

Neurotechnology at EPFL embedded in the lemanic neuro ecosystem



**Neurological disorders are the world's #1 cause of overall disease burden — ahead of cardiovascular disease**

3.4 billion people affected (43% of the global population) · 443 million DALYs lost in 2021 (GBD 2021 / Lancet Neurology 2024)

**Stroke****94M**

people living with stroke worldwide

- 11.9M new cases/yr · 1 in 4 lifetime risk · #3 cause of death & disability
- **Cost:** >US\$700B/yr → >US\$1T/yr by 2030

**Traumatic Brain Injury****69M**

new TBI cases every year worldwide

- Leading cause of death & disability in people under age 40
- **Cost:** >US\$40B/yr direct (US) · ~US\$760B lifetime/cohort

**Parkinson's Disease****12M**

people living with PD worldwide (2021)

- Fastest-growing neurological disorder → 25.2M projected by 2050
- **Cost:** US\$82B/yr (US, 2024) · 71% indirect/caregiving

**Alzheimer's & Other Dementias****57M**

people living with dementia worldwide

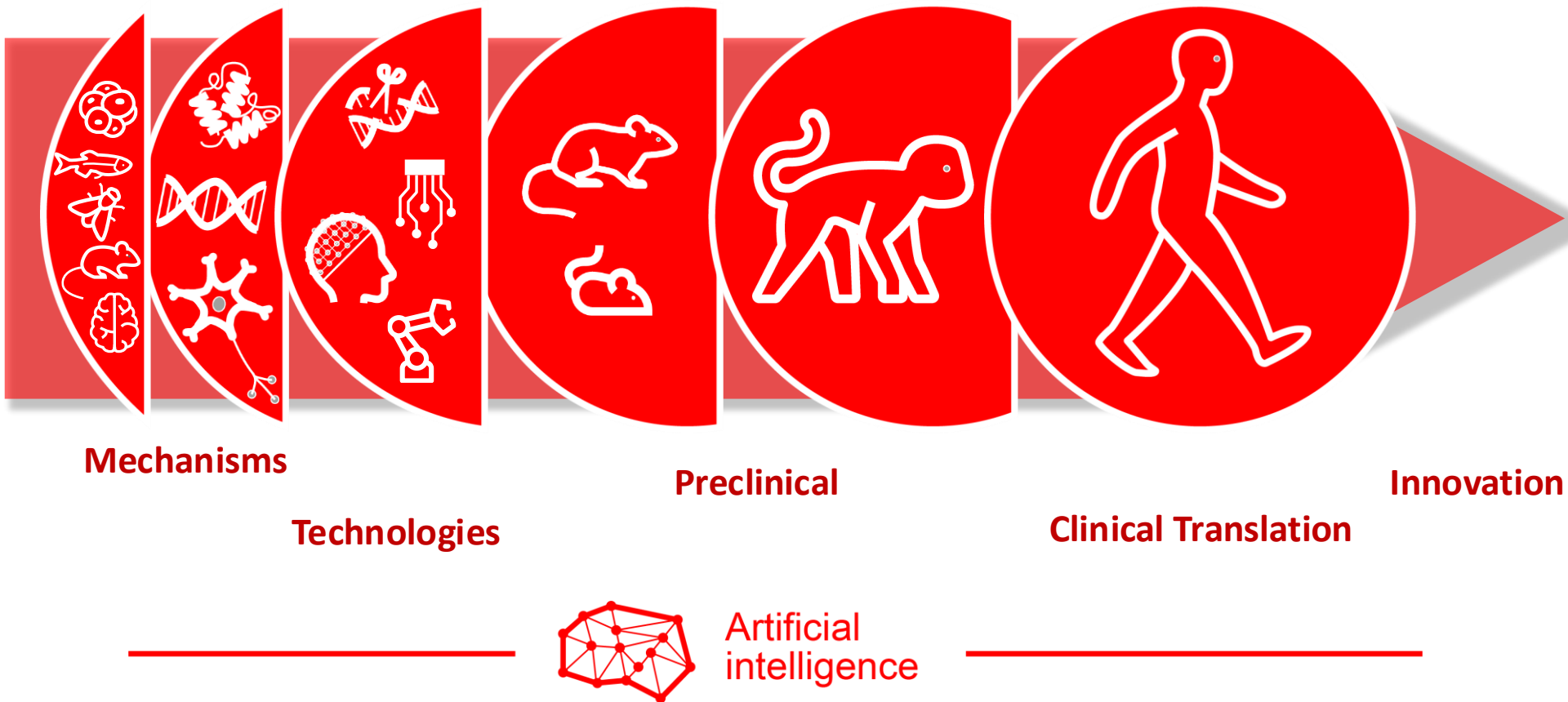
- ~10M new cases/yr → 78M by 2030 → 139M by 2050
- **Cost:** US\$1.3T/yr → >US\$2.8T/yr by 2030 (~50% informal care)

**Global burden: >US\$2 trillion/yr today**

Stroke + dementia alone — set to exceed US\$3.8 trillion/yr by 2030

**European & Swiss context**

All brain disorders: ~€800B/yr in Europe (EBC) · Dementia alone: ~CHF 11.8B/yr, ~128,000 people in Switzerland (Alzheimer Schweiz, 2020)



Neuro X Institute

Neural Interfaces

Reading & writing the CNS: soft bioelectronic implants, closed-loop brain-computer interfaces



Neuroimaging & Brain Networks

fMRI network modeling, connectomics, imaging biomarkers for diagnosis



Neuroprosthetics & Motor Restoration

Spinal stimulation, rehab robotics, sensory-feedback hand prostheses



Embodiment & Consciousness

VR/robotic body-perception research; cognitive neuroprosthetics for pain & psychiatric disorders



Personalized Recovery

Individualized neuromodulation for stroke, TBI & neurodegenerative disorders



Fundamental & Molecular Neuroscience

Circuits, memory formation, brain organoids, perception — molecules to behavior



Computational & AI Neuroscience

Markerless motion tracking, brain-inspired computing & AI models



Gene Therapy & Molecular Tools

Viral vector platform enabling gene-therapy research across neuroscience

Neuro-Lemanic Ecosystem

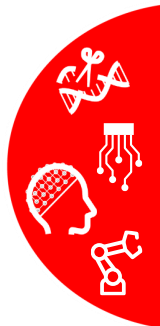
Convergence of neuroscience,
neuroengineering, neuroAI, and innovation



Mechanisms



Technologies



Human Translation



UNIVERSITÉ
DE GENÈVE



WYSS CENTER

Lausanne

Unil.

Fribourg

UNI
FR



Preclinical

Sion

Hes·SO VALAIS
WALLIS

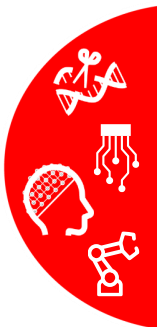


Clinical Neuro-Lemanic Ecosystem

Convergence of neuroscience, neuroengineering, neuroAI, medicine and innovation



Mechanisms



Technologies



Clinical Translation



Preclinical



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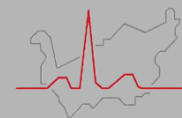


Lausanne

Geneva

UNI
FR

Fribourg



Hôpital du Valais
Spital Wallis

Sion



Hes-so



Neural Interfaces



Neuroprosthetics & Motor
Restoration



Personalized Recovery



Fundamental & Molecular
Neuroscience



Computational & AI
Neuroscience

Orchestrated Neuromodulation

Neuroprosthetics/ Bionic limbs

Cell reprogramming

Characterization of patients
using neurotechnology/AI

Geneva



Lausanne

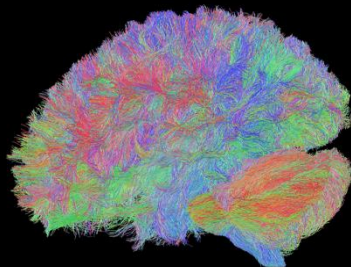


Fribourg



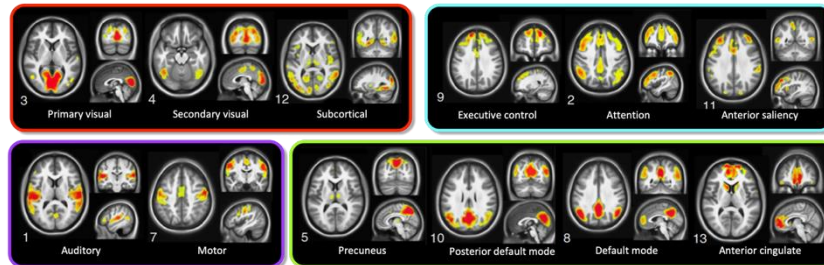
Sion





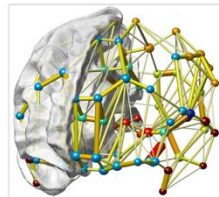
Spatiotemporal dynamics in health and disorder

■ Functional network dynamics captured by transient activity

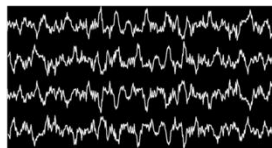


- phenotyping
- fingerprinting
- imaging-based biomarkers

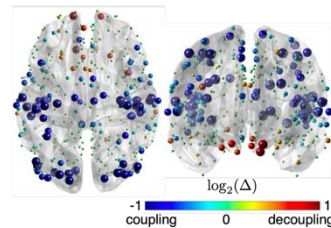
■ Connectomics

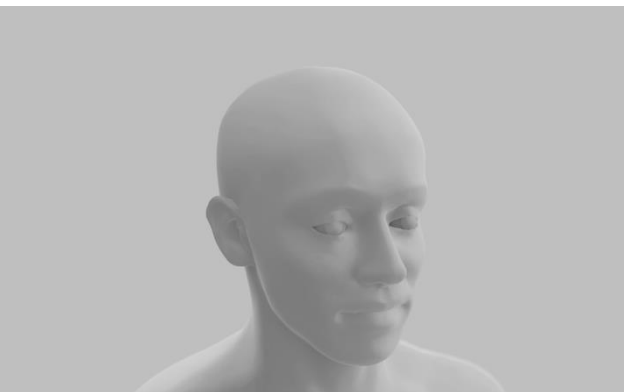
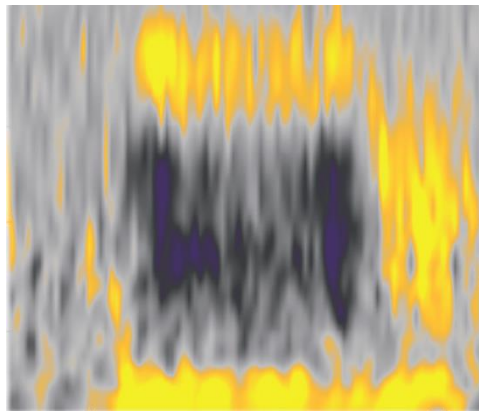


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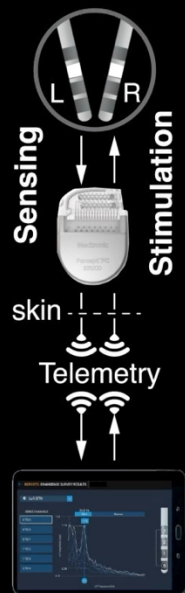


structure-
function
coupling

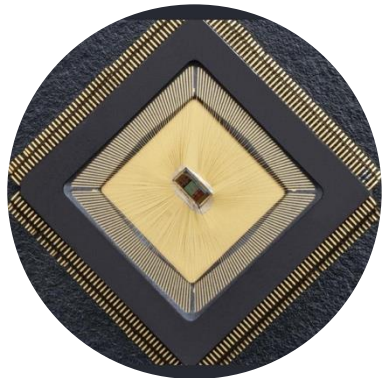




activity-dependent adaptive DBS therapies

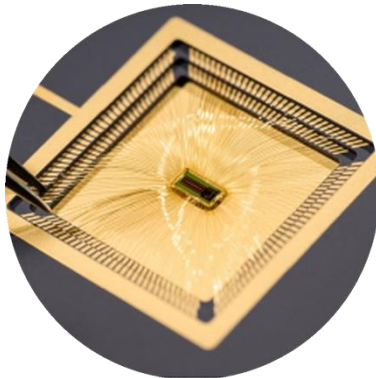


Chips that decode speech and movement on the implant



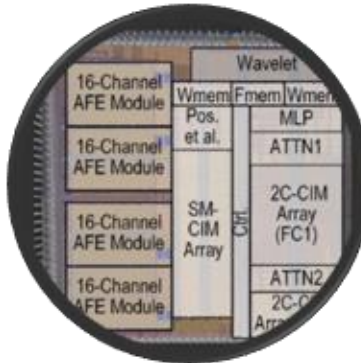
NeuralTree

Closed-Loop AI-Enabled
Stimulation for Epilepsy & PD



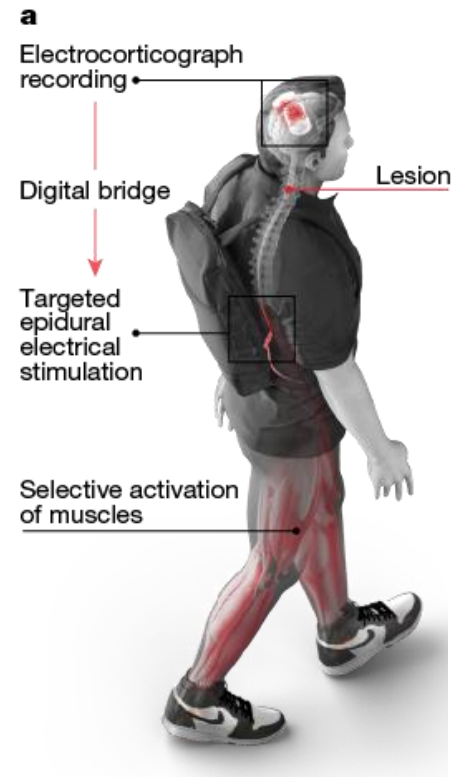
MiBMI

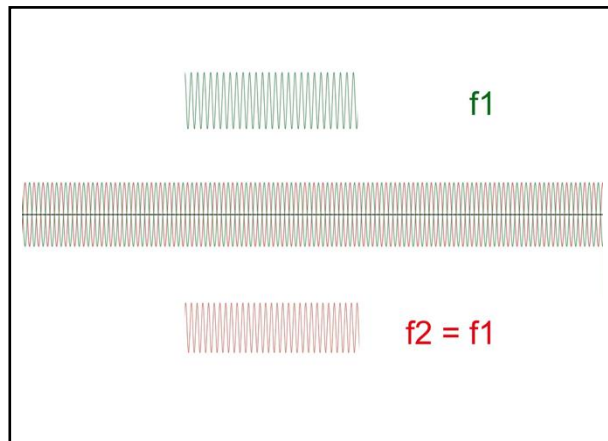
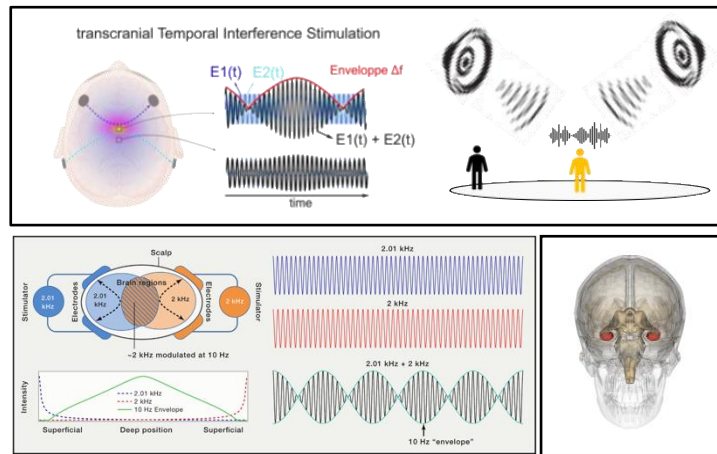
Brain-to-Text Decoding for
Speech Restoration



Digital Bridge

Brain-Spine Decoder for
Movement Recovery

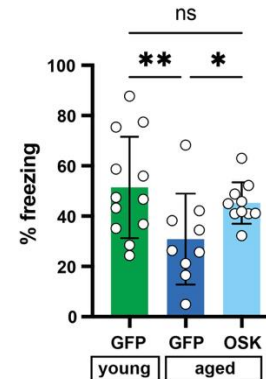
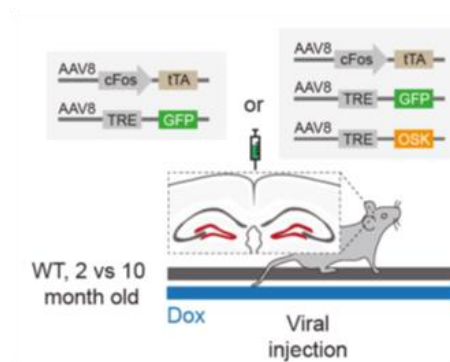
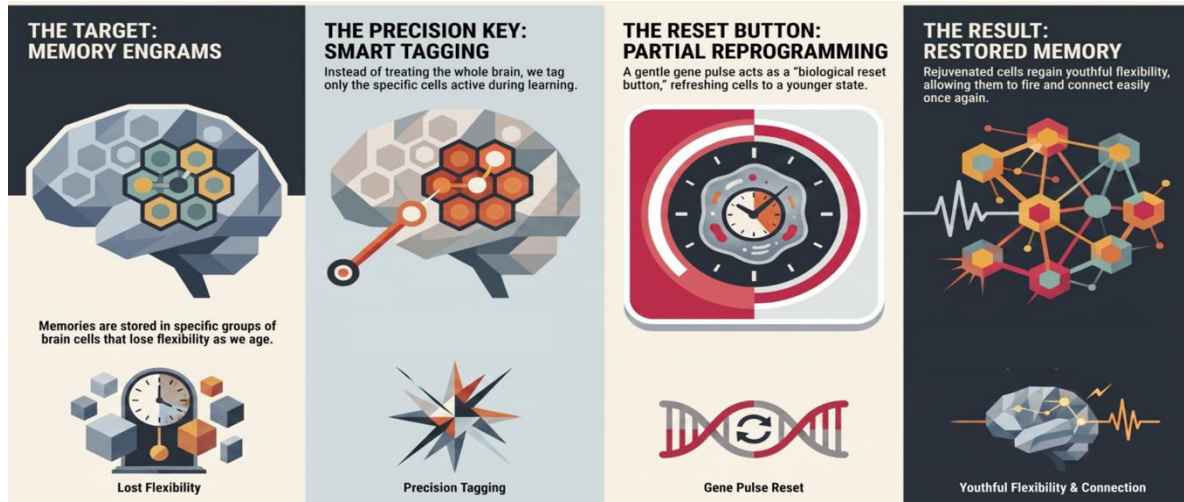




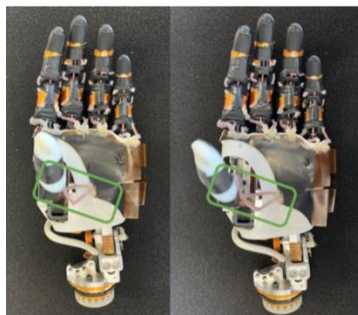
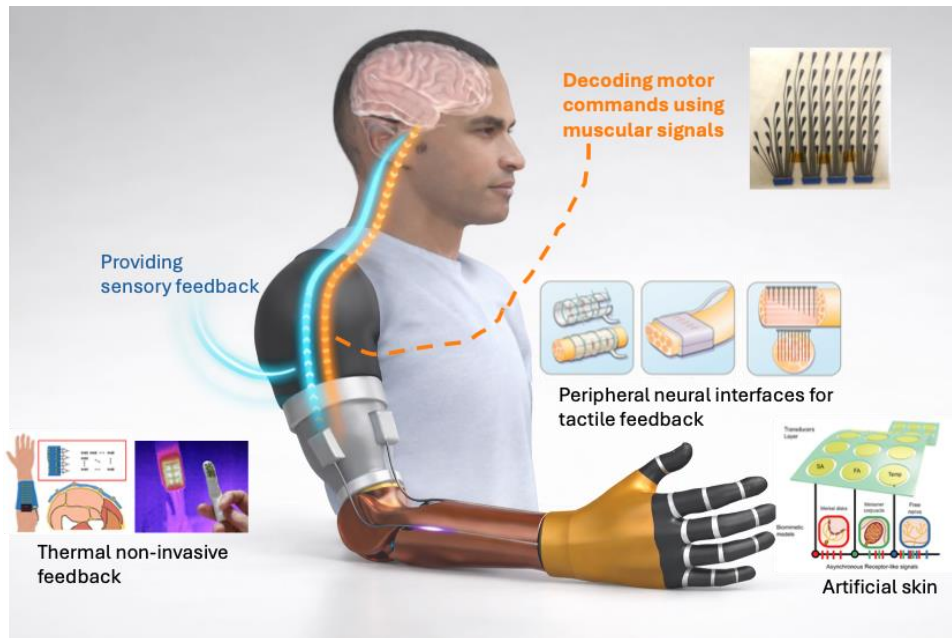
Novel interventional options to address

- Dementia
- Recovery after brain damage
- Movement disorders
- Apathy
- Anxiety

Vassiliadis *et al.*, Nature BME, 2026
 Nench *et al.*, JAMA Netw Open, 2026
 Rektorova *et al.*, Nature Rev Neurol, 2025
 Wessel *et al.*, Nature Neurosci, 2023



Berdugo-Vega *et al.*, Neuron, 2026
Delamare *et al.*, Brain, 2026



Enhancing functional abilities and cognitive integration of the lower limb prosthesis

Movie S2:

Neuroprosthesis working principle and active tasks

Caution: Investigational device

Iberite *et al.*, Science, 2023
Shokur *et al.*, The Lancet Neurology, 2026
Micera *et al.*, Nature, in press

Clinical assessments

Clinical survey → Clinical score → Functional Assessment

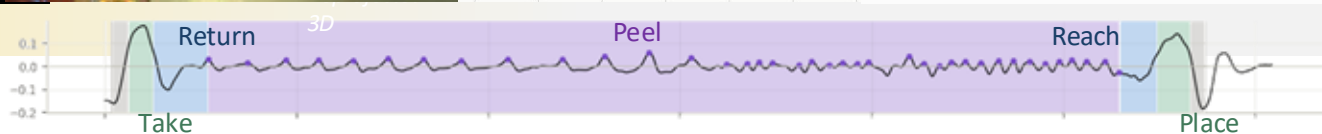
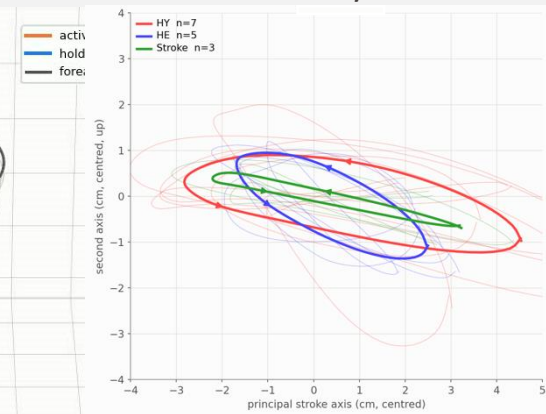
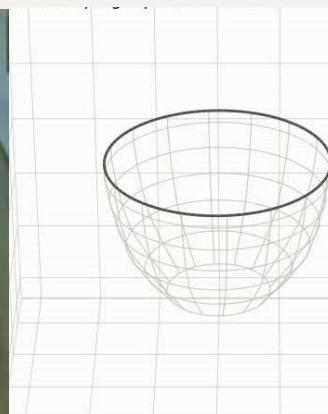
Movement quality
Compensation / Restitution
Bimanual interactions ...

Ecological Assessment

Multiview calibrated and
synchronized recording platform

Deep Learning based 3D pose estimation
and Object reconstruction

Kinematic and
behavior analysis



EXPERTISE IN
NEUROSCIENCE



EXPERTISE IN
NEUROENGINEERING



EXPERTISE IN
AI



SCIENCE
DIPLOMACY



CONVERGENCE

COMPUTING
INFRASTRUCTURE



INNOVATION



INTENTIONAL
PHILANTHROPY



CLINICAL
HUBS

