Main Collaborations:

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Elite SA, Aubonne
Gesundheistzentrum Bad Wimpfen
Hocoma AG, Volketswil
Institut universitaire romand de Santé au Travail, Epalinges
Klinik Lengg, Zurich
Politecnico di Torino
Rehaklinik Zihlschlacht AG
Stoll Giroflex AG, Koblenz
Swiss Federal Laboratories for Materials Science and Technology (EMPA)
Swiss Textile College (STF), Zurich
Universitätsklinikum Tübingen
University of Michigan, Wisconsin
University Children's Hospital Zurich
University Hospital Zurich
ZHAW School of Health Professionals, Zurich

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Swiss National Accident Insurance Fund (SUVA)
Swiss National Science Foundation (SNSF)

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ETH zürich

Sensory-Motor Systems Lab

Moving people and technology

Director: Prof. Dr. Robert Riener

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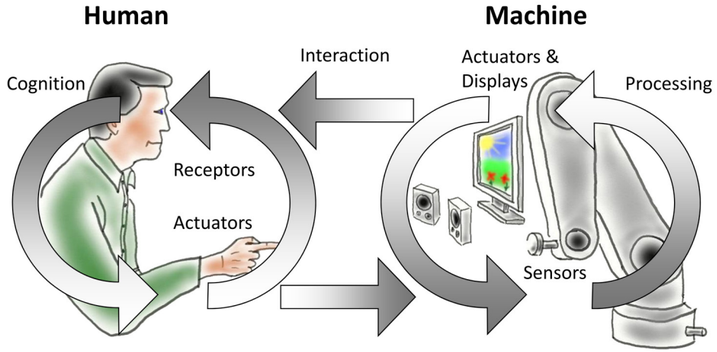
The Sensory Motor Systems Lab

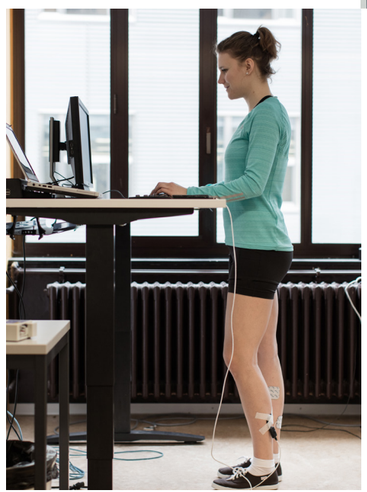
The Sensory-Motor Systems Lab is part of the Institute of Robotics and Intelligent Systems (IRIS) at the Department of Health Sciences and Technology (D-HEST), ETH Zurich, and part of the Spinal Cord Injury Centre at Balgrist University Hospital. The main research of the laboratory focuses on the investigation of sensory-motor interactions between humans and machines. The laboratory develops multi-modal and user-cooperative techniques to investigate the principles of human motor learning



and movement restoration and uses them for the rehabilitation of patients with movement disorders. This multi-disciplinary research includes the design of novel robotic systems for rehabilitation and sports, the investigation of movement learning strategies and evaluation of the developed technologies and strategies in clinical and sports environments.

Cybathlon

The Cybathlon is the world's only competition where cutting edge robotic assistive technologies help people with disabilities to compete in a series of races: BCI race, functional electrical stimulation (FES) bike race, powered arm prosthesis race, powered leg prosthesis race, powered exoskeleton race, powered wheelchair race. Cybathlon is organised by the SMS Lab and ETH Zurich.



Muscle Fatigue

Musculoskeletal pain is prevalent and often work-related. Musculoskeletal disorders may be linked not only to heavy work but also to one-sided loads such as prolonged standing or sitting, constrained postures and repetitive movements. To ascertain healthy and productive work, adequate rest schedules and optimal work organisation must be developed and muscle fatigue should be prevented.

Robots in Sport

Concurrent feedback strategies facilitate learning of complex motor tasks such as rowing. The impact of these strategies depends on the subjects' skill and the specific characteristics of the task, such as its difficulty. This project designs multimodal feedback strategies addressing different phases of learning and develops concepts to switch automatically to the most effective and appropriate feedback modality for the individual subject.

Somnomat

The objective of the Somnomat is to develop an autonomous bed, able to monitor the state of the user and, if required, interact with them in order to promote sleep and improve sleep quality. Presently, vestibular stimulation and changes in mattress shape are studied with respect to their influence on sleep and how these interventions can be automatically applied and controlled in a closed-loop way based on the user's needs.

Arm Rehabotics

The therapy robot ARMin was developed for intensive arm neurorehabilitation. It allows development of novel strategies for motor learning and therapy, which can be integrated into clinical practice. Novel patient-cooperative control and multi-modal feedback strategies assist the patient as needed and increase motivation. The strategies are embedded into games and activities of daily life through virtual reality settings.

Exoskeletons

Lower limb robotic exoskeleton research focuses on development and evaluation of devices for gait rehabilitation and mobility assistance. This project investigates physical human-exoskeleton interaction to create novel designs of versatile, rigid exoskeletons and soft exosuits. By addressing existing limitations, the project aims at improving performance and acceptance in gait therapies and daily life.