From the virtual to the robotic: bringing emoting and appraising agents into reality

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Goal

→ Reimplement a cognitive model for a virtual human in a humanoid robot. The robot should have human-like emotional complexity and be adaptive and flexible in real world tasks

Explore the differences between real and virtual body/environment and find ways to properly transfer the current mechanisms and provide new where needed.

Introduce a metabolic-arousal mechanism in order to provide a preliminary investigation into energy-efficient work-refueling behaviors where energy production and distribution is required to be either slow or fast concerning the agent-environment interactions

Provide an exemplar study of the potential of generic fuel cell technology to be utilized in the service robotics industry

Provide an experimental scenario that is deliberately made as abstract as possible in order for us to assess cycles of work-refuel activity that, as a measure of the autonomy of the agent, are required to be sustainable according to a dynamic problem

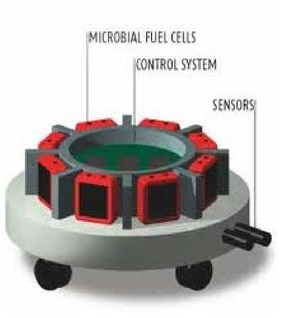
MFC

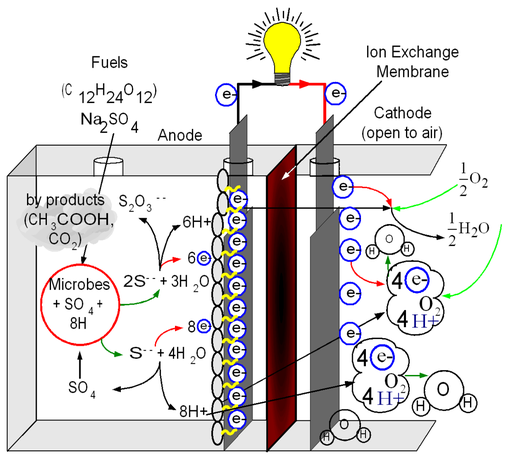
MFC (Microbial Fuel Cell) - an example of artificial metabolism

Converts fuel (biodegradable mass) into usable electric energy

MFC technology has, until the present time, been applied only to a wheeled robot - EcoBot

The technology potentially provides greater energy autonomy in human habitable environments because of the availability of the required resources



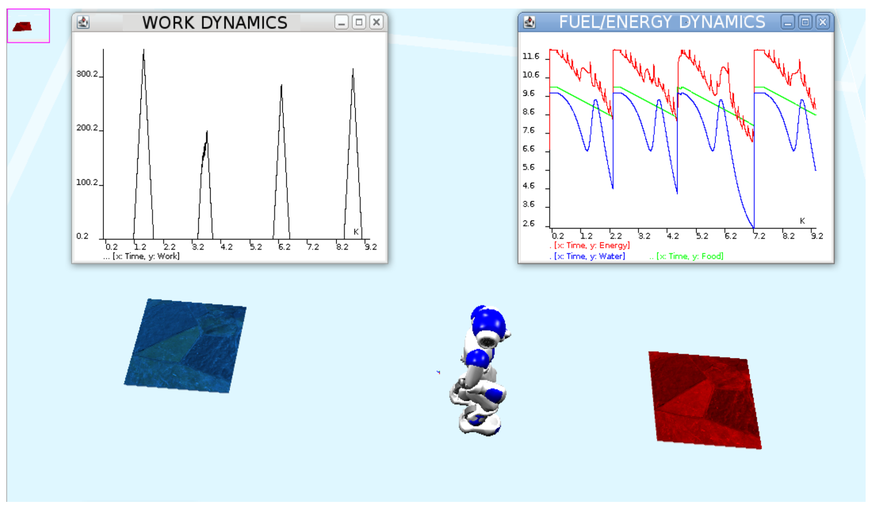


Experimental Methods

McFarland concept of basic cycle

– "If the robot is to be self-sufficient and economically viable then there are two basic resources (work, energy) that should be provided in the robot environment"

Fuel spot is the recharging station, waste products that could be digested etc. Work spot is symbolizing the work to be done. Availability/urgency of the work resource is changing over time - time restricted, unpredictable resource



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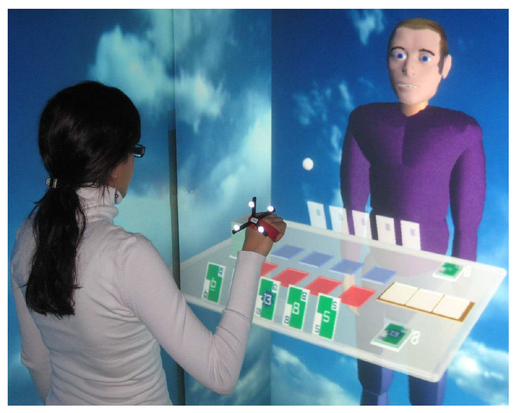
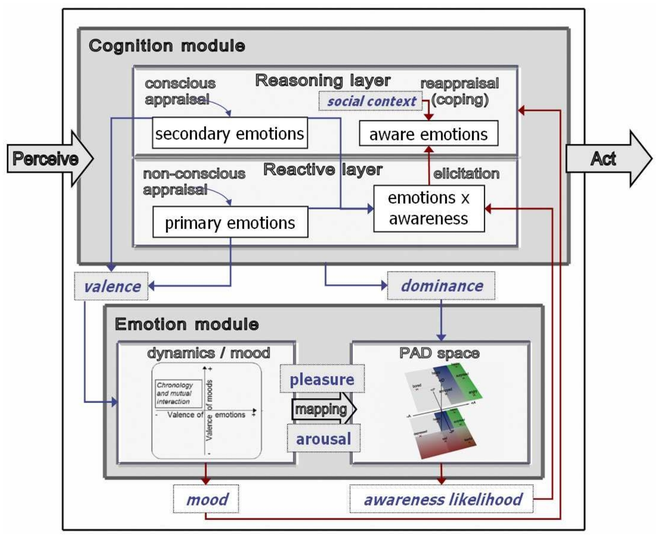




[W]ASABI [A]ffect [S]imulation for [A]gents with [B]elievable [I]nteractivity

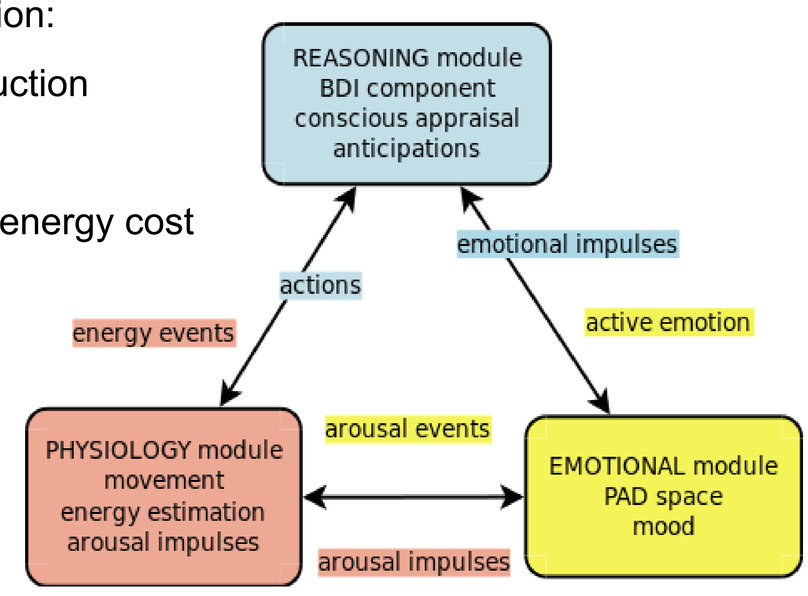
Cognitive model based on emotion dynamics and appraisal theory of emotion

Applied in virtual game playing partner and a museum guide

Integrated Architecture

Body state evaluation:

- Energy rate production
- Energy level
- Estimation of the energy cost of movements
- Fuel level



"Embodied" appraisal

$$Arousal\ impulse = Energy * (Cue_{work} * Deficit_{work} + Cue_{fuel} * Deficit_{fuel})$$

Two modes of movement – relaxed, burst controlled by the level of arousal

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