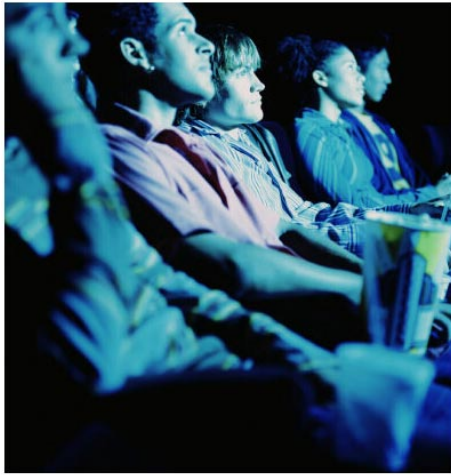


# Neural Correlates of Anticipatory Behavior

antÉ

Institute for Research in Anticipatory Systems  
University of Texas at Dallas

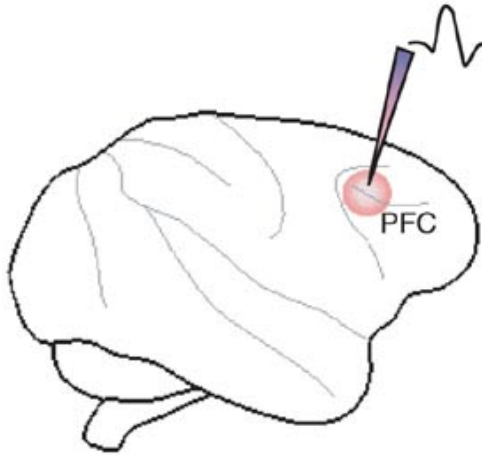
# Anticipation in everyday life



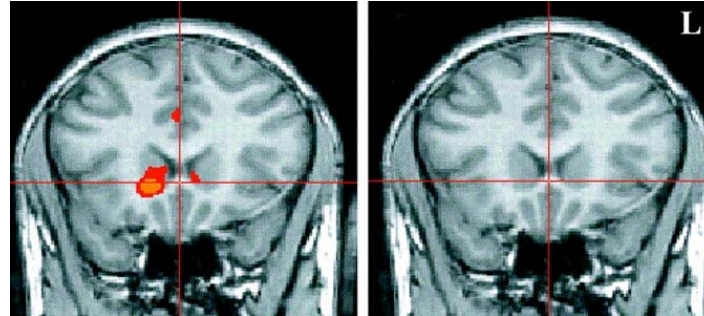
*We somehow know what to expect*

# Tools for the study of anticipation

## Electrophysiology



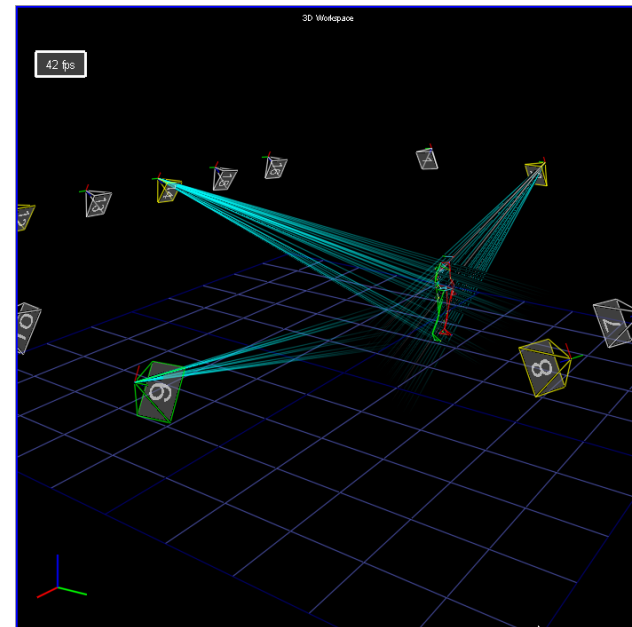
## Functional brain imaging



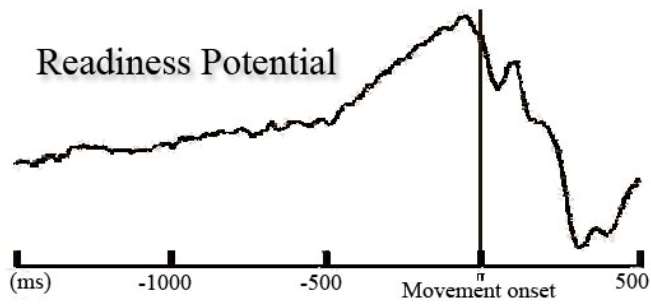
## rTMS



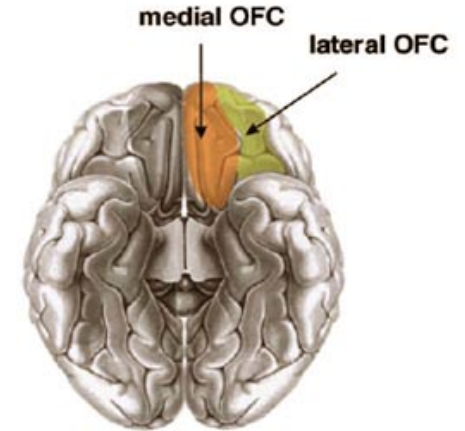
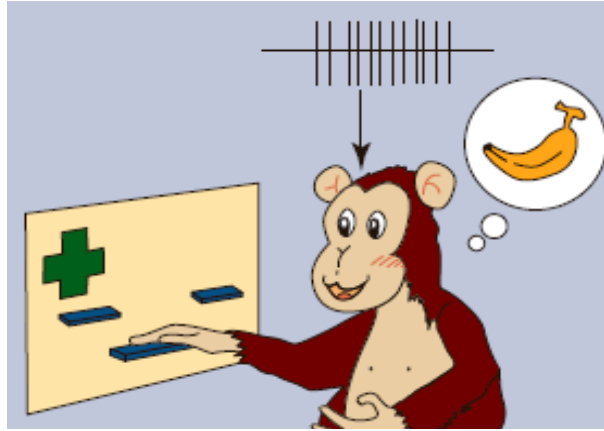
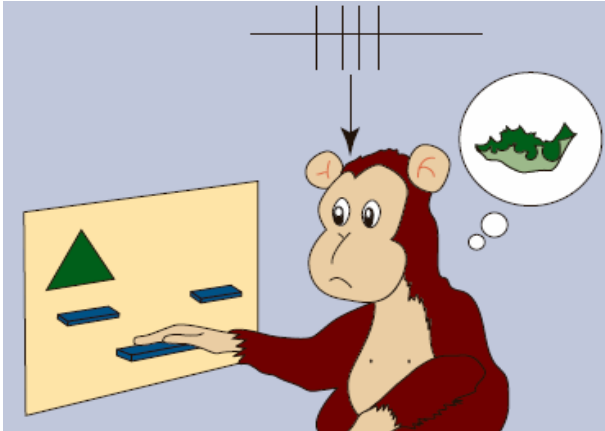
## New approach – Motion capture with integrated sensor data (antÉ)



## Surface evoked potentials



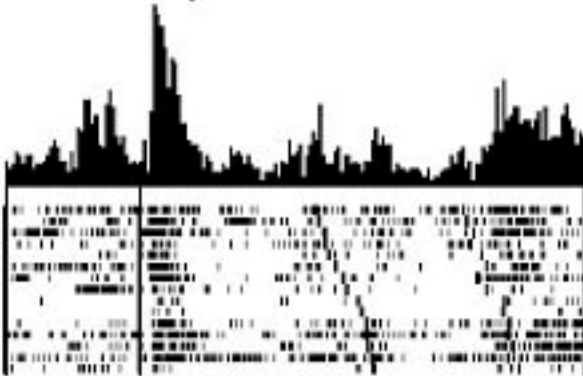
# Reward anticipation



Orange juice

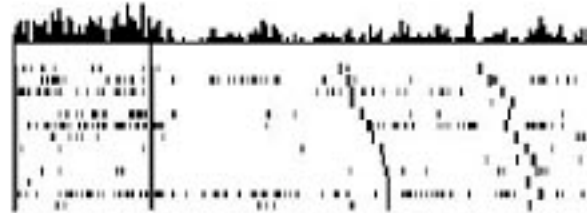


Grape juice



Cue

Reward

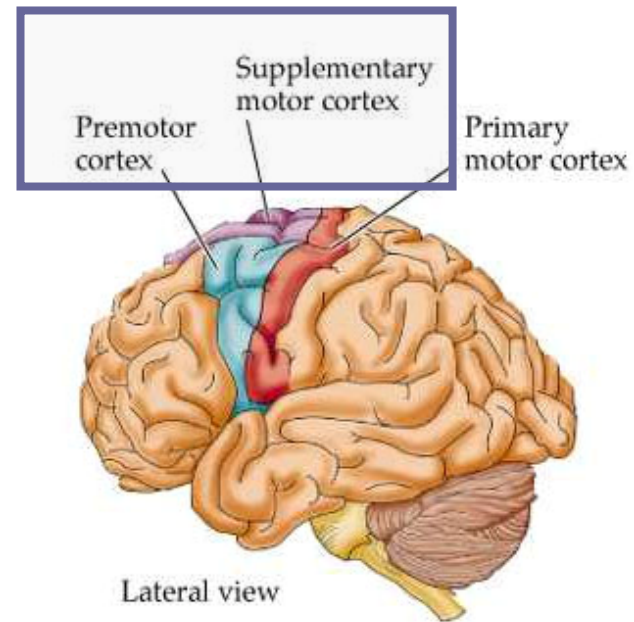
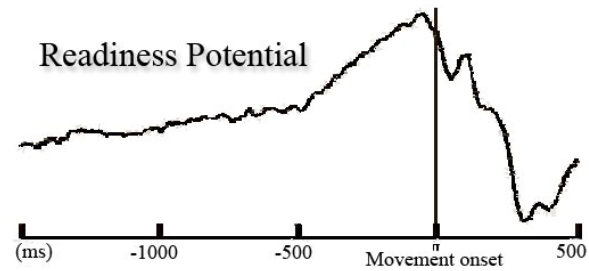
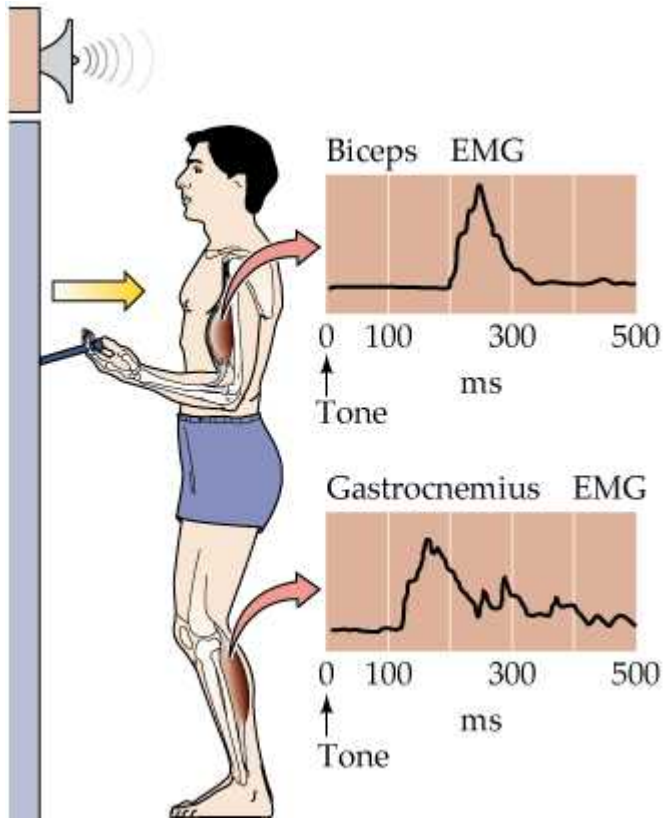


Cue

Reward

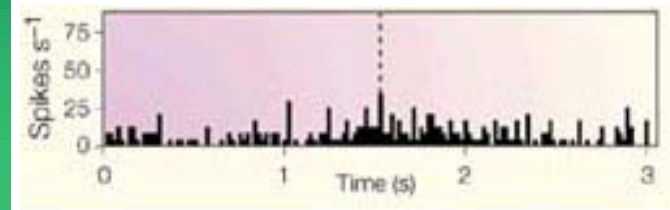
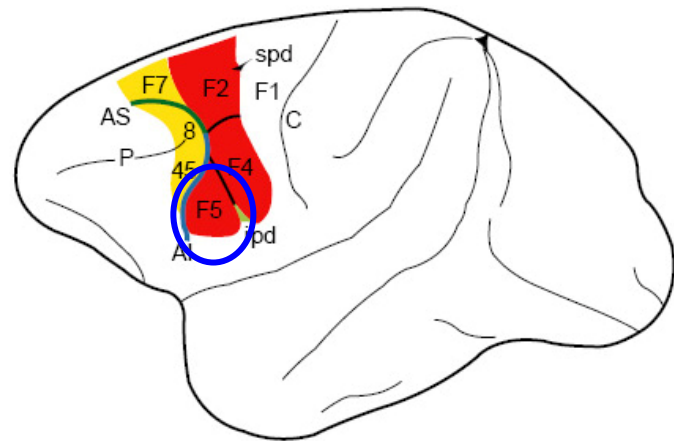
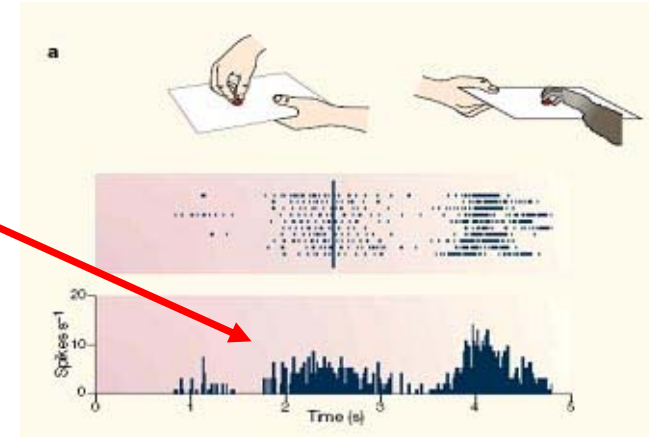
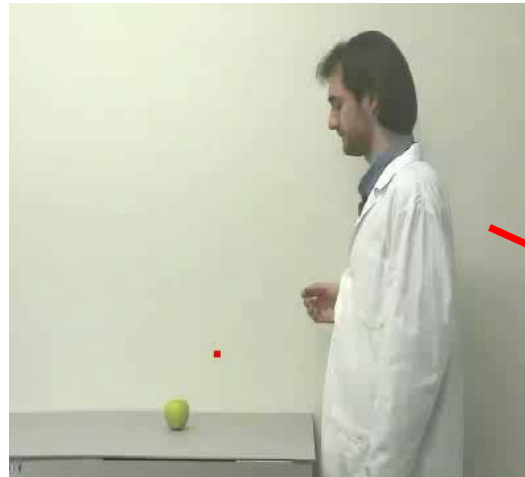
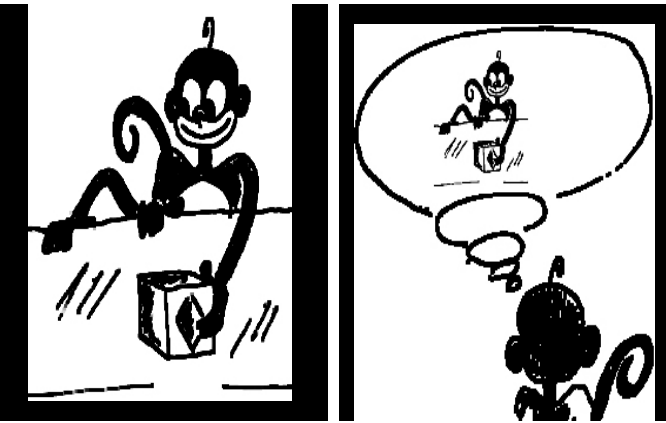
# Motor anticipation

## Surface evoked potentials (EEG)





# Understanding others actions (“mirror neurons”)



**Action has no meaning -  
does not imply a goal**

# 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's 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**

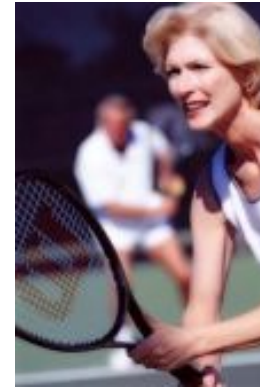


# Age-related decline in perceptual, cognitive and motor function

Learning new fine motor skills



Games



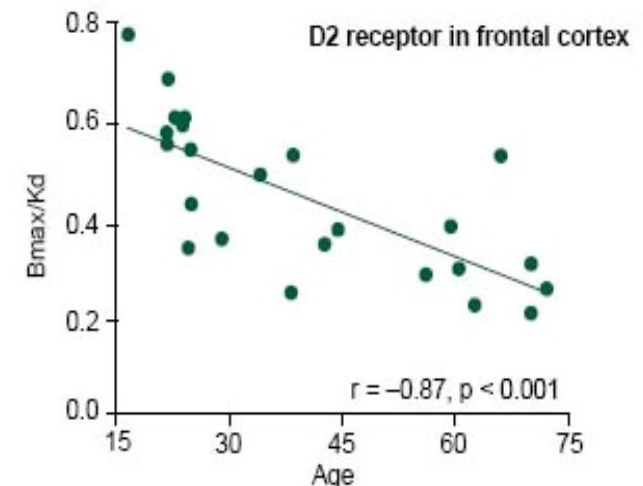
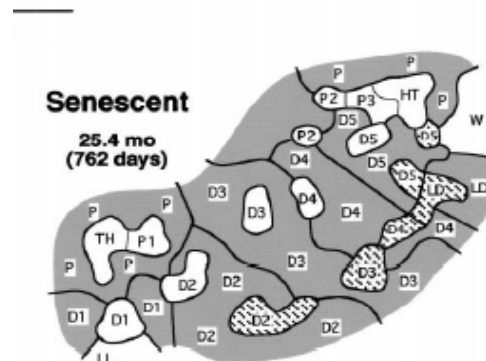
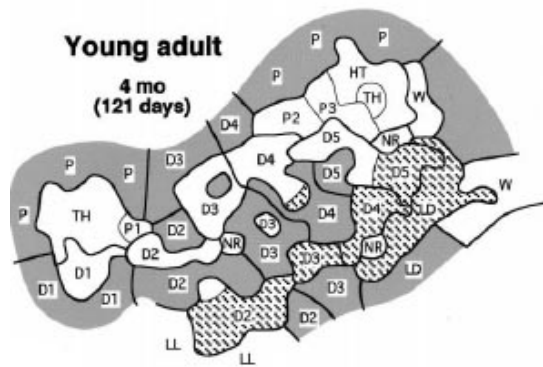
High performance sports



**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**

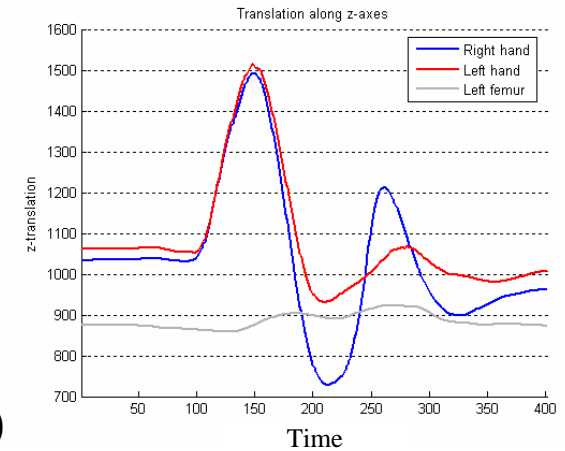
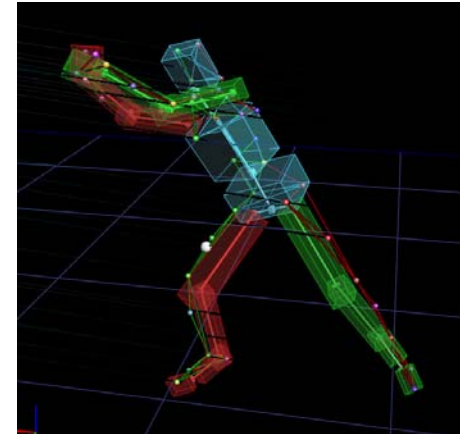
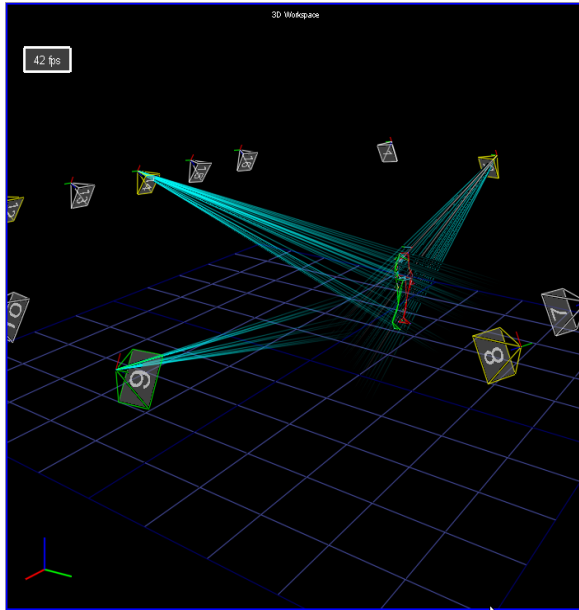
Cortical reorganization in aging brains



- Quantify anticipatory characteristics
- Develop game-based rich environments

# Quantifying anticipatory characteristics

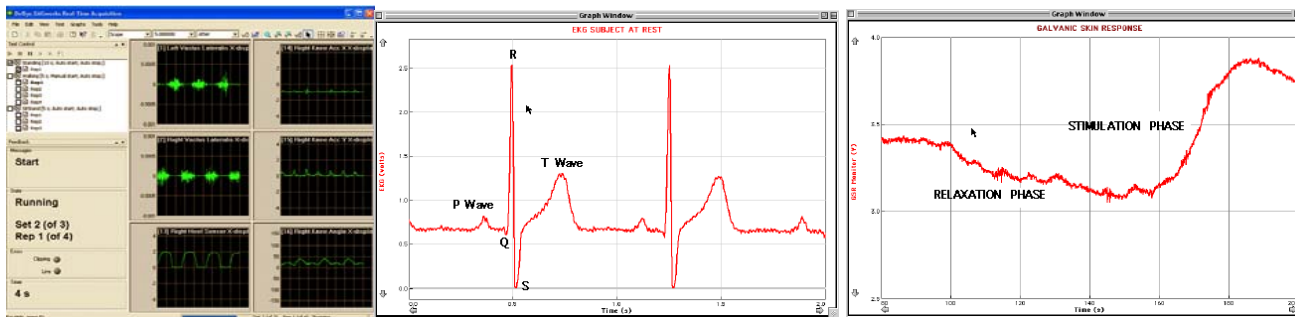
## Motion capture



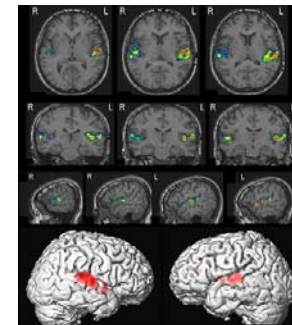
## EMG (muscle activation)

## EKG (heart rate)

## EDR (galvanic skin response)

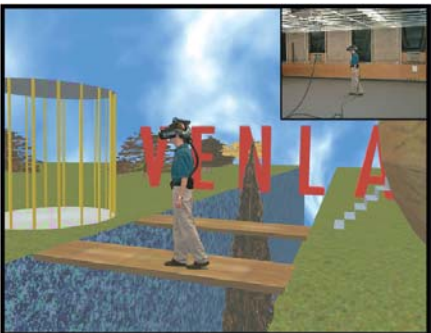


## Brain Imaging



- 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**







Institute for Research in Anticipatory Systems

UTD The University of Texas at Dallas

Seneludens®: From the Latin senescere, "to grow old," from senex, "old;" and ludus, "play."  
Copyright 2004 antÉ Institute. All rights reserved.

[Full project description \(PDF\)](#)

[Project timeline \(PDF\)](#)

[igda interview with Mihai Nadin on Seneludens](#)

### Seneludens® – A Research Project

Addressing the various limitations and costs that aging entails has become a major challenge. Many resources are utilized for fighting the limitations of aging as they progressively occur, but few for attenuating the consequences of aging before these become a medical problem.

Seneludens takes a proactive approach. It seeks methods for combining the will of the aging to enjoy quality of life with means other than medicine for maintaining characteristics that make life worth living. Seneludens focuses on maintaining anticipatory characteristics during the aging process. Senescence is the stage at which anticipation degrades to such an extent that the body is practically reduced to its physical-chemical reality. Based on the findings of physicians, gerontologists, experts in brain research, cognitive science, and the social sciences, this project attempts to design games through which the aging person is enticed to remain physically and mentally active, to connect to others, and to remain competitive. Game-supported maintenance of skills will contribute to keeping the elderly independent and capable of further contributing to society.

Activities

- [Home](#)
- [Members](#)
- [Research](#)
  - [\\_Seneludens](#)
- [Articles of Incorporation](#)
- [Seminars](#)
- [2nd Cartesian Revolution](#)
- [Contact](#)
- [Sitemap](#)

Navigation

[ACM Ubiquity Interview with Mihai Nadin](#)

[IGDA Interview on Seneludens](#)

Website:  
[anticipation.info](#)

Website: [nadin.name](#)

Links

<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!**

antÉ presents:  
Research opportunities  
— a series of  
presentations for the  
Metroplex area  
(download pdf)  
&  
Jack W. Stauffacher &  
Dennis Letbetter: The  
Vico Collaboration,  
October 19 – 27