



# New Friends

The 1st international conference on social robots in therapy and education

# 2015

October 22-23  
Almere  
The Netherlands

Bridging the Gaps between Different Worlds

*A Legal and Ethical Approach towards Assistive Robots: Risks and Solutions*

## Which Perspectives of Using Exoskeletons in Activities for Daily Living?



ÉCOLE POLYTECHNIQUE  
FÉDÉRALE DE LAUSANNE

**Dr Eng. Mohamed Bouri**

Ecole Polytechnique Fédérale de Lausanne

Laboratoire De Systèmes Robotiques



Rehabilitate a limb is **train it** in order to **recover** the **mobility**



Rehabilitation as clinically practiced

- ➔ Mobilisation
- ➔ Evaluation
- ➔ Interaction

# Walk Rehabilitation devices

## The Lokomat from HOKOMA, ZH, CH

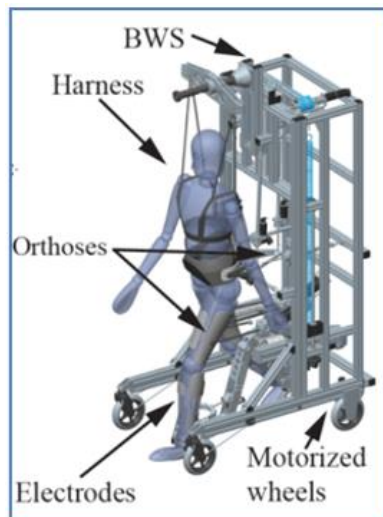


First  
Verticalized  
Rehabilitation  
device that has  
been sold

## The Kineassist from KineaDesign, IL, USA



Overground Walking.  
BodyWeight support  
And pelvis orthosis.



The WalkTrainer,  
developed at EPFL  
and commercialized  
by Swortec SA, CH

## From therapeutical devices to exoskeletons

Exoskeletons are **motorized and instrumented** devices. Their mechanical shape **reproduces the anthropomorphic and skeleton of the human** with which they are rigidly interfaced through dedicated components **to transmit** a closed loop controlled **movement**.



## Motivations:

- Walk as others
- Re-feel the vertical posture
- Parity with others
- Therapeutical motivations

A personal service robot or a **service robot for personal use** is a service robot used for a non-commercial task, usually by lay persons.

Examples: Domestic servant robot, automated wheelchair, personal mobility assist robot, and pet exercising robot.  
IFR, 2012





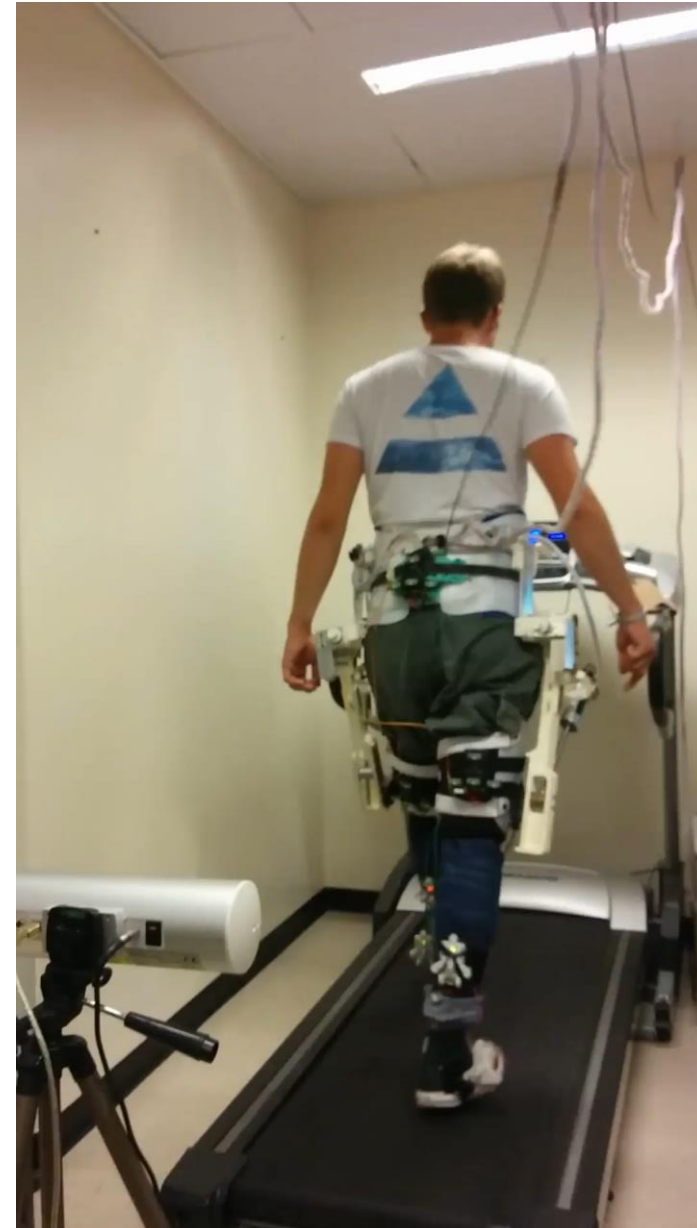
The most know exoskeletons available in the market.

All these devices are available for **Rehabilitation purposes**.

The home use of these devices also means ease of wearability, autonomy and management of any ambiguous situation.

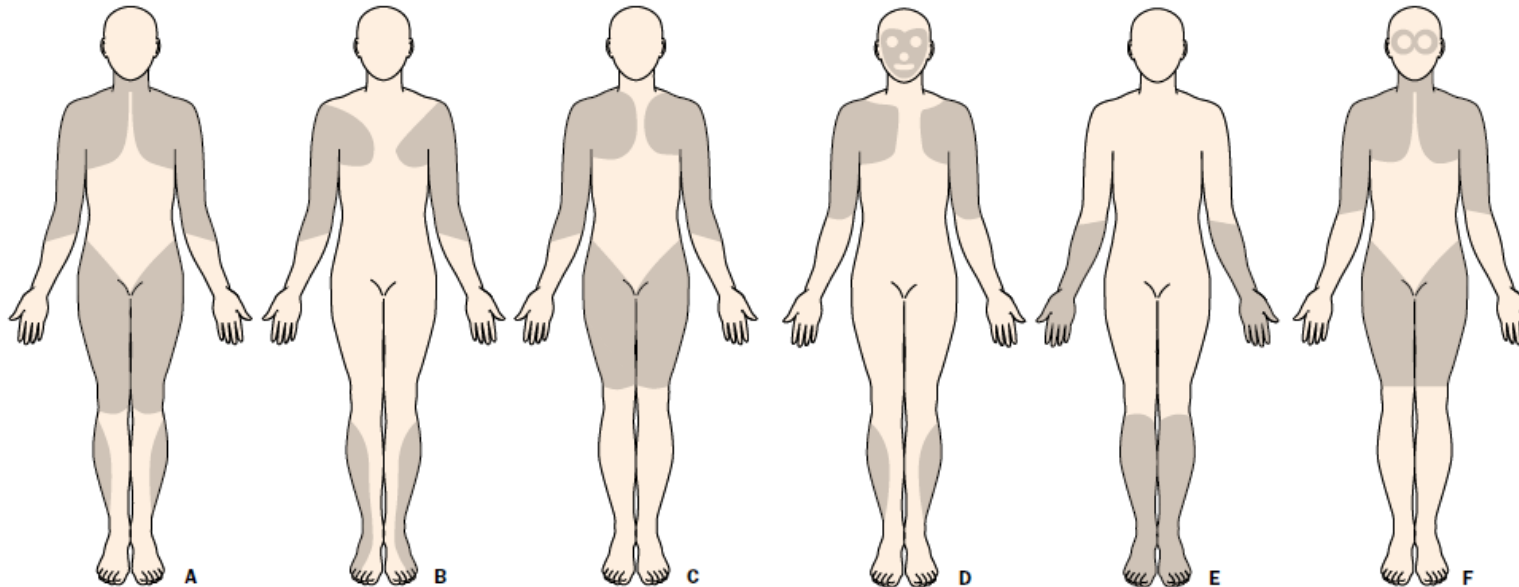
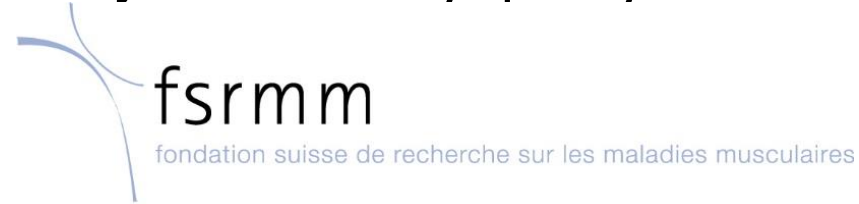
# HiBSO – Orthosis for elderly

The technology is mature but what about Wearability?



# Autonomyo : A new project @EPFL

## An exoskeleton for subjects with Myopathy



**Figure** Predominant affected area (shaded) regarding different types of dystrophy:  
 A) Duchenne-type and Becker-type, B) Emery-Dreifuss, C) limb-girdle, D) facioscapulohumeral, E) distal and F) oculopharyngeal. Reproduced from A. E. H. Emery, "The muscular dystrophies," *BMJ*, vol. 317, no. 7164, pp. 991–995, Oct. 1998 [7].



# Test Ekso with myopathes

P1 – Myopaty mitochondriale, Woman, 68 yo

50 m



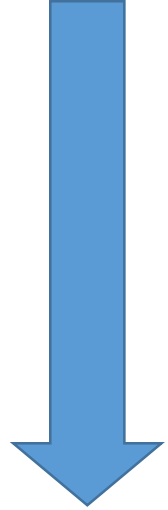
~ 50 m



**VILLA BERETTA - Centro di Riabilitazione**

Foundation Valduce @Lecco, Italy

## Certification procedures



Main issue for the regulatory procedures :

Manage the administrative risks (ISO 13485, ISO 9001, CE, FDA,...)

Main issue for the product:

Avoid any injury to the wearer.

# *Is the availability of exoskeletons for home use for tomorrow?*

More constraints on the certification and legal issues.

What happens if the device faces a critical failure and it stops moving and assisting the wearer?

A presence of another person is necessary and no technological answer is available to this issue.

The Rewalk is the first device with an FDA approval for home use, it still needs a presence of a companion (husband, wife,...) who helps managing some configuration aspect

Social acceptance of these devices.

Social acceptance is related to cultural origins. Japan could be considered the most accepting country when it comes to invasion of technology in daily lives. Besides, people are trusting robots for surgery operations in more than a case because of their precision, efficiency and reducing undesirable effects.

Pricing (Cost of the device, insurance reimbursement, .....