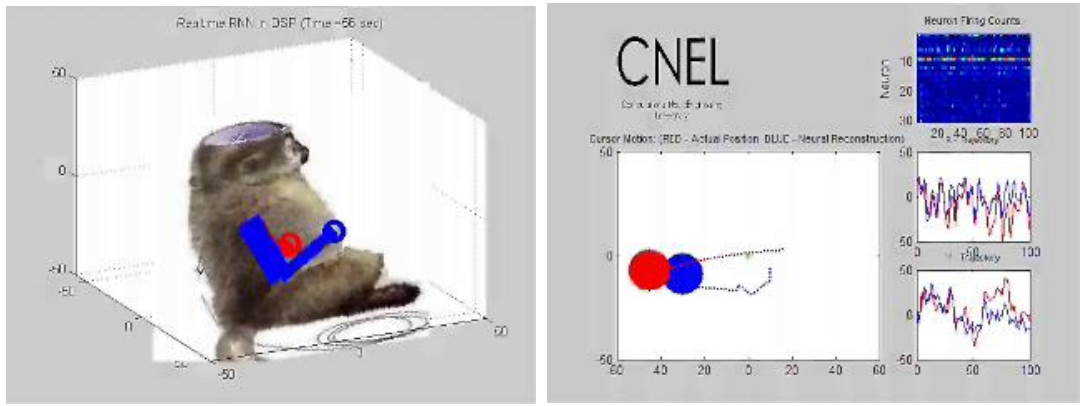
Augmented Reality
Brain Machine Interfaces Project

Objective: Develop an Augmented Reality (AR) system to support experiments with disabled humans for Brain Machine Interfaces (BMI) – in partnership with U Florida, linked to broader research project funded by DARPA including as partners Duke, MIT, SUNY, U Florida and Plexon.

Tests with monkeys: demonstrated the ability to use electrophysiological methods to extract information about intentional brain processes (e.g. moving an arm), and then translate these neural signals into models that successfully controlled external devices.

Problem: in tests with humans, desired signal in disabled humans (paraplegics, quadriplegics) is not available to sample activity-motor tasks and thus data can not be collected to train the models.

Model outputs are generated using only neural activity.



Source: Justin C. Sanchez “From Cortical Neural Spine Trains to Behavior: Modeling and Analysis”, CNEL, Department of Biomedical Engineering, UFL..

YDreams AR System: key technological approach to derive the desired response for the disabled subjects in human experiments, efficiently and with flexibility to scale up to train with more complex motor tasks.

Augmented Reality
Brain Machine Interfaces Project (cont.)

YDreams Augmented Reality System for BMI:

- Integration of brain machine interfaces in augmented reality environments.
- Object detection and tracking algorithms.
- Camera calibration and dynamic 3D model reconstruction techniques.
- Simulation models in augmented reality environments.

- YDreams Simulation System – core system, 3D engine
- Simulation Editing – forward/inverse kinematics, wearables
- Interaction with patient
- Stereoscopy with video-through HMD
- Spatial 3D sound
- 3D modeling
- Encoded spatial coordinates, kinematic parameters
- Occlusion, collision, shadows between real and virtual objects
- Moveable camera calibration and positioning
- 3D camera registration
- Cortical Data Acquisition Unit (CNEL-UFL)
- Signal processing neural network models (CNEL-UFL)
- Wireless data transmission

Superimposing rendered computer graphics of moving virtual hands and arms on real images in real time: resulting immersive environment stimulates the subject's cortical activity associated with "mixed" reality being simulated.

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