The Case for Multimodal Virtual Environments in Multi-Agent Simulations

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Workshop on
Multimodal Human-Agent Interfaces for Virtual Environments

Macquarie University
Sydney

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Context

Computer Science

Artificial Intelligence and Intelligent Agents

Software Engineering

Multi-Agent Simulations

Computational Science

Computational Operations Research

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Computer Science

Artificial Intelligence and Intelligent Agents

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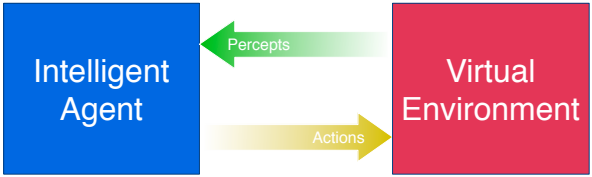
Aim

- Authentic, credible and situated computational models of human decision making in multi-agent simulations used in computational operations research.

Agent-Environment Interaction

Perception-Reasoning-Action Model

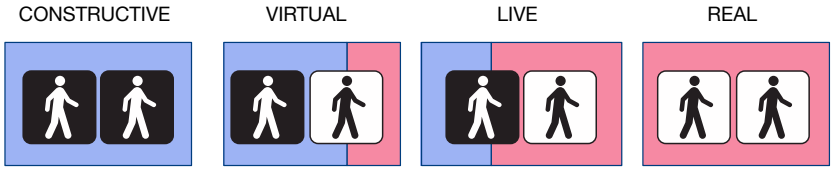


Virtual Environment a dynamic computational representation of a world [1] populated by entities and intelligent agents.

Intelligent Agents an autonomous decision making entity situated in virtual environment that can perceive the environment, reason and make decisions and take action in the environment.

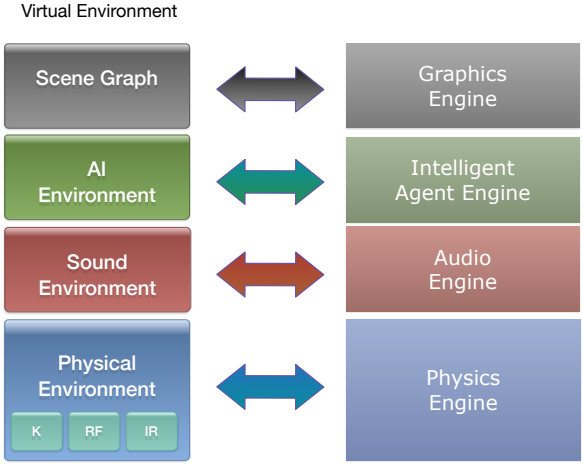
[1] Real, fictitious or abstract world

Spectrum of Agent-Human Interaction



Multi-Agent
Simulations

Multi-Modal Virtual Environments



See: *The Human-Agent Virtual Environment* Papasimeon, Pearce and Goss.

6th International Conference on Autonomous Agents and Multi-Agent Systems, 2007

Ecological Psychology

The study of how humans and animals interact with the environment they are situated in.

Ecology

Ecology = Environment + Humans/Animals + Interaction

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- A Multi-Agent Simulation or a Video Game is an example of a virtual ecology.
- Designing one of these systems involves designing a virtual ecology.

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Direct Perception

Gibson claimed that affordances (action possibilities) are directly perceivable by humans and animals in the environment.

Computing Affordances

- The action possibilities available to an agent depend on many different things... not just the physical environment.
- Action possibilities maybe influenced by the social, command, electromagnetic, team, network or other abstract environments.
- We want action possibilities that are dynamic, observer tailored, relational, intentional/goal oriented, introspective, meaningful and context sensitive. [2]
- In order to compute affordances (or find the action possibilities), our virtual environments have to be inherently *multimodal*

[2] *Modelling Agent-Environment Interaction in Multi-Agent Simulations with Affordances*. M. Papasimeon. 2009

Take Home Points...

- Designing situated intelligent agents means we need to consider the agent-environment interaction as an ecology.
- That is we should be talking about... *Designing Virtual Ecologies*
- Computational models of affordance (action possibilities) give us a closer (more situated link) between agent and environment.
- However, in order to determine what actions are possible (what the environment affords the agent) the environment needs to be *multimodal*

Challenges

- Non-situated models of agency
- Design of Agent-Friendly Virtual Environments
- Software Engineering
- Adoption of Ecological Models