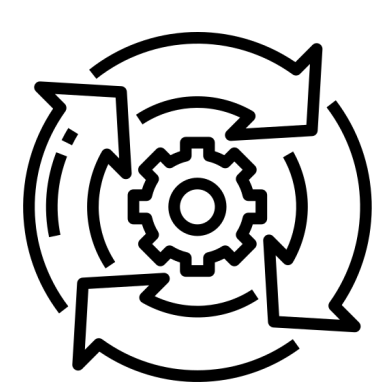
**Mixed-Method Focus Group:** semi-structured interviews, decision making analysis, hands-on demonstration

- A **qualitative** analysis, supported and complemented with **quantitative** outcomes

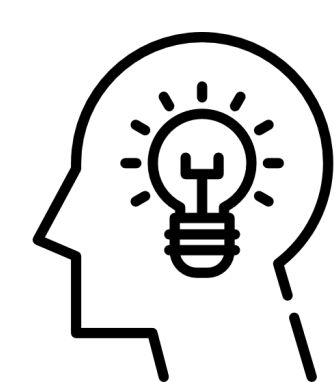
### Methodological Evaluation (n=5)

- High **frequency** of mention was met with a high level of **importance**

Most desired features for upper limb AT:



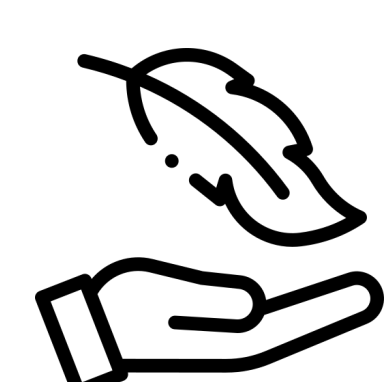
Effective



Intuitive



Easy to use



Lightweight

## RELab tenoexo

A lightweight, fully wearable RHO intended for grasping assistance for individuals with sensorimotor hand impairments

- Comprised of:
  - Ⓐ Back module containing motors, controls and battery (720g)
  - Ⓑ Lightweight hand module (<150g)
  - Ⓒ Unobtrusive cable transmission
- Supports various grasp types (Figure 1) to maximise grasping assistance in ADL, increasing the independence of the end user
- Fully tailorable design: accounting for end user hand measurements, preferences on backpack location and grasping intention methods (ex. Button, phone app...)

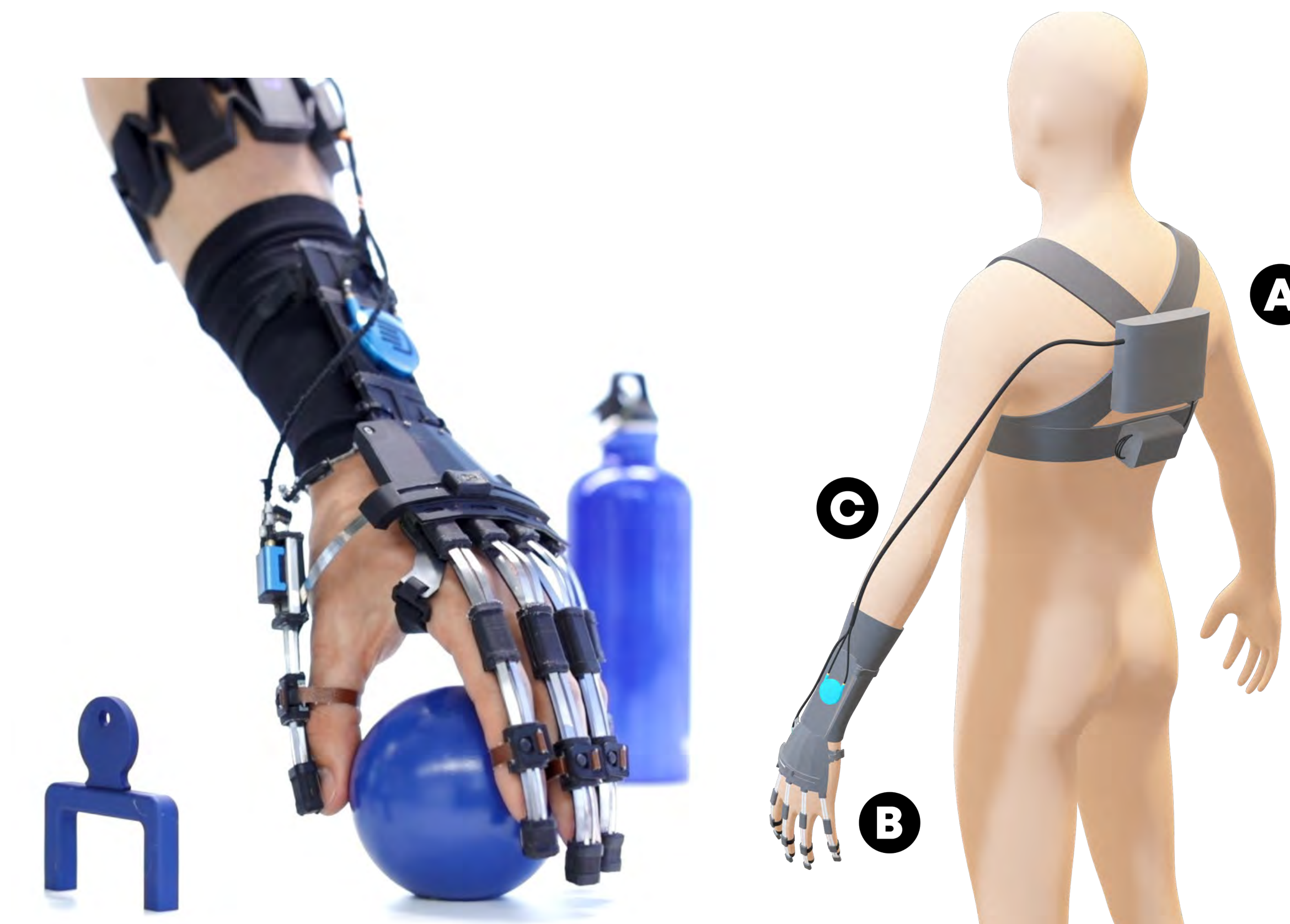


Figure 1: The RELab tenoexo, a fully wearable assistive soft hand exoskeleton for daily activities. The hand module has two actuated degrees of freedom and passive thumb opposition allowing for grasps covering 80% of ADL.



Figure 2: (Left) Participants ranking their previously listed desired device features in terms of importance. (Right) A participant trying out the RELab tenoexo.

## 4 Future work

1. **Mechanical characterisation:** systematically testing iterations of new RHO designs
2. **Feasibility testing in clinic:** validating the functionality of the RELab tenoexo with the specific needs of the stroke population
3. **Extension to independent use at home:** exploring the feasibility of using the RELab tenoexo independently in the home setting to support ADL

### References

[1] N. Tanczak, R. Ranzani, J. T. Meyer, G. Devittori, D. Dinacci, R. Gassert, O. Lambercy, and C. M. Kanzler, "A Novel Mixed-Method Approach to Identify Needs and Requirements for Upper Limb Assistive Technology for Persons after Stroke," Accepted for publication at the 17th International Conference on Rehabilitation Robotics (ICORR), 2022.

