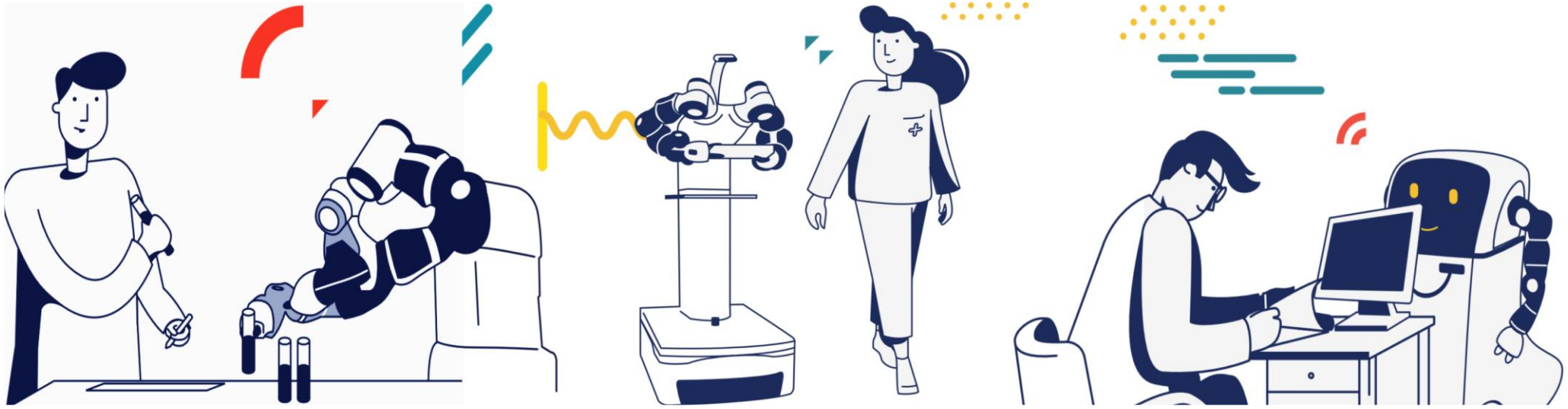

The hospital of the future –
advances in healthcare robotics

Outreach Event, February 8, 2023

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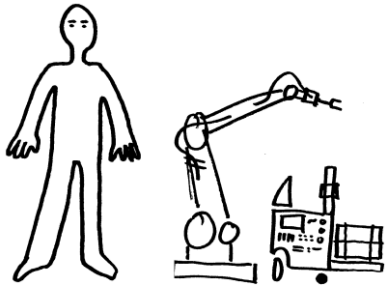
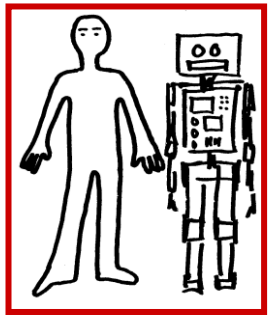
Next Generation of Robots

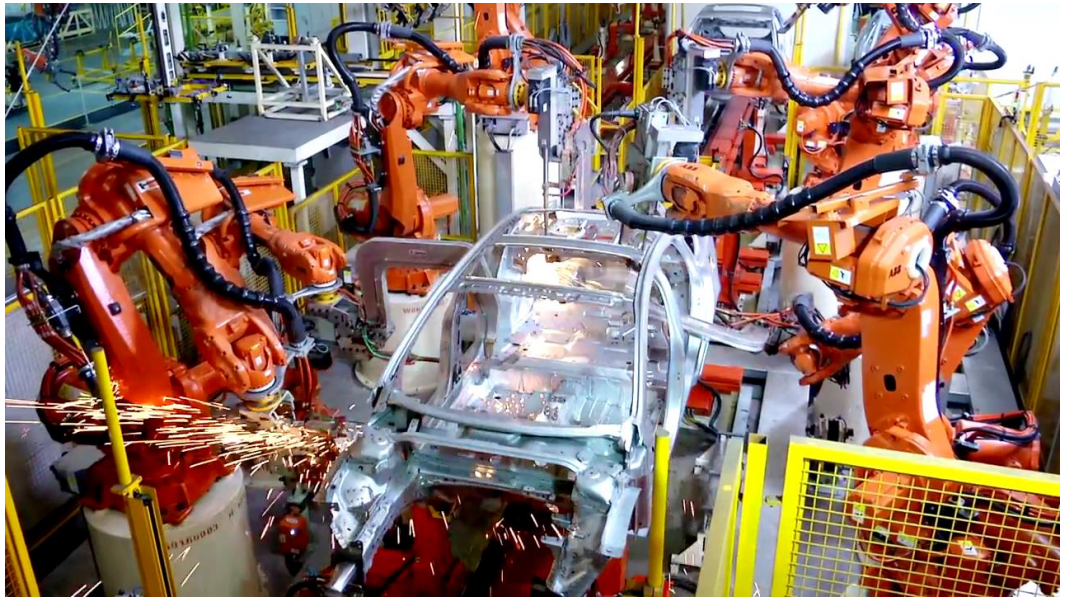
mobile, smart, connected, adaptive and closer to humans



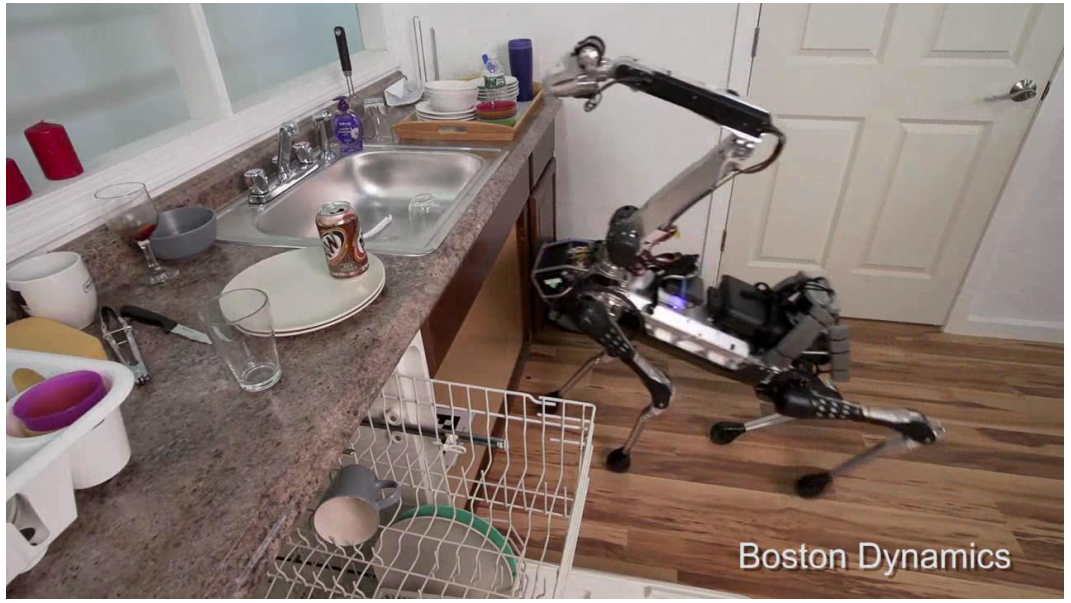
Industrial Robots



Service Robots



https://www.youtube.com/watch?v=SeIoQy0oXjI



https://www.youtube.com/watch?v=tf7IEVTDjng

Service Robots | ***k**ey **c**hallenges*

Our real “physical” world is ***multi-modal***,
very ***diverse*** and ***complex.***

We need robots that …

… can ***dealing*** with ***uncertain***
and ***partially available information***

… ***see, feel*** *and* ***understand*** their environment

… have ***torque*** and ***force*** control
for ***tactile*** and ***dexterous*** interaction (“soft robots”)

… offer ***intuitive human-machine interfaces***

… ***learn*** and ***adapt*** every day

→ all this required AI/ML but even more novel sensing, actuation and robot concepts!!

50x speed
www.youtube.com/watch?v=gy5g33S0Gzo

Manipulation with anesthetized tactility
https://www.youtube.com/watch?v=HH6QD0MgqDQ

Robotics: Pain-Points and Opportunities in Healthcare

Pain-Points

- Aging society
- Shortage of labor
- Increasing costs
- …

Robots as high-quality tools

- Precise, reliable
- Less invasive
- Faster recovery of patients
- Perfect for “background” tasks, complementing people
- …

TAGBLATT

abo+ FACHKRÄFTEMANGEL

Die Anzahl offener Stellen wächst weiter an – vor allem in der Deutschschweiz gibt es viele Vakanzen

Über 260'000 Stellen waren in der Schweiz Mitte Oktober ausgeschrieben. Zwischen den Regionen gibt es deutliche Unterschiede. Das gilt auch für die einzelnen Branchen.

Ruben Schönenberger
22.10.2022, 05.00 Uhr

Neue Zürcher Zeitung

Notstand in der Pflege: wie die Heime und Spitäler um die rarer Fachkräfte kämpfen

Der Personalmangel in den Gesundheitsinstitutionen ist dramatisch. Gerade die Pflegeheime als vermeintlich unattraktivs müssen sich einiges einfallen lassen, um gute Leute zu bekommen.

Simon Hehli
29.12.2022, 05.30 Uhr

Aargauer Zeitung

GESUNDHEITSWESEN

Düstere Prognose zum Fachkräftemangel: 2030 fehlen über 32'000 Pfleger und Ärztinnen

Der Mangel an Fachpersonal in den Spitälern spitzt sich gemäss einer neuen Studie in den nächsten Jahren rasant zu. Und nur jedes vierte Spital stehe finanziell auf gesunden Beinen.

Gina Bachmann
09.10.2022, 13.54 Uhr

Intro to the main project behind the event

Harmony
Assistive robots for healthcare

- Roland Siegwart

HOSMARTAI
AI for the smart hospital of the future

the future of drug delivery
angie

MINIGRAPH

- Salvador Pané Vidal

HERO

- Peter Wolf

ETH zürich

TU Delft

UNIVERSITÄT BONN

THE UNIVERSITY OF EDINBURGH

UNIVERSITY OF TWENTE.

create

KAROLINSKA UNIVERSITETSSJUKHUSET

USZ Universitäts Spital Zürich

ABB

IDMIND LIVING ROBOTICS

Harmony

Assistive robots for healthcare

Enhancing Healthcare with Assistive Robotic Mobile Manipulation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101017008

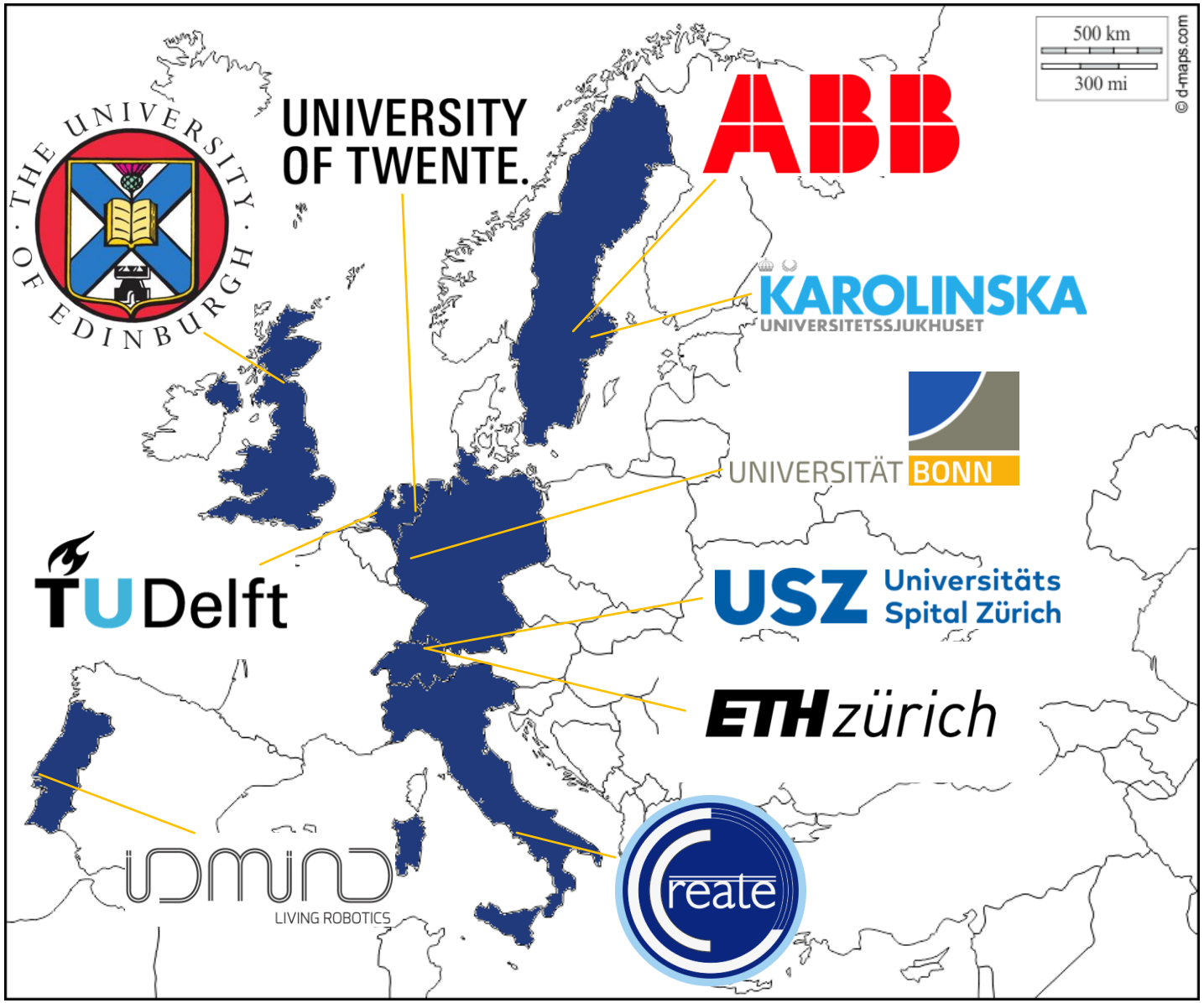
Harmony Consortium

2 industrial partners

2 end user experts

5 universities

1 research organisation



JUST-IN-TIME DELIVERY

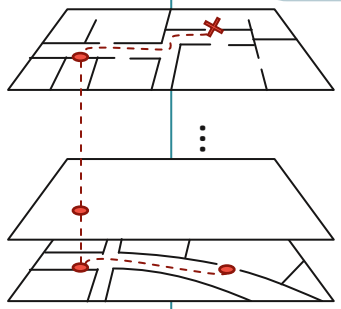
Internal post

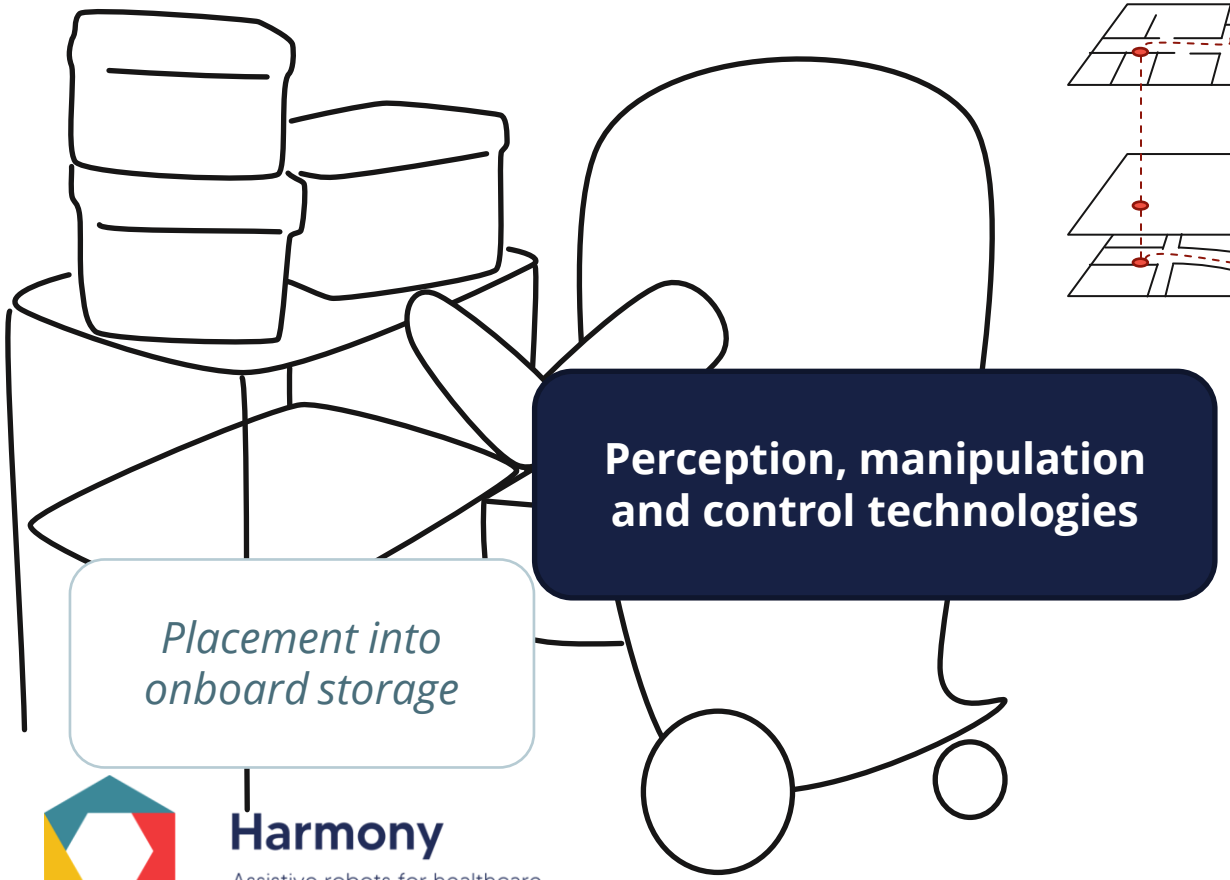
Human-robot interaction technologies

Boxes for delivery

Interaction with hospital infrastructure (e.g. elevators)

Handle outgoing boxes

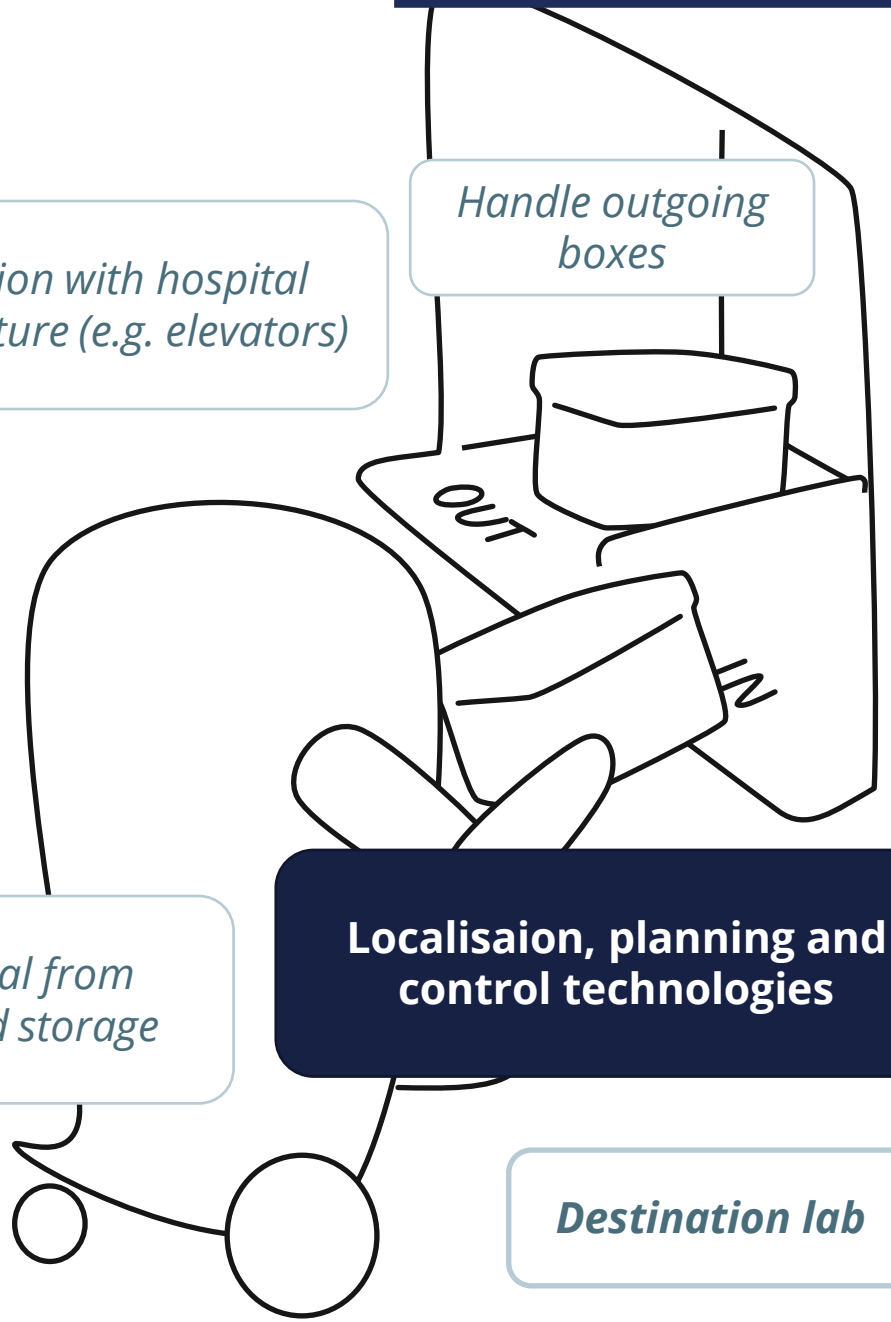




Perception, manipulation and control technologies

Placement into onboard storage

Retrieval from onboard storage



Localisaion, planning and control technologies

Destination lab

Harmony

Assistive robots for healthcare

BIO-ASSAY SAMPLE FLOW

Perception, manipulation and control technologies

Incoming boxes

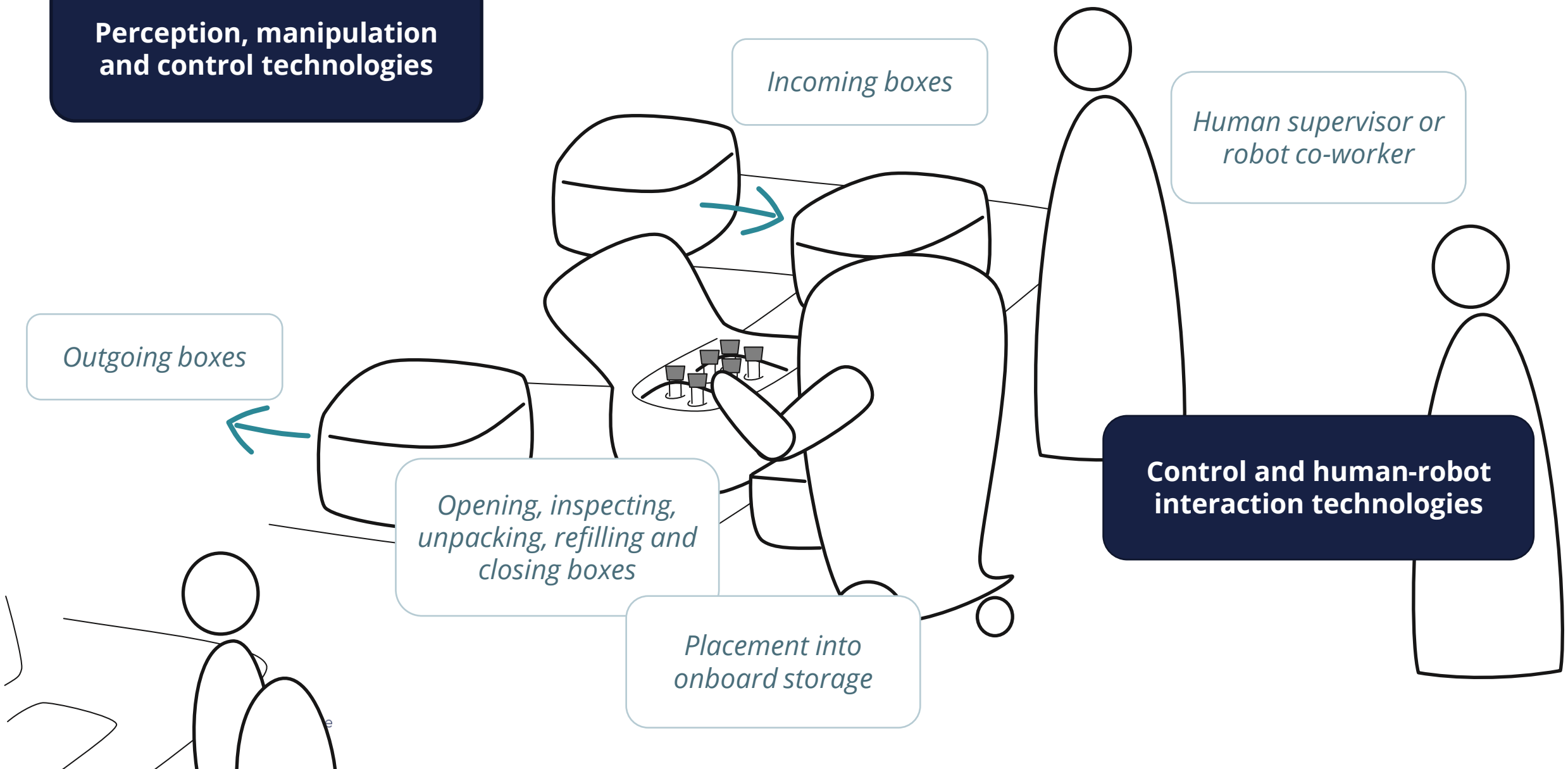
Human supervisor or robot co-worker

Outgoing boxes

Opening, inspecting, unpacking, refilling and closing boxes

Placement into onboard storage

Control and human-robot interaction technologies

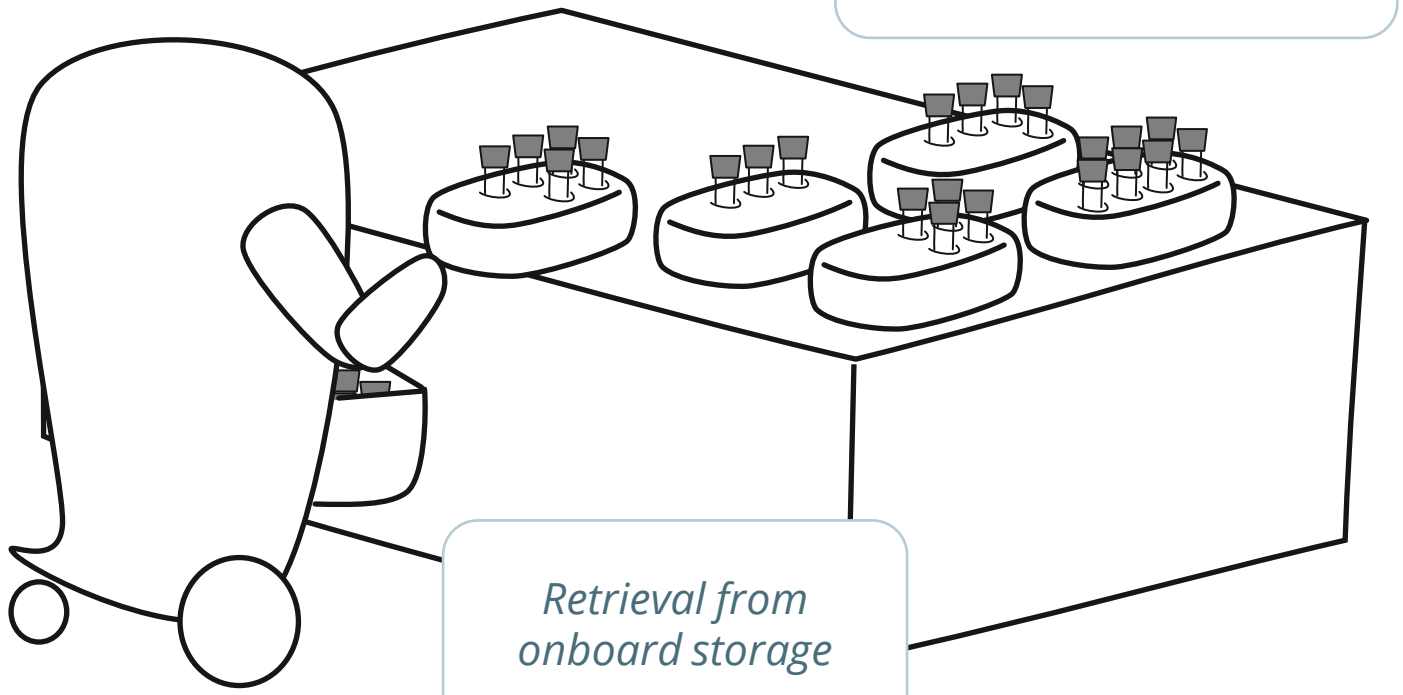


BIO-ASSAY SAMPLE FLOW

Localisation, planning and control technologies

Physical interaction with hospital infrastructure

Sorting , processing and redistribution station



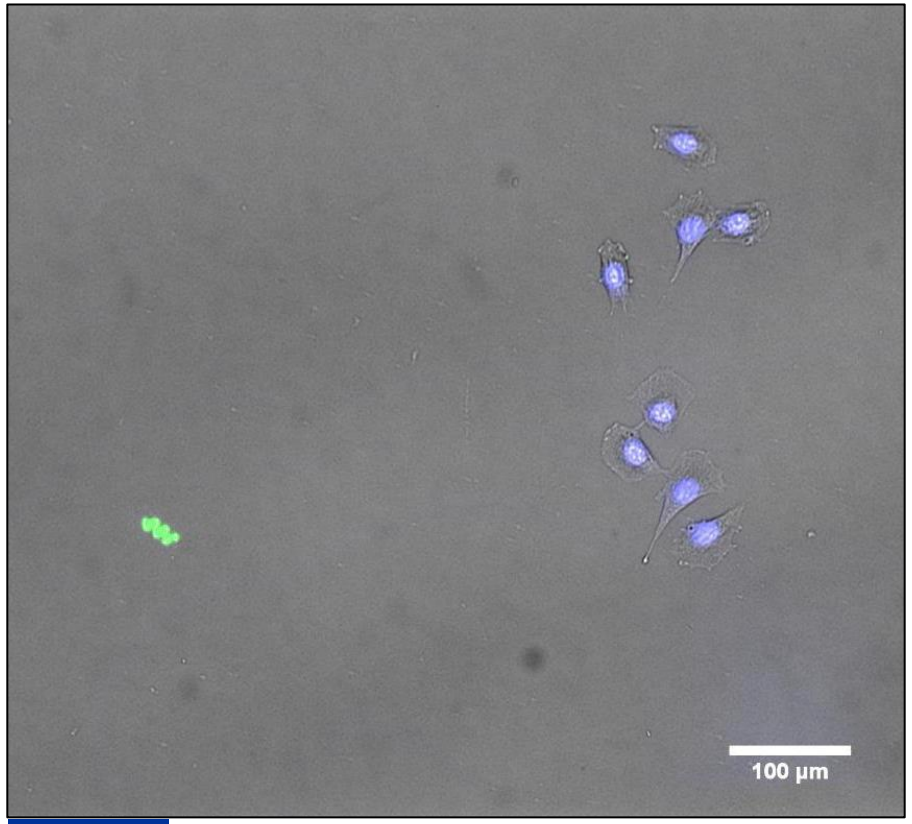
Retrieval from onboard storage

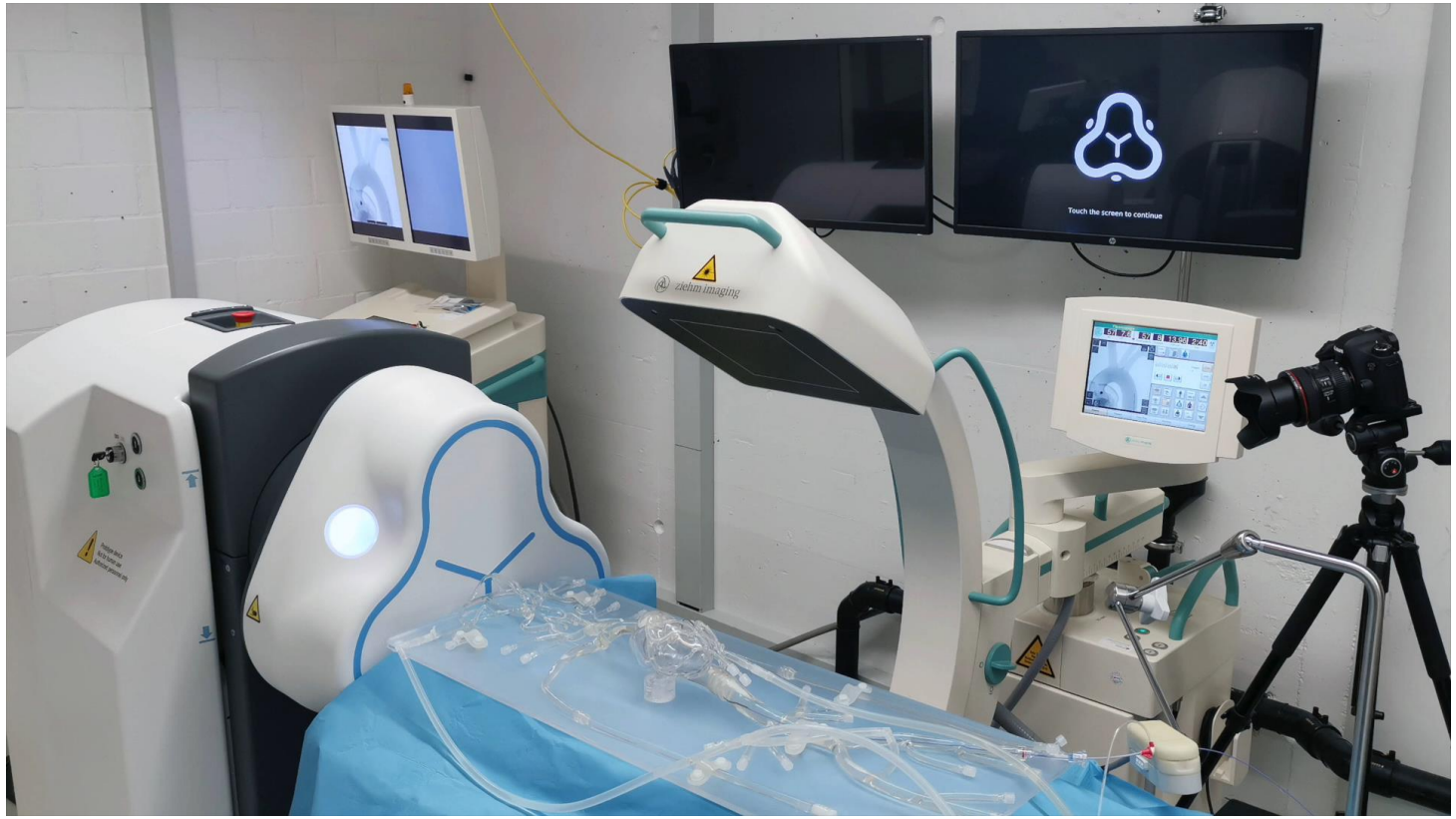
Harmony

Assistive robots for healthcare

Multi-Scale Robotics Lab

Small-Scale Robots and Magnetic Navigation Systems





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8. February 2023

Challenges in clinical translation

Requirements and constraints to develop minimally invasive technologies with magnetic small-scale robotics for application in clinical environment:

- Load, transport and deliver **relevant** therapeutic **amounts** for a given disease
- **Control rate of delivery** of therapeutic agents to the targeted location in the body
- **Ensure degradation and biocompatibility** of the devices and structures
- Manipulate devices in **realistic volumes or workspaces** (i.e. human body regions)
- Systems are **compact enough** to allow easy integration in existing operating rooms
- Magnetic navigation systems **comply with regulations** for use in medical settings
- Manipulation systems pose **no risk for health professionals** carrying magnetic-sensitive tools (e.g. metal parts, electronics)
- Instruments **minimize the physical burden** on the health professionals

Harmony
Assistive robots for healthcare

HERO

HOSMARTAI
AI for the smart hospital of the future

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the future of drug delivery
angie

Develop a targeted drug delivery plaform using magnetic microrobots for treating stroke

MINIGRAPH

Magnetic navigation and cataheters to assist the implantation of miniaturized neural devices for treating neurological disorders

HOSMARTAI
AI for the smart hospital of the future

Integration of magnetic navigation systems in helathcare environments, and develop AI solutions that facilitate their use and deployment.

The importance of stakeholders

■ Develop new technologies that can be successfully transferred to society, **by considering, from the onset, the requirements, barriers and framework conditions of the final application** (e.g. health providers facilities, national health systems budgetary restrictions, ethical aspects)

■ Build a large network of professionals, entities, and organisations **covering the entire supply-chain of the developed technology** (from developers to final users), and that can contribute to its faster development and uptake by society.

■ **Widen the pool of contributors to the development of the new technology,** via the multiple planned discussion forums planned (e.g. ideas/innovation competition, annual workshops, public debates, best thesis competition, platform for online courses on related topics)

■ Generate momentum, engagement and interest by the different entities, and stakeholders that can benefit the most from the developed technology and maximise its **uptake by society.**

■ At the same time, stakeholders can anticipate needs, technological developments and commercialization market opportunities (e.g. for equipment manufacturers, entrepreneurs, technology investors)

Examples of stakeholders in ANGIE

Siemens
(medical equipment manuf.)
CLS Behring
(Pharma & Biotech)

Vifor Pharma

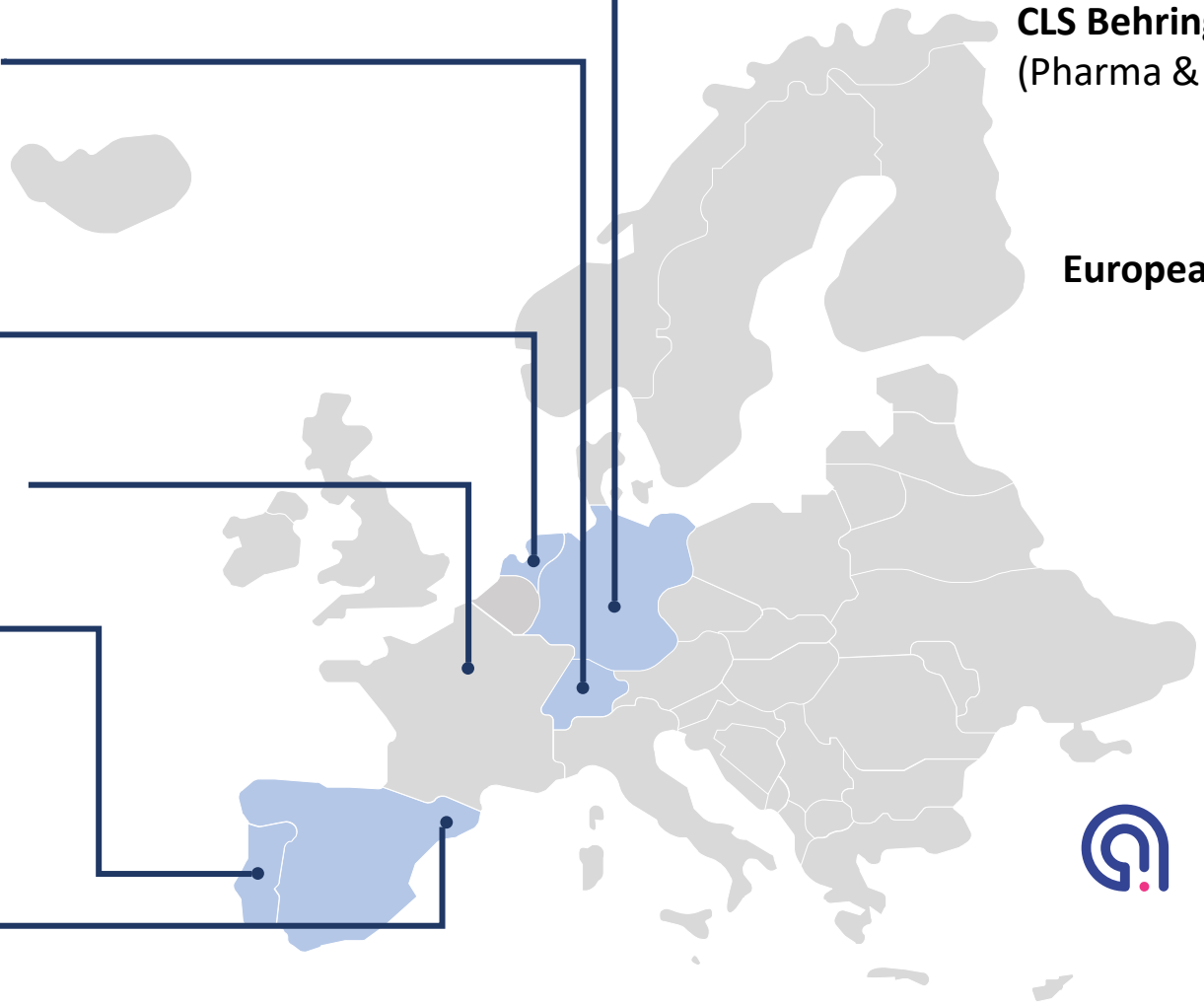
European Stroke Organization

NLC Ventures Netherlands B.V.
(Health Tech. venture builder)
Tjongerschans Hospital

George-Pompidou European Hospital

Portuguese National Health Service

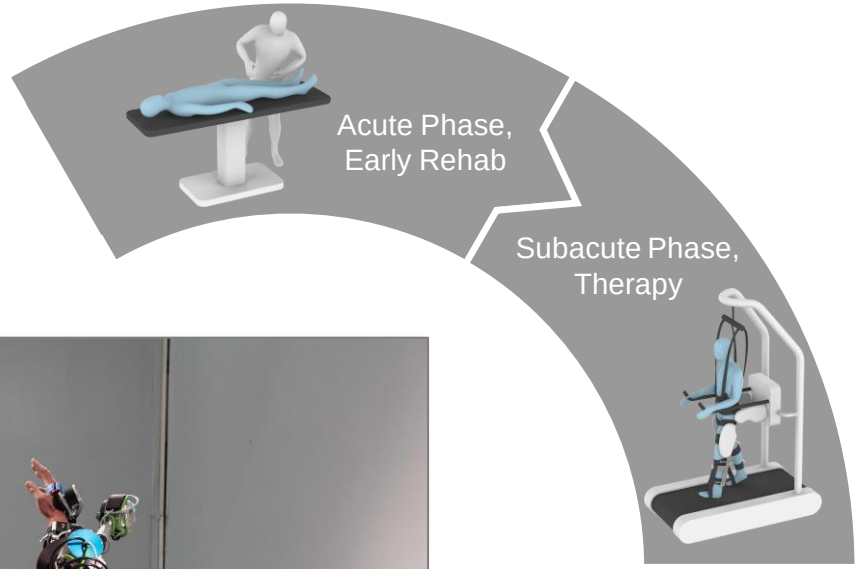
SegurCaixa Adeslas
(Insurance industry)
Ictus Foundation
(Stroke patients organization)
Institut Català de la Salut
(Regional health System)
Hospital del Mar

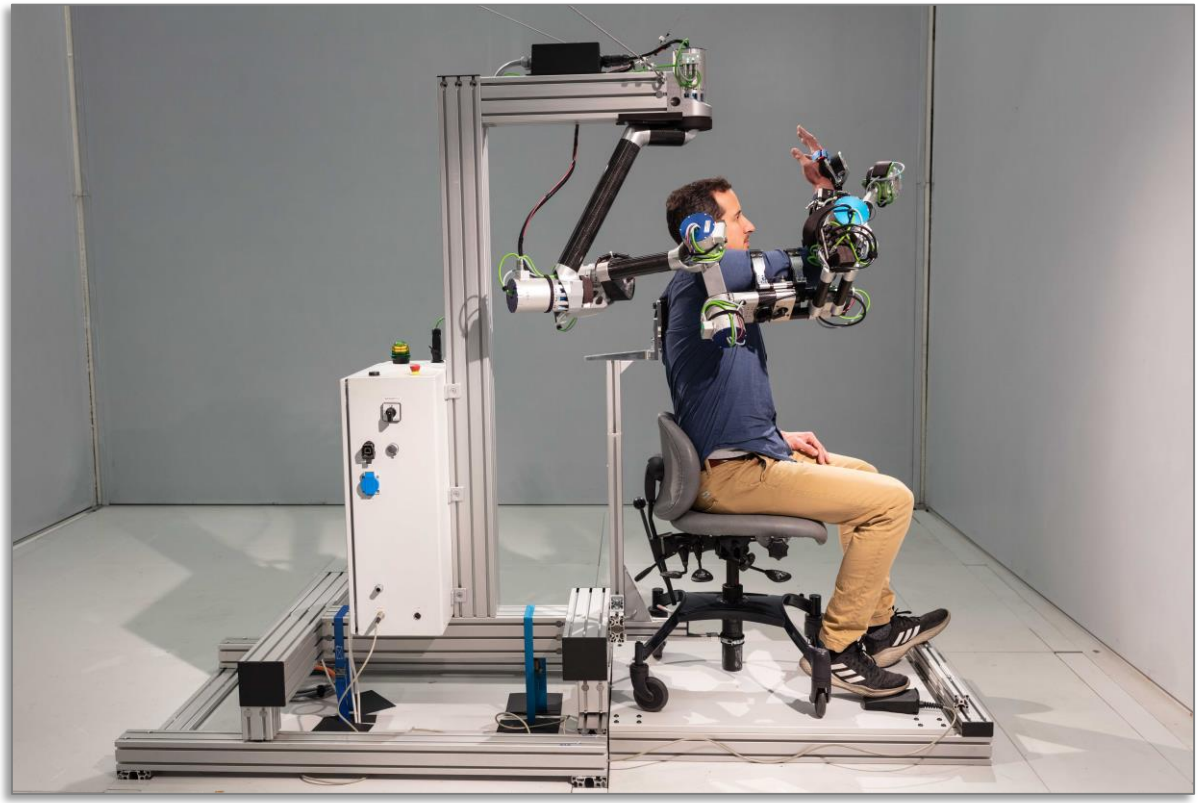


the future of drug delivery angie

Rehab now / in future

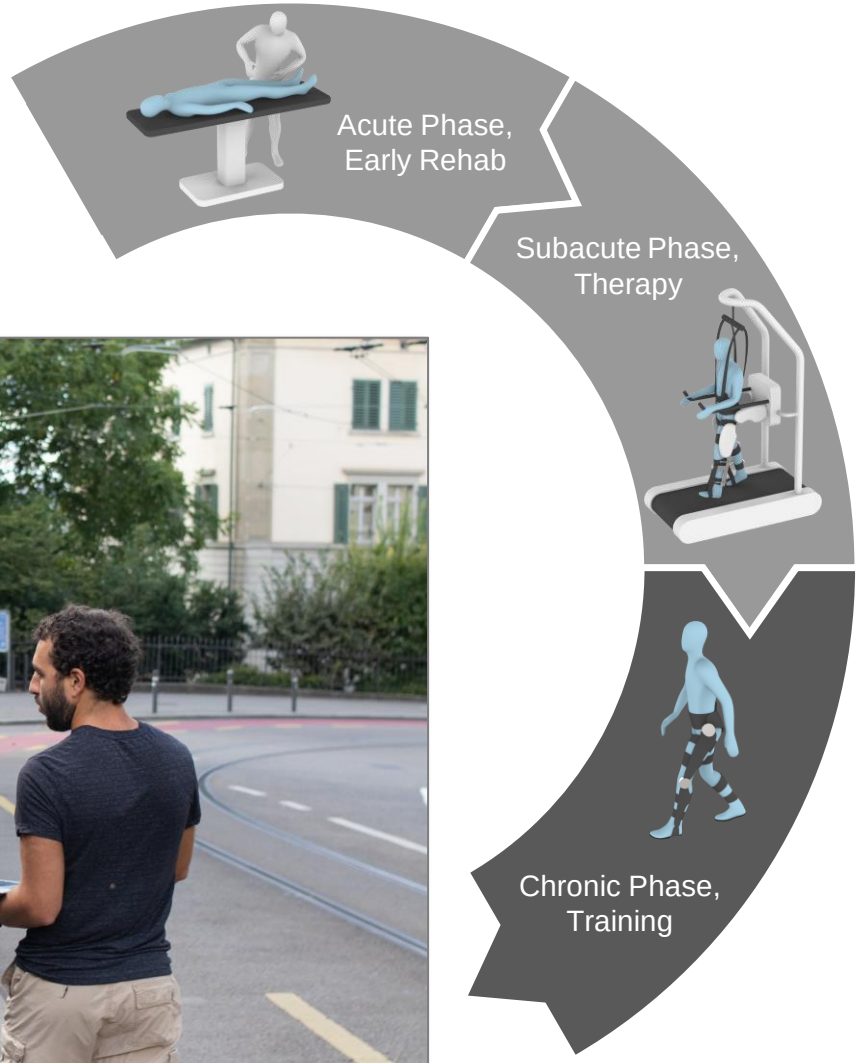
Sensory-Motor Systems Lab





Rehab now / in future

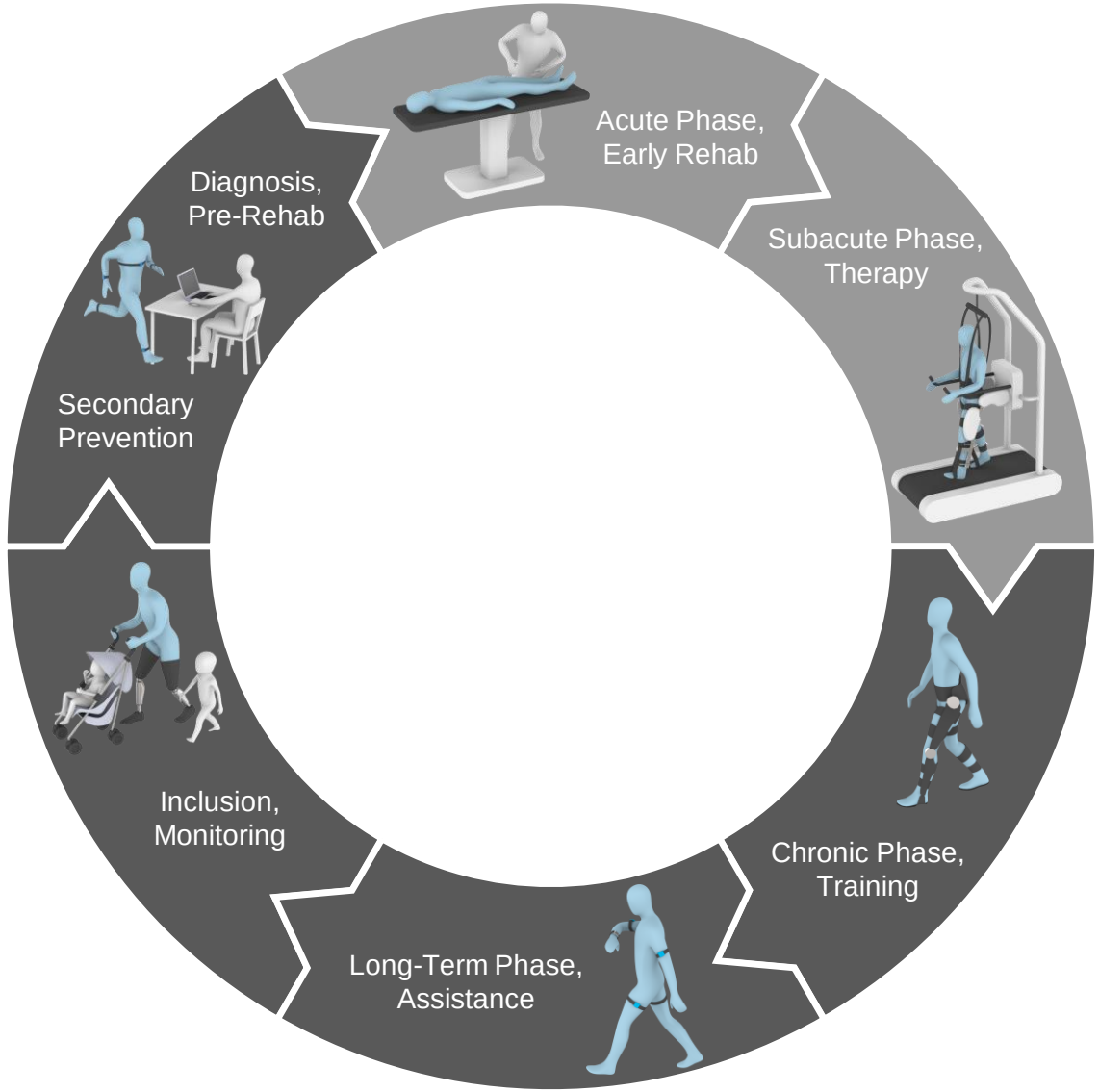
Sensory-Motor Systems Lab

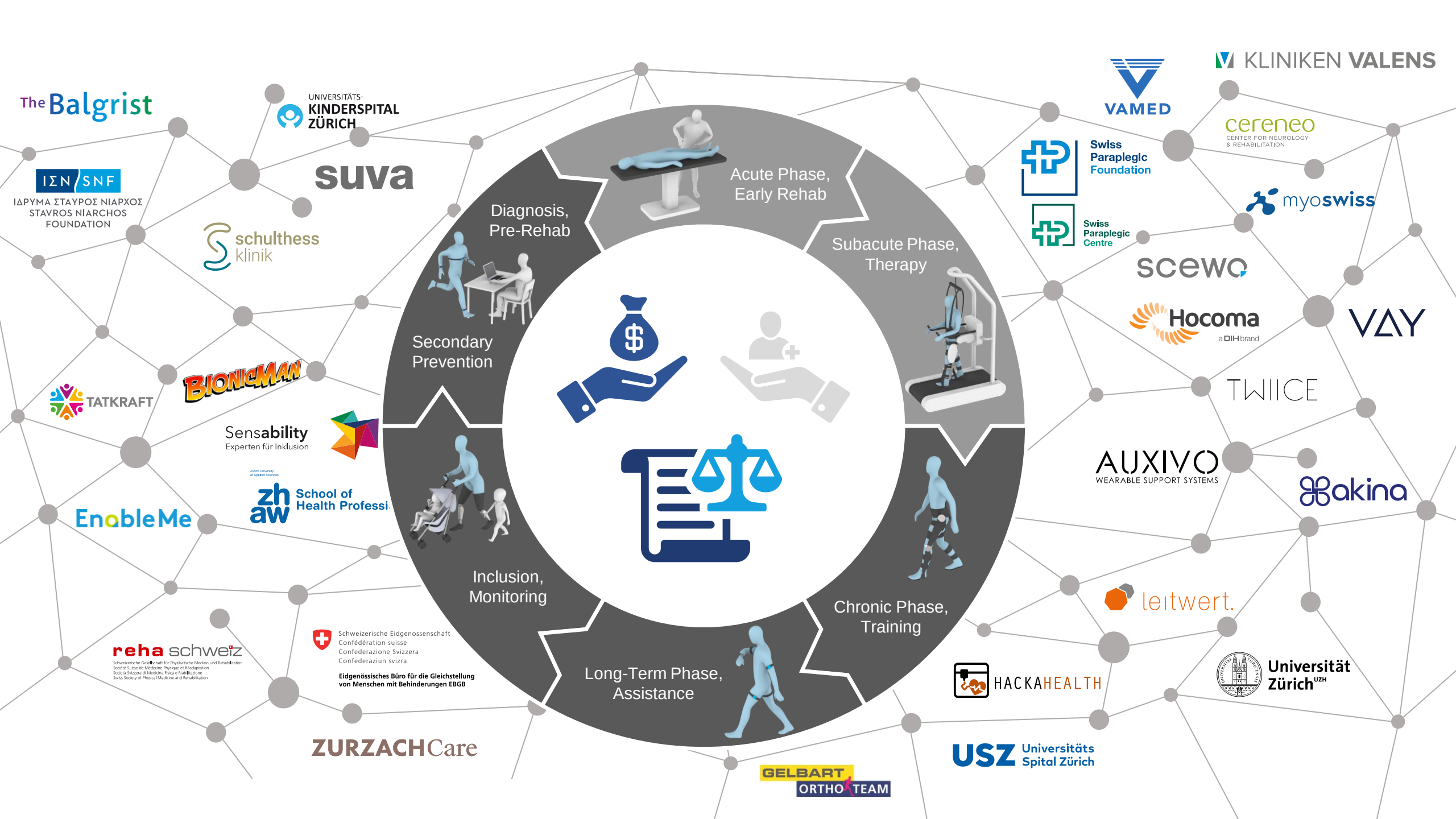


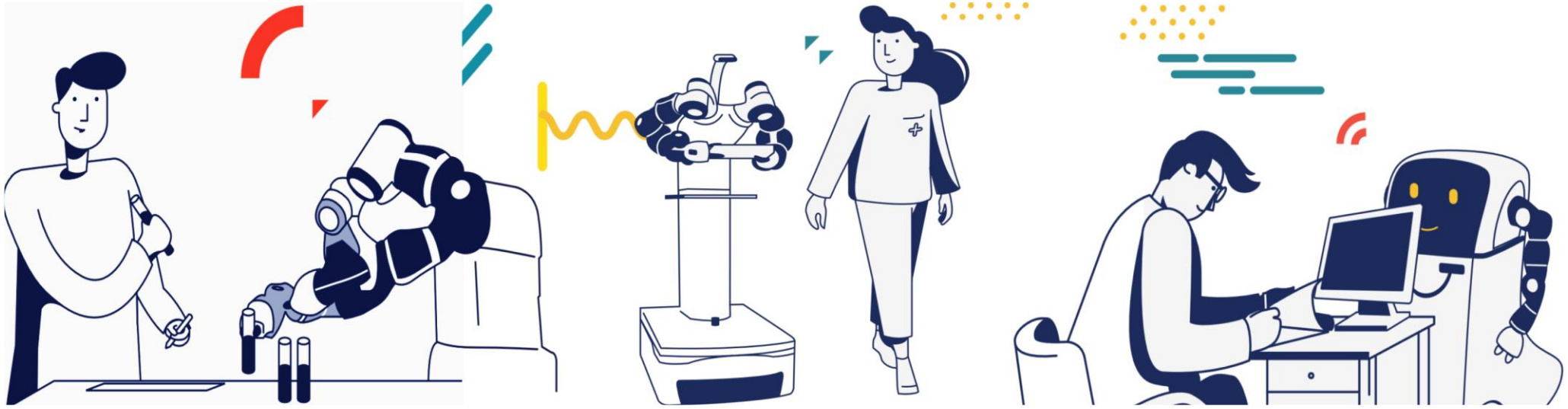
Continuum of care

Sensory-Motor Systems Lab

REHABILITATION ENGINEERING SCIENCE




Acute Phase, Early Rehab
Subacute Phase, Therapy
Chronic Phase, Training
Long-Term Phase, Assistance
Inclusion, Monitoring
Secondary Prevention
Diagnosis, Pre-Rehab
The Balgrist
UNIVERSITÄTS-KINDERSPITAL ZÜRICH
suva
ΙΣΝ/SNF ΙΔΡΥΜΑ ΣΤΑΥΡΟΣ ΝΙΑΡΧΟΣ STAVROS NIARCHOS FOUNDATION
schulthess klinik
TATKRAFT
BIONICMAN
Sensability Experten für Inklusion
zhaw School of Health Professi
EnableMe
reha schweiz
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Eidgenössisches Büro für die Gleichstellung von Menschen mit Behinderungen EBGB
ZURZACHCare
GELBART ORTHO TEAM
USZ Universitäts Spital Zürich
HACKAHEALTH
leitwert.
Universität Zürich UZH
AUXIVO WEARABLE SUPPORT SYSTEMS
akina
TWIICE
VAY
Hocoma a DIH brand
scewo
Swiss Paraplegic Foundation
Swiss Paraplegic Centre
myoswiss
cereneo CENTER FOR NEUROLOGY & REHABILITATION
VAMED
KLINIKEN VALENS



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Program

14:30 Welcome & Introduction
Roland Siegwart, Salvador Pane, Peter Wolf

14:45 Project Presentations:
- HARMONY, *Lionel Ott, ETH Zurich*
- HOSMARTAI, *Florian Heemeyer, ETH Zurich*
- DIH-HERO, *Andrea Schwier, DLR*
- A Submillimeter Minimally Invasive System for Cardiac Arrhythmia Ablations, *Cedric Fischer, ETH Zurich*
- ANGIE, *Fabian Landers, ETH Zurich*
- MINIGRAPH, *Sandra Wells ETH Zurich*

16:15 Networking Break:

16:45 Company presentations:
- Magnebotix, *David Sargent, CEO*
- NanoflexRobotics, *Christophe Chautems, CTO & Alice Segato, Eng.*
- F&P Robotics, *Lukas Wirth, CTO*

17:45 GuidedLab Tours:
- Multi-Scale Robotics Lab
- AutonomousSystems Lab
- Sensory-Motor Systems Lab

18:30 Networking & Apero Riche