



Aalborg Universitet

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DENMARK

**Invited series of talks and lectures at Yale University (USA) on Rolf Nordahl's research**

*Presentation of Rolf Nordahls research on Presence and the "Natural Interactive Walking" project (FET OPEN, FP7)*

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**Rolf Nordahl, AAU Copenhagen, presenting  
at Yale University, March 25<sup>th</sup> and 26<sup>th</sup>,  
2010**

## **Natural Interactive Walking - NIW -**

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Dipartimento di Informatica – University of Verona (Coordinator)

Centre for Intelligent Machines - McGill University

Institute of Media technology and Engineering Studies - Aalborg University

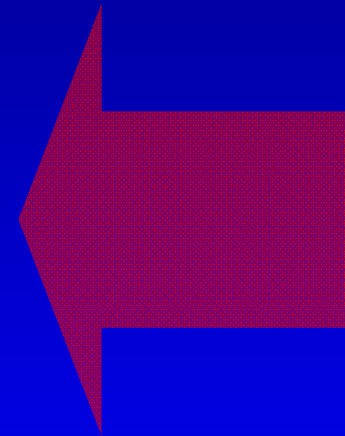
French National Institute for Research in Computer Science and Control

Université P. & M. Curie - Institut des Systèmes Intelligents et de Robotique

# In these 10 minutes...

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- Field of research
- Objectives
- Methodology & Expertise
- Palette of experiments
- Perspectives



# Field of research

NIW is about

- **Rendering** virtual ecological floor attributes:  
>>material >>texture >>elasticity
- **Understanding** user inputs:  
<<foot gesture
- **Integrating** such methodologies into closed-loop walking interfaces

NIW is **not** about the

- Study of locomotion
- Engineering of treadmills

Hence, NIW **complements** know-how on locomotion interfaces

# Objectives

## 1. Design of multimodal floor interactions

- Haptic & auditory synthesis methods
- Cross-modal illusions and **pseudo-haptic effects**
- Haptic devices
  - >> actuated floors >> active shoes
- Floor sensing methods complementary to positional and force detection
  - << gesture detection via TAI

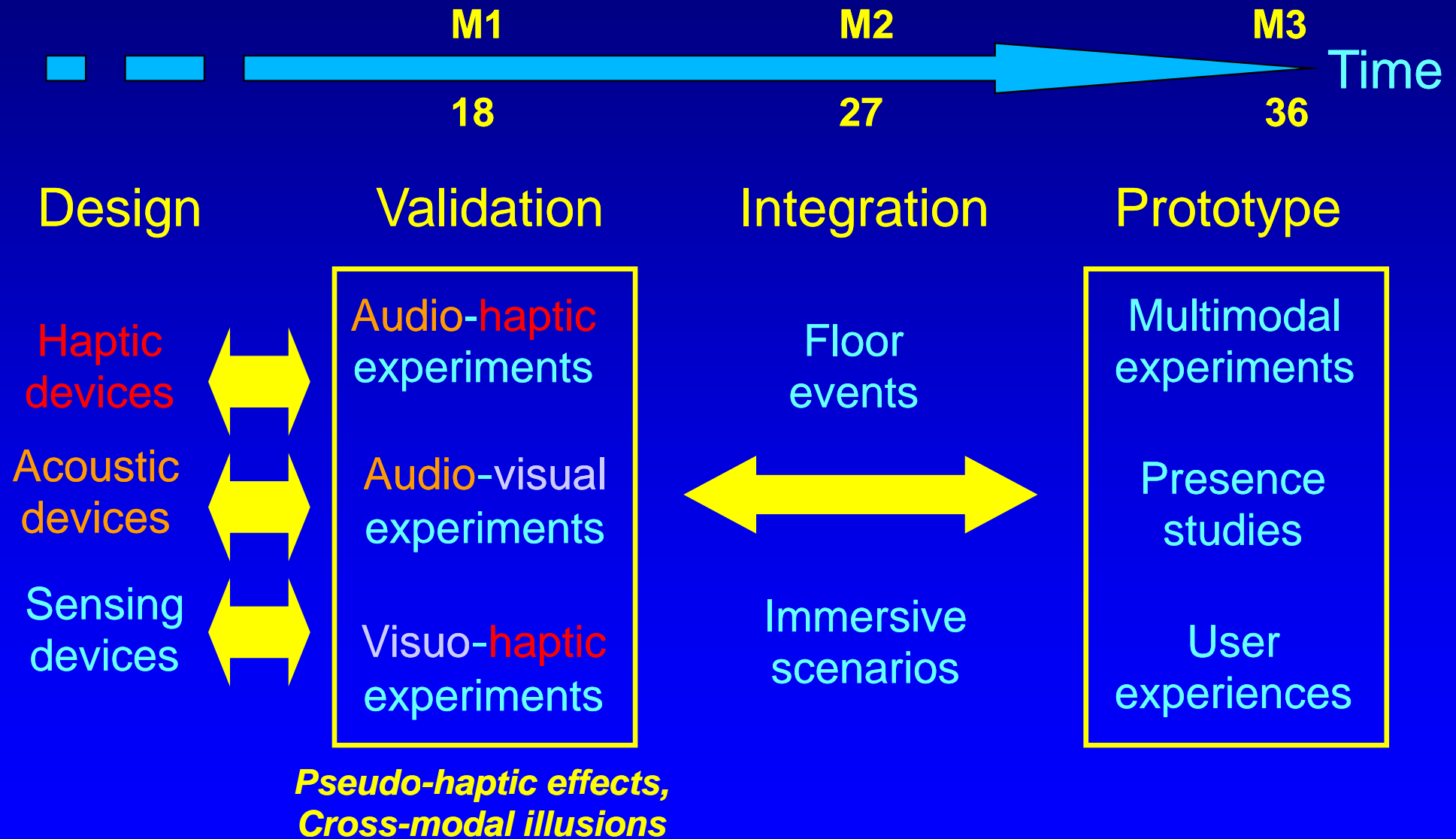
## 2. Evaluation of floor feedback

- in mono-modal experiments (haptics or audio)
- in multi-modal experiments (audio-haptic, visuo-haptic, ...)

## 3. Integration of validated floor interaction designs into an immersive VE

- Walking across grounds of different natures and in presence of floor events
- User experiences, presence studies

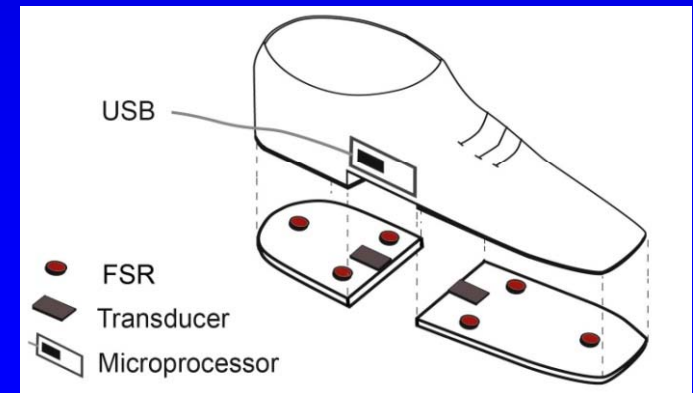
# Timeline



# Methodology – WP2: devices

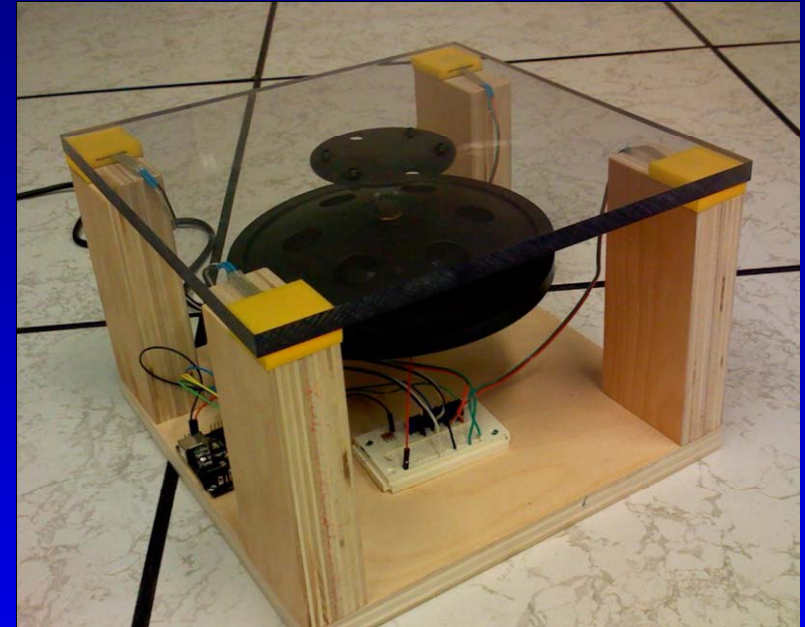


Active shoes –  
UPMC >

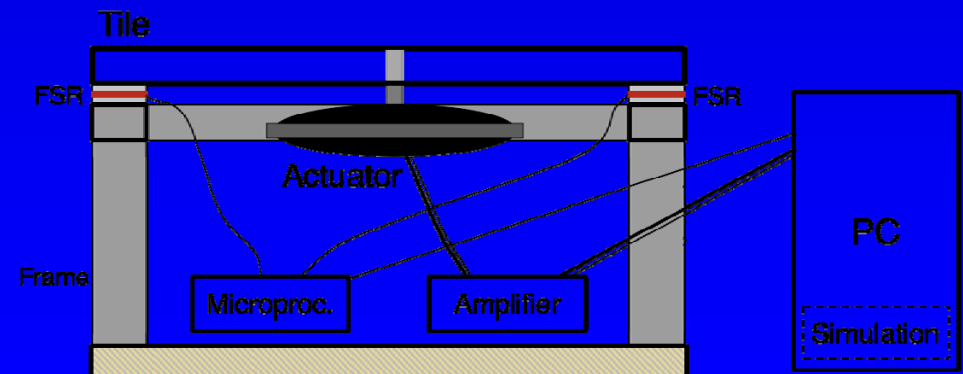




# Methodology – WP2: devices

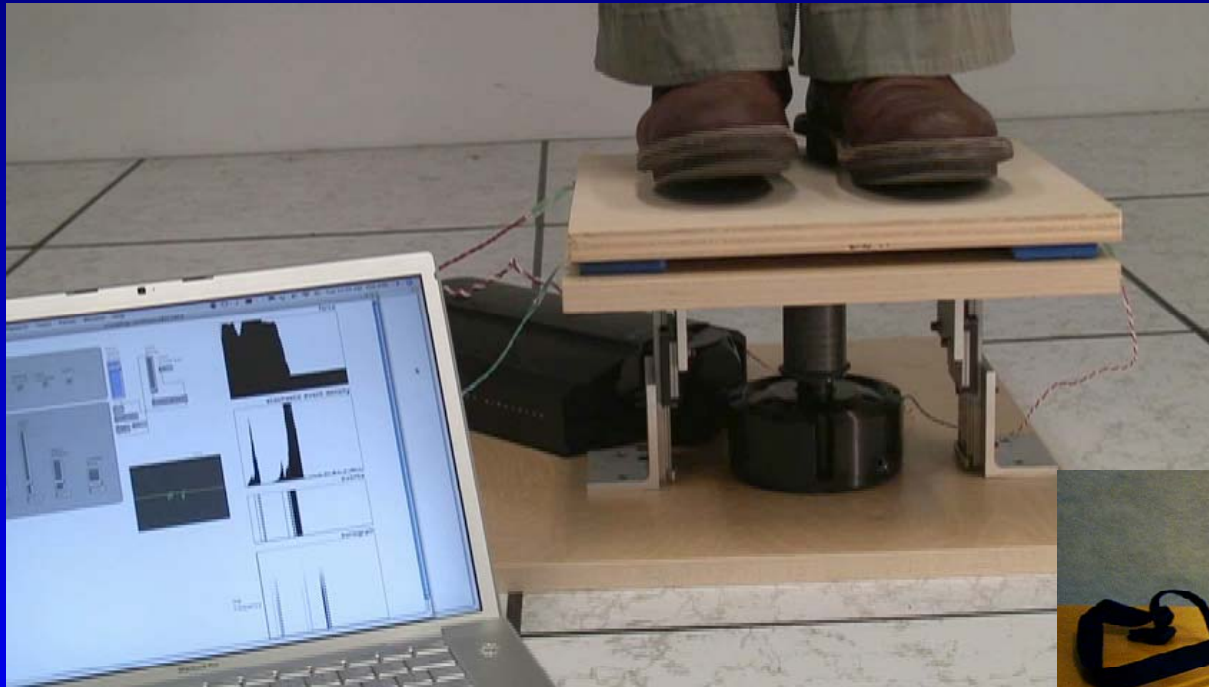


Actuated floors –  
McGill University





# WP3: sensing and analysis

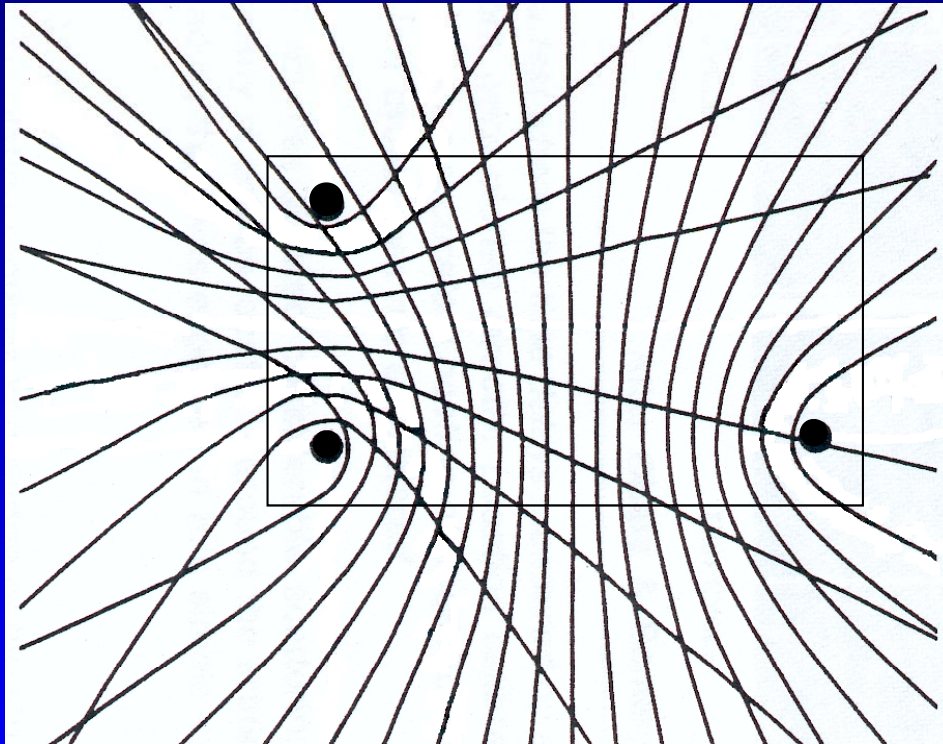


Force sensing tiles –  
McGill

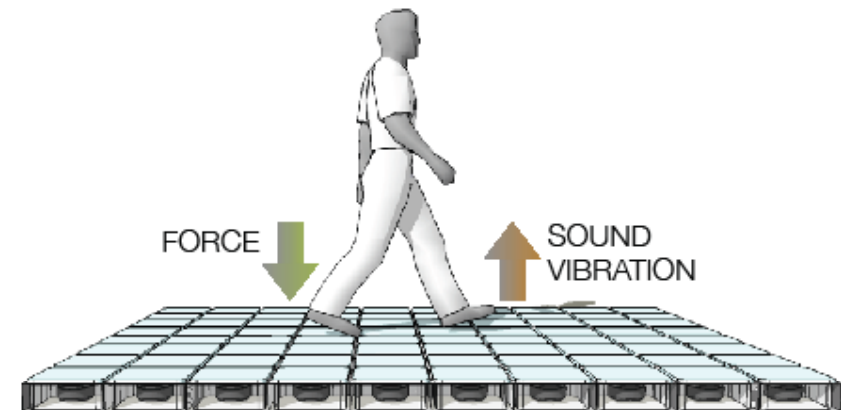


Force sensing shoes –  
AAU >

# WP3: sensing and analysis

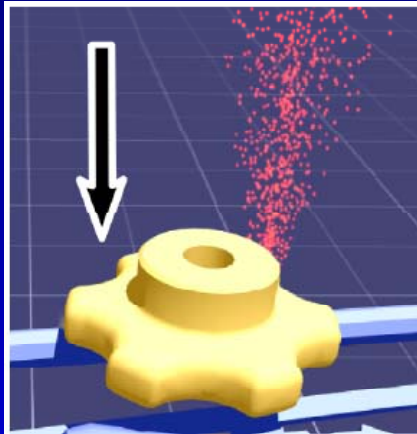


TAI-based gesture sensing -  
UNIVR

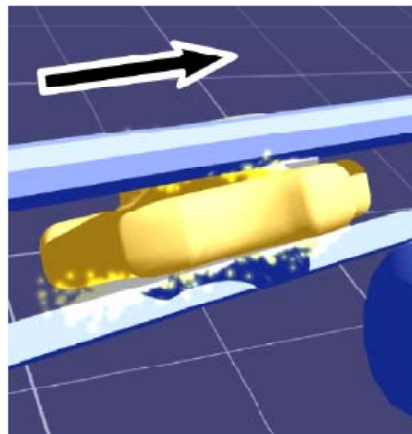


Integration and analysis -  
McGill >

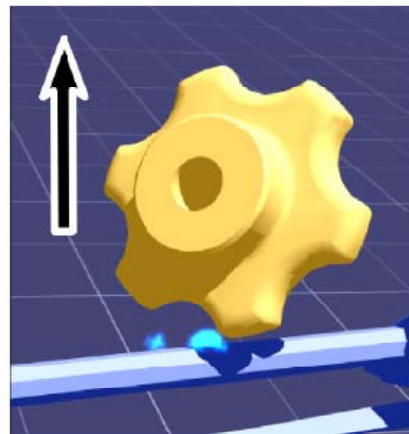
# WP4: feedback modelling



Impact



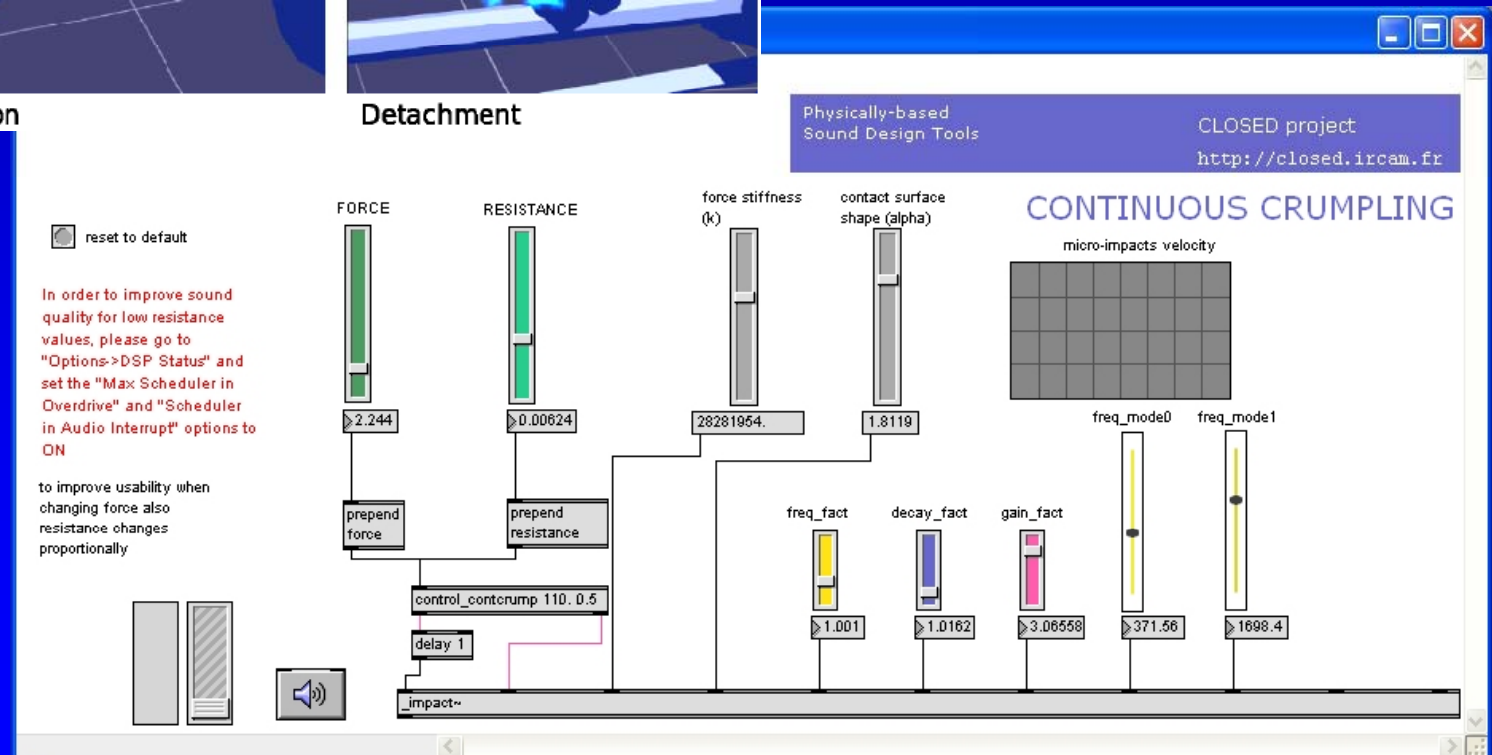
Friction



Detachment

Event-based  
Multimodal feedback -  
< INRIA

Physically-based  
sound synthesis -  
UNIVR >>>>>>



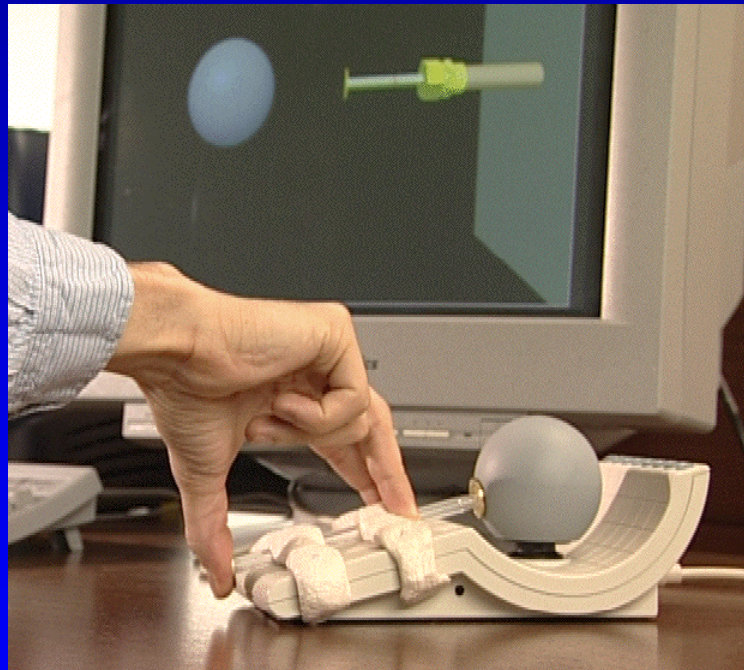


# WP5: experiments & evaluation



Identification of walking grounds -  
(Giordano, Visell, Hayward, ...)

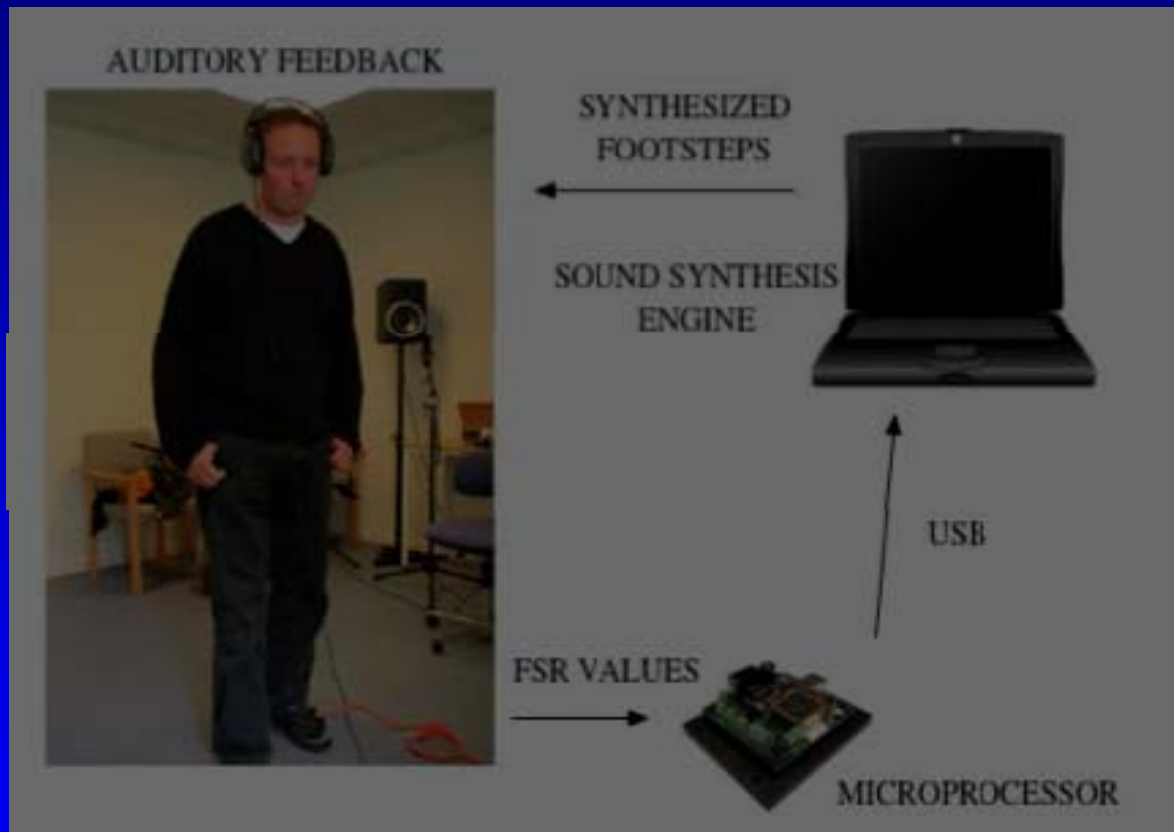
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INRIA  
Cross-modality and pseudo-haptics



# WP6: integration



Force-sensing shoes driving  
an audio-visual headset –  
AAU >





# Palette of grounds

Preliminary experiments (... **Visell**, **Hayward**, ...)  
Further characteristics (holes, inclination, viscosity...)



# Perspectives

NIW in the **short** term will nurture

- Birth of **new technologies** for haptic and multimodal floor interaction
- Innovative experiments assessing **ecological navigation paradigms**

In the **mid** term

- **Floor-based communication** in functional spaces (airports, ...)
- Assisted navigation in public (urban) spaces, for **diverse user categories**
- Aid to **sensory depriving environments** (astronautical, undersea labor)

In the **long** term

- Exploiting/repairing the **strong sensitivity of human feet**
- Contributing to synergize **AI** with “artificial perception” in machines