Neural Correlates of Anticipatory Behavior

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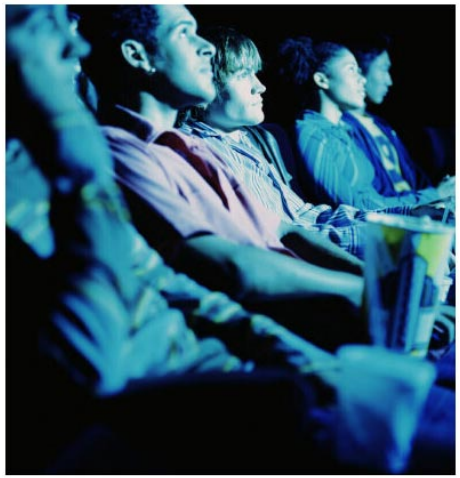
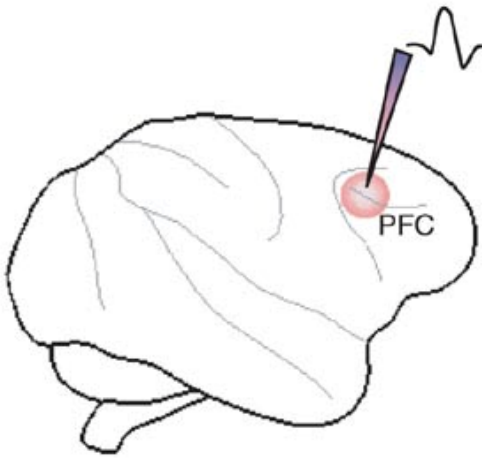
Anticipation in everyday life



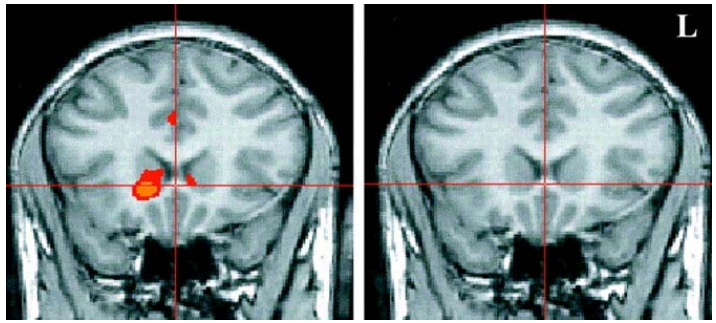
We somehow know what to expect

Tools for the study of anticipation

Electrophysiology

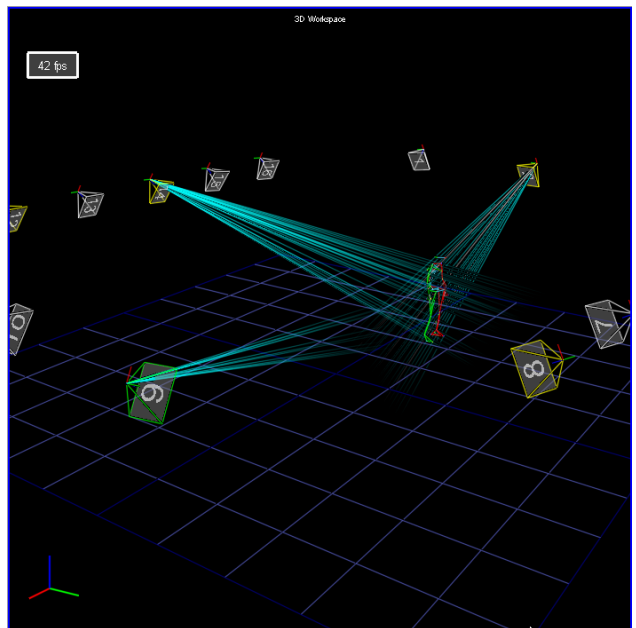


Functional brain imaging

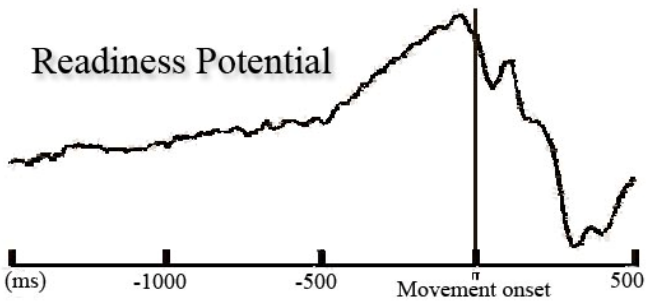


rTMS

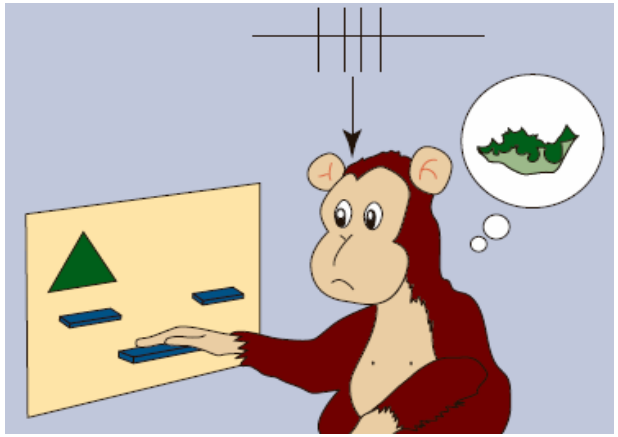
New approach – Motion capture with integrated sensor data (antÉ)

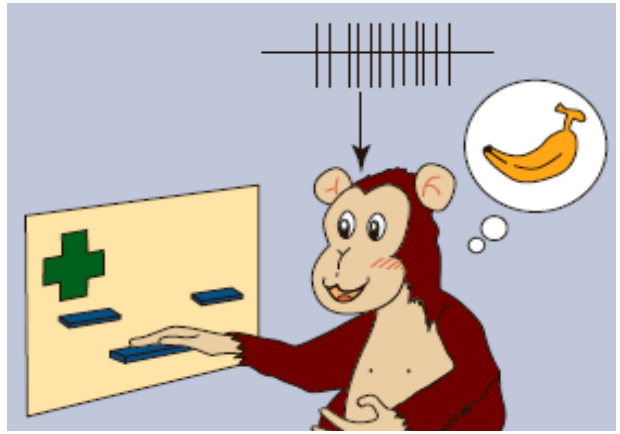


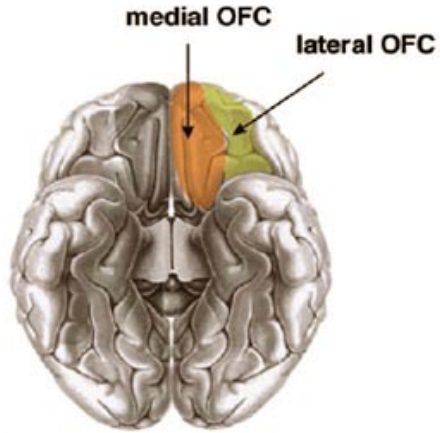
Surface evoked potentials

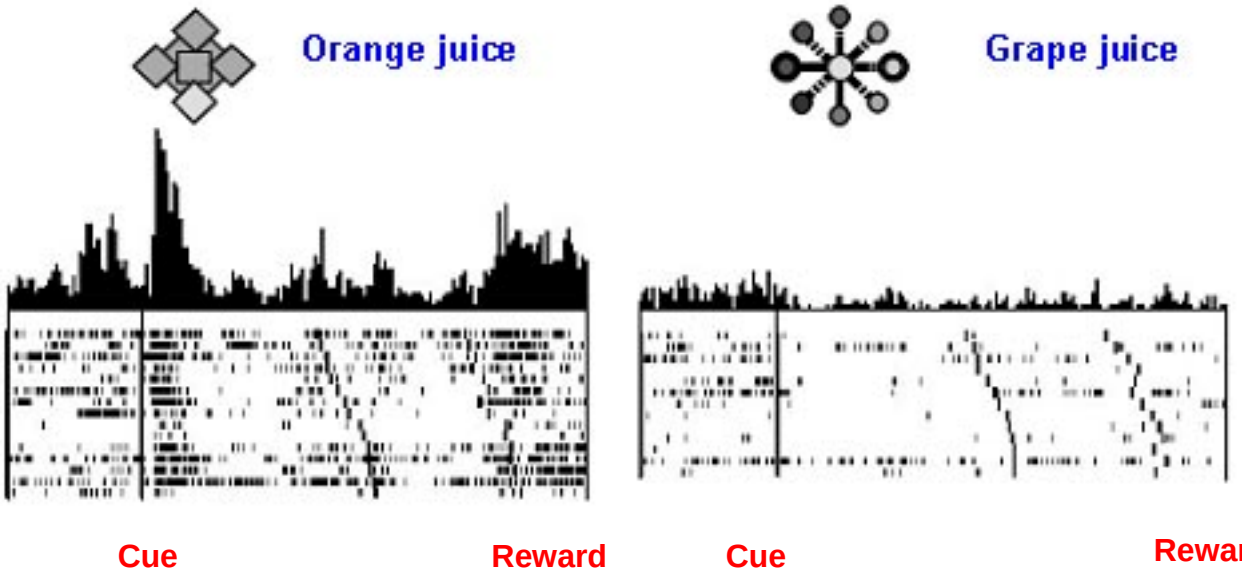


Reward anticipation



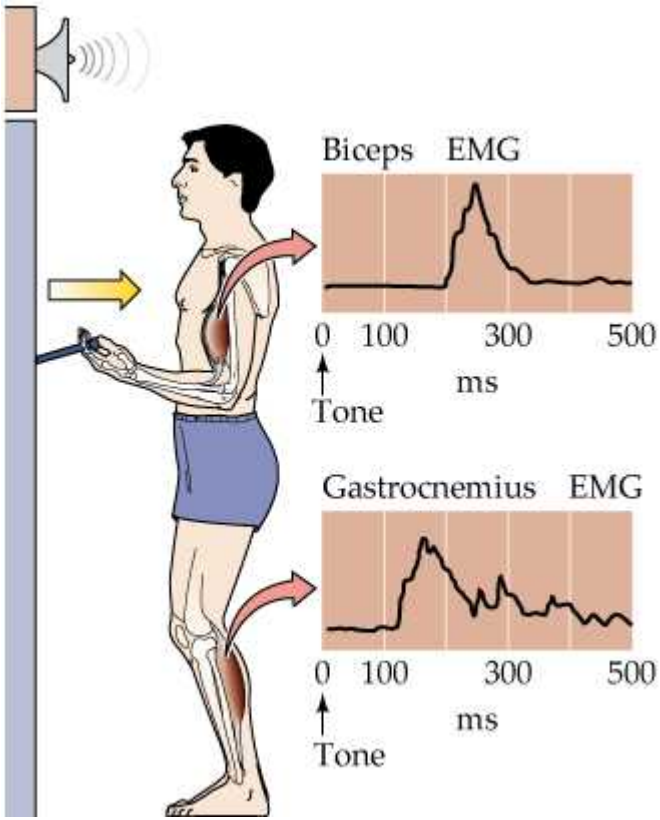




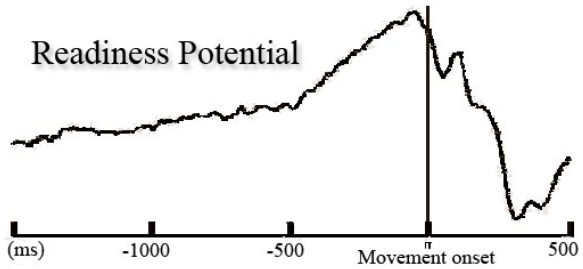


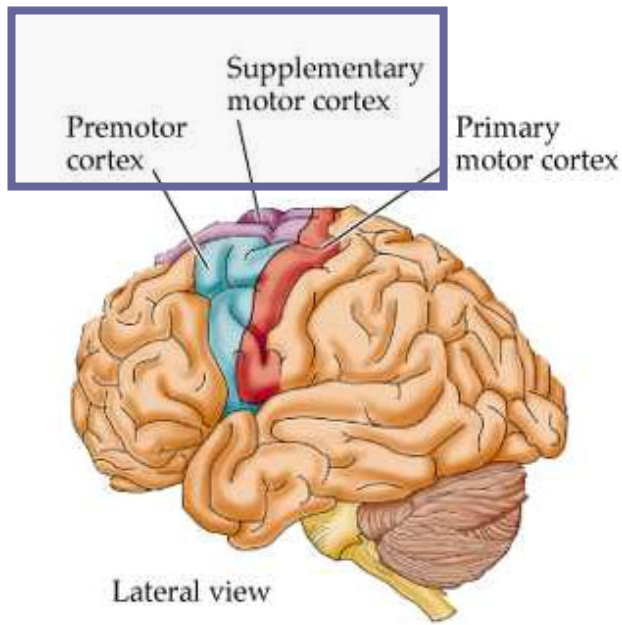
Tremblay & Schultz, *Nature*, 1999

Motor anticipation

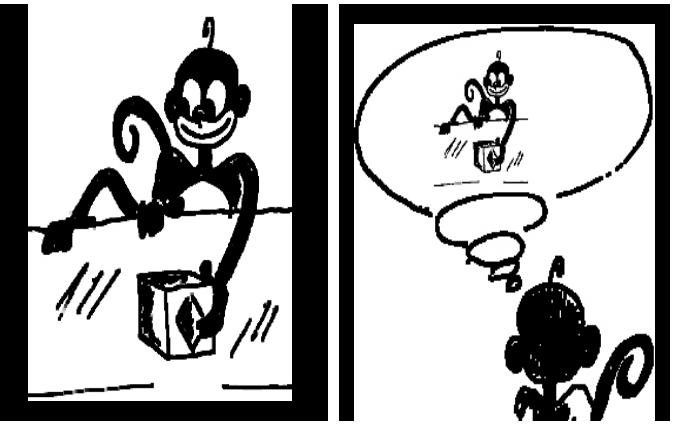


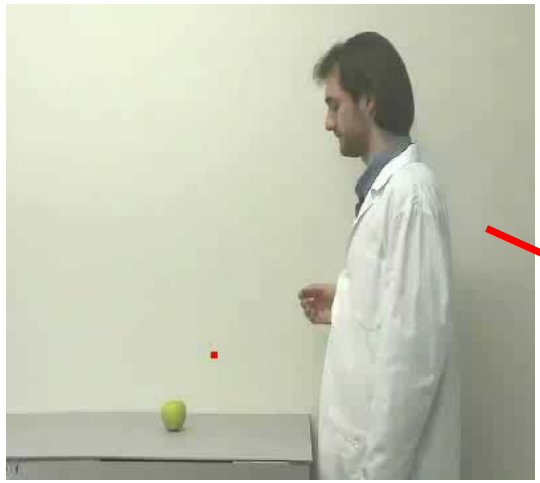
Surface evoked potentials (EEG)

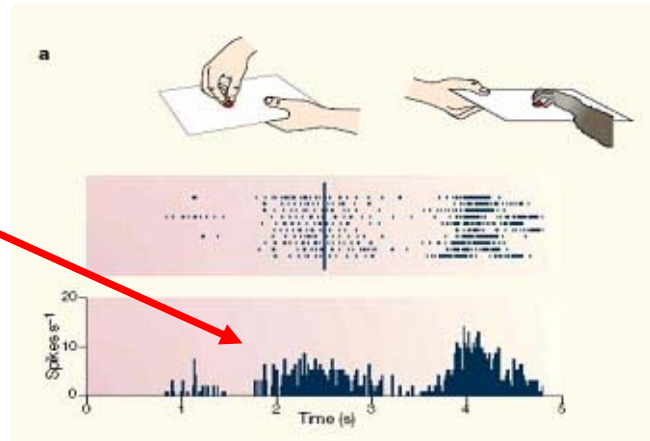


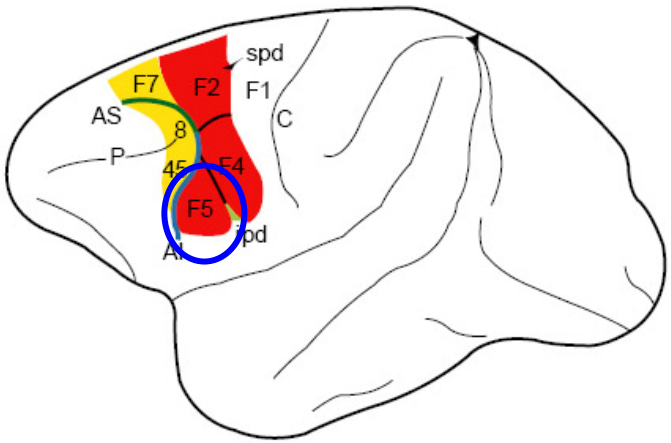


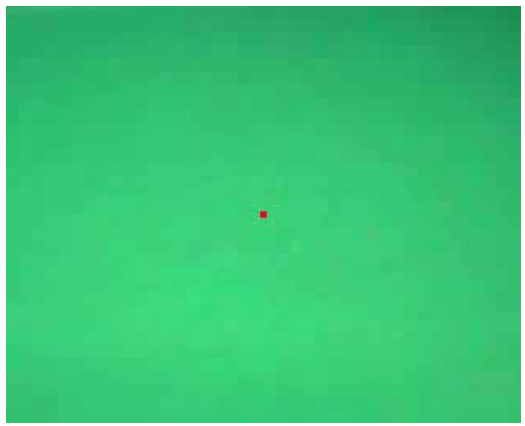
Understanding others actions (“mirror neurons”)

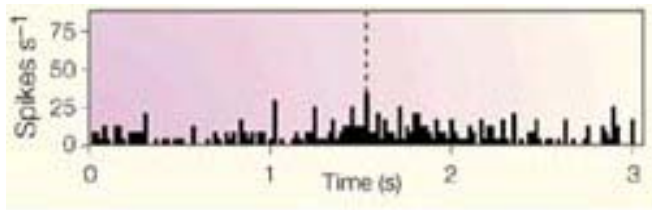












Action has no meaning - does not imply a goal

Gallese et al., *Nature Neuroscience Rev.*, 2001
Nelissen et al. *Science, 2005;*

Understanding intentions of others - allows us to predict future behavior

By observing people acting, we can usually say *what* they are doing and what their *goals* are

fMRI and PET-

- Broca'a area (F5 in monkeys)
- Medial PFC
- Anterior Paracingulate Cortex

senÉLudens

Senescence is the state or process of aging.
The word derives from the Latin term **senex**
which means old man or old age.

The Latin term **ludere** means to play,
thus **ludens** is playing or playful —
as in **homo ludens**, the playful human being.

Sensori-motor and cognitive stimulation

"Game-based rich environments"

↓

Improve quality of life for the aged

Age-related decline in perceptual, cognitive and motor function

Learning new fine motor skills

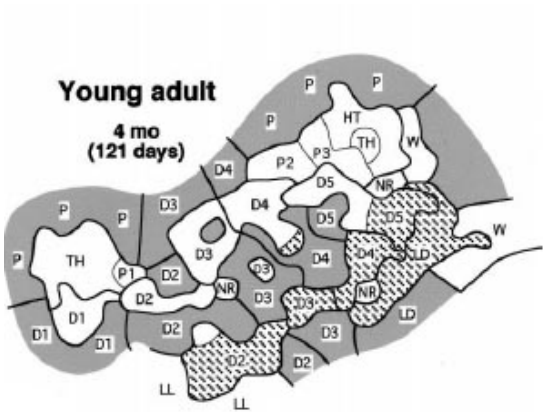
Games

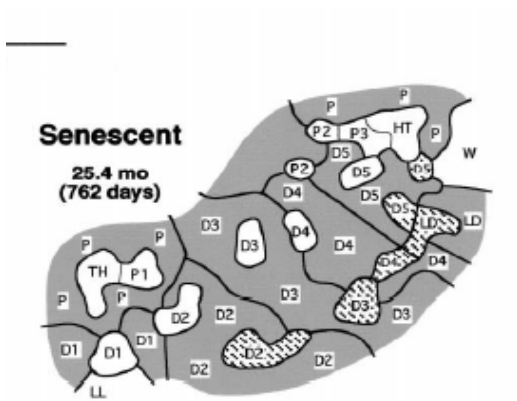
High performance sports

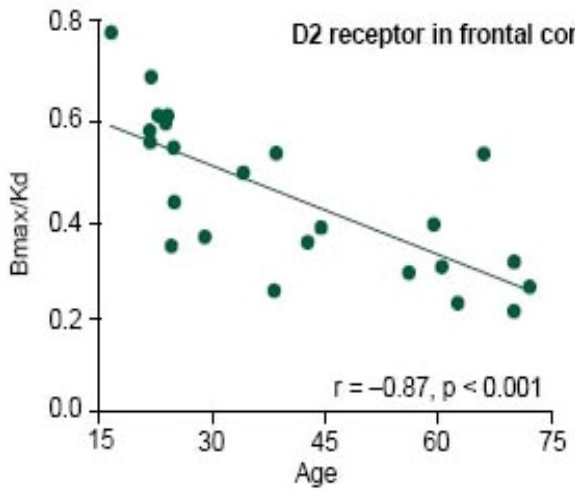
Weaker input (vision, hearing, haptic)
Decreased **synaptic efficacy**

Decrease in **neurotransmitters** and **neuromodulators**

Extensive cortical remodeling







Improving brain plasticity with stimulation and training

Older brains process information differently :

- **Weaker** input (vision, hearing, haptic)
- **Decreased synaptic efficacy**, slowing of cognitive function
- Decrease in **neurotransmitters** and **neuromodulators**

Enrichment, cognitive stimulation, motivation

- **Decrease social isolation**
- **Improve cognitive function**
- **Perceptual and motor learning skills**

Cortical reorganization in aging brains

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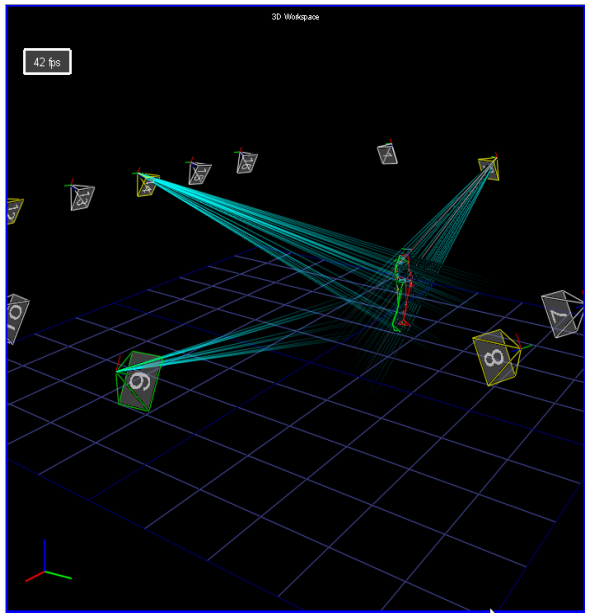
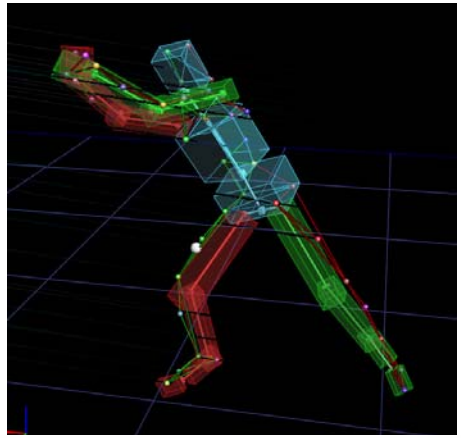
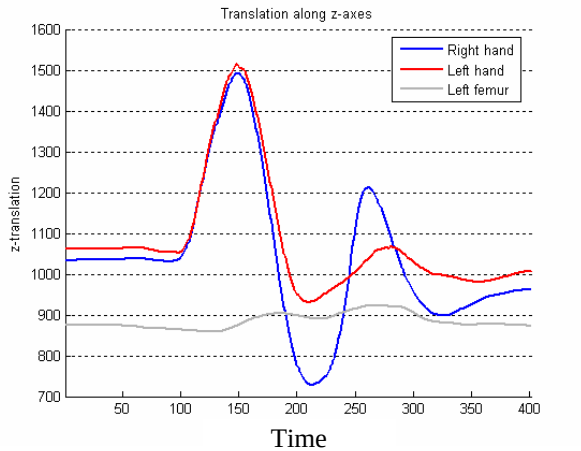
- **Quantify anticipatory characteristics**
- **Develop game-based rich environments**

Quantifying anticipatory characteristics

Motion capture



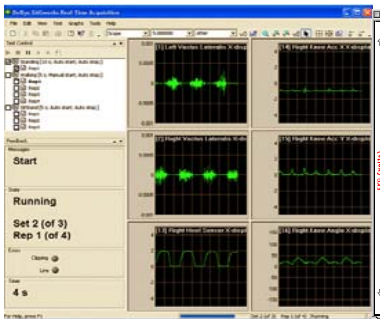


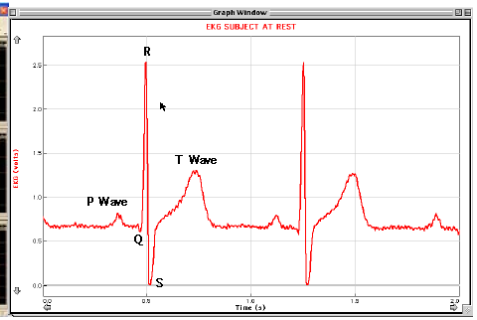


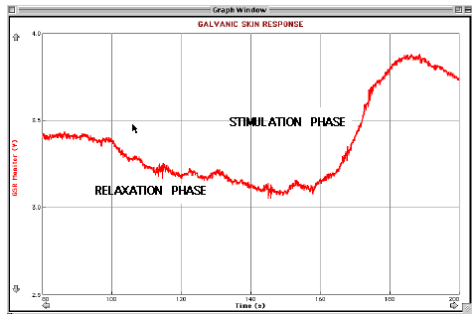
EMG
(muscle activation)

EKG
(heart rate)

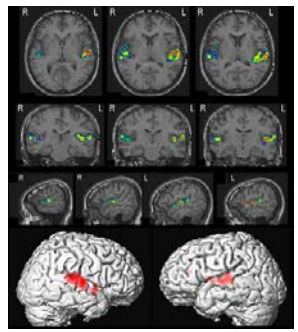
EDR
(galvanic skin response)





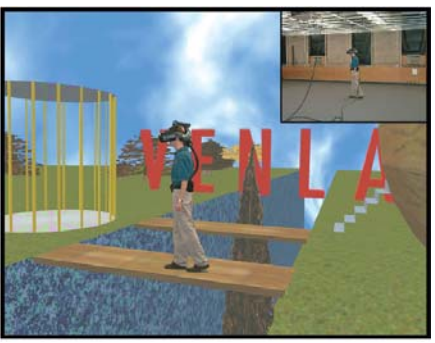


Brain Imaging



- Games – **different** from cognitive training interventions.
  - Games can be **physical, social, cognitive**
  - **Individualized** and **adaptive**
  - Motivating, challenging and rewarding – **decrease social isolation**
- Elderly with limited mobility can engage in activities in virtual space which they would not normally be able to participate in (e.g. navigation)
- Games that incorporate anticipatory characteristics, that dynamically "sense" the **affective state** of the user (e.g., face tracking, gesture recognition, physiology)
- **Integrate** games that have been developed by companies into the anticipatory framework - for the aged
- Interactive environments – with robots that can anticipate user states and respond accordingly

Virtual environments (e.g. navigation)



Real-time gesture recognition

Motor skill learning

Hanson robot

http://www.anteinstitute.org/seneludens.html

If you would like to get involved with Seneludens or collaborate on our research projects, please do not hesitate to contact us!