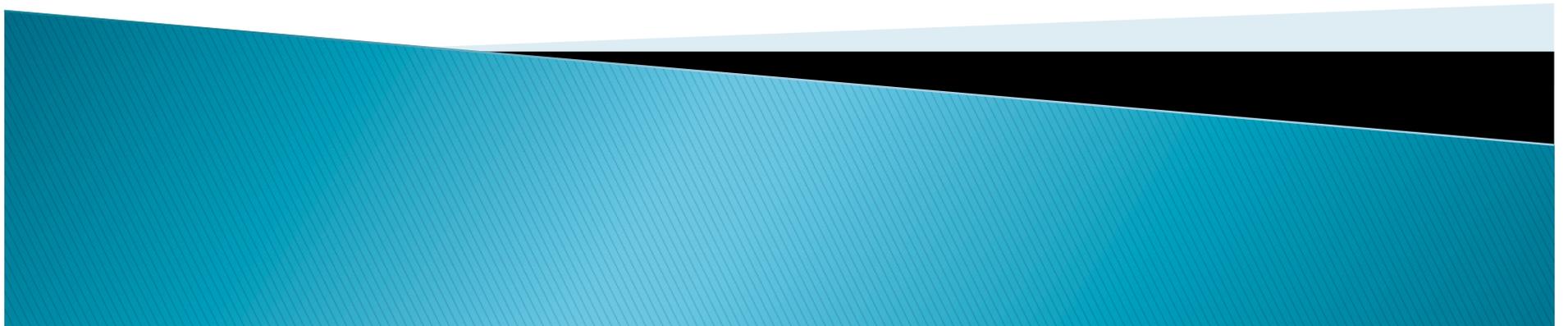


# Federal Virtual Worlds Conference 2010

## Artificial Intelligence Panel

**Facilitator:** Mark Phillips

**Panel:** Lt Gen Robert Wood (Ret), Dr. Michael Van Lent, Glen Van Datta and  
Dr. Ben Bell



# Format

- ▶ Each panelist will get 5 minutes to state their position on AI.
- ▶ The panel will then be moderated in a few key questions to encourage debate.



# Cognitive Architectures for Actors in Virtual Worlds

Michael van Lent, Ph.D.



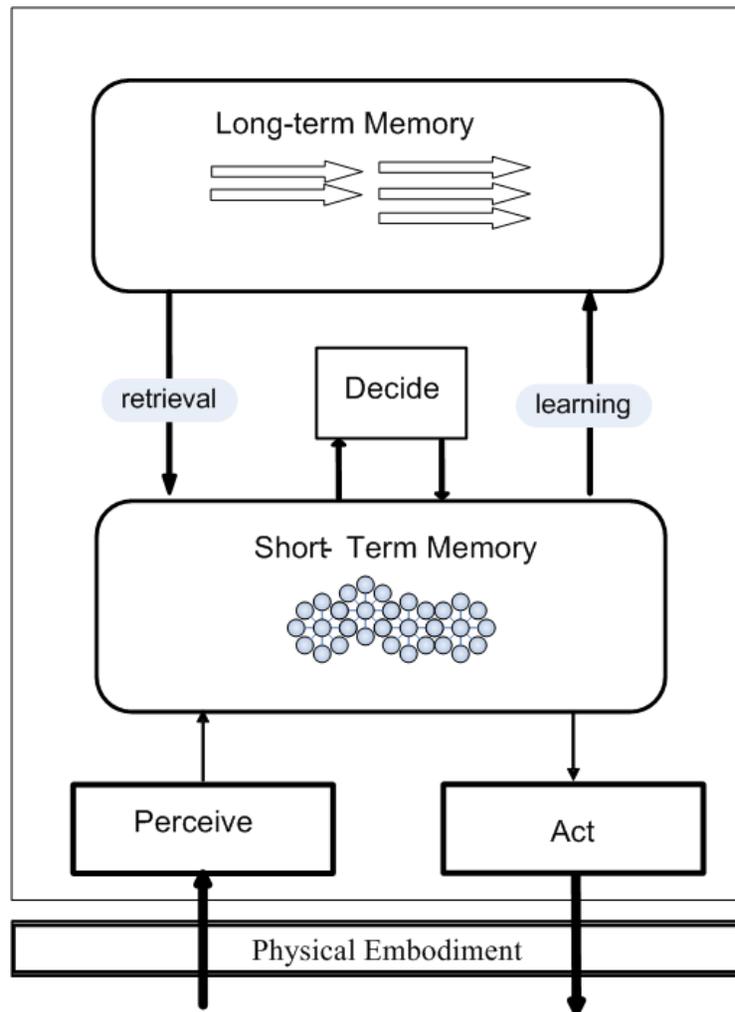
**SOARTECH**

Modeling human reasoning.  
Enhancing human performance.

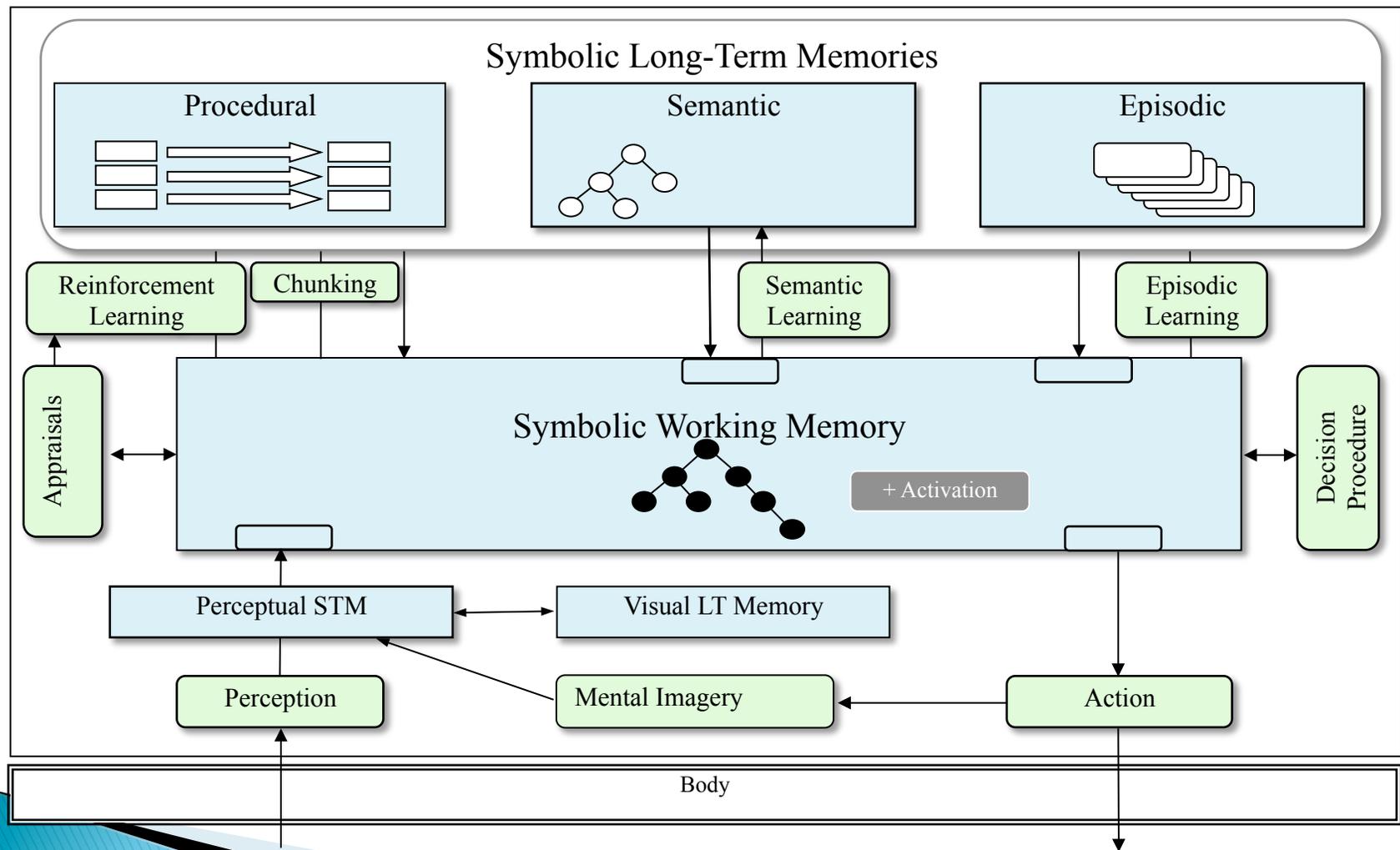
# Functionality for Actors in Virtual Worlds

- ▶ A cognitive architecture that thinks the way people think naturally supports:
  - Emulation of human behavior
  - Collaboration with human players
- ▶ Behave realistically
  - Believable to support immersion
  - Realistic to support training
- ▶ Interact naturally
  - Capable of speaking and understanding natural language
  - Capable of discussing goals, knowledge, future plans...
- ▶ Reason transparently
  - Understandable to support collaboration
  - Directable (explicitly and implicitly) to assist the player
- ▶ Adapt quickly
  - Able to learn from experience and instruction

# Basic Cognitive Architecture



# Soar Cognitive Architecture

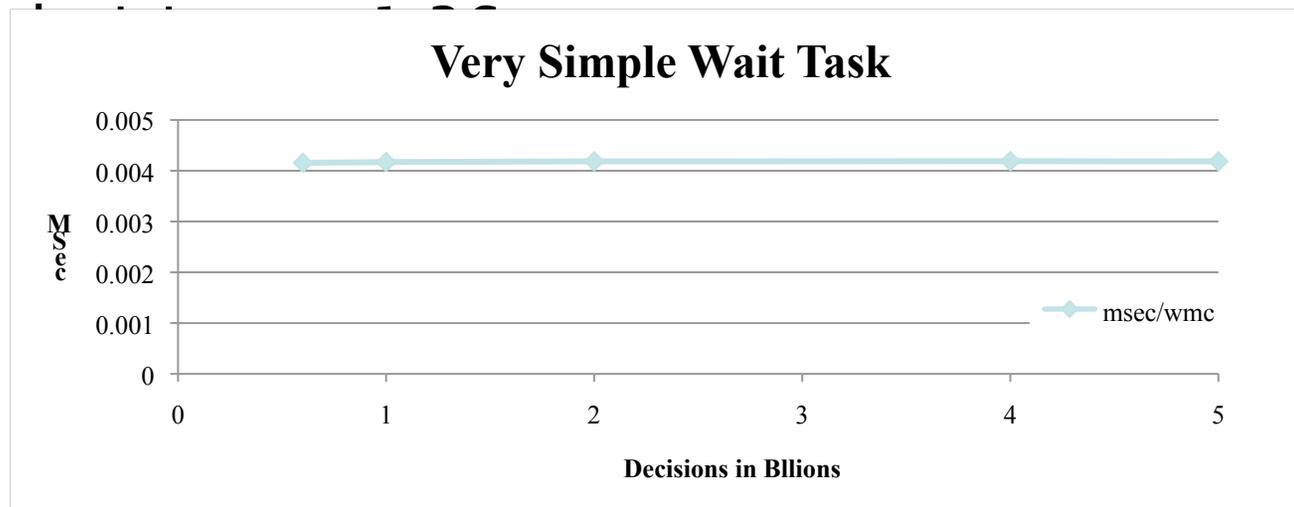


# Soar's Architectural Commitments

- ▶ **Highly reactive decision making**
  - Soar will attend to sensor input at least every 50 milliseconds
  - Complex reasoning or memory retrievals must be spread across decision cycles
  - As a result, Soar is fairly lightweight (iSoar on the iPhone)
- ▶ **Human cognition modeling**
  - Every feature supported by evidence from cognitive psychology, neuroscience...
  - Soar is also a research tool for cognitive psychologists (CMU, Ohio State, Michigan)
  - As a result, Soar's knowledge and decisions are easy for humans to understand and a human's knowledge and decisions are easy for Soar to understand
- ▶ **Knowledge-rich reasoning**
  - Everything not a human cognitive capability is assumed to be knowledge
  - If humans learn it then it's knowledge, not part of the architecture
  - As a result, knowledge bases can encode many different reasoning strategies and classes of knowledge.
- ▶ **Integrating reasoning, knowledge and learning**
  - Explanation-based learning automatically learns from all reasoning and knowledge
  - As a result, Soar continually improves procedural knowledge

# Stress testing the Soar Architecture (1)

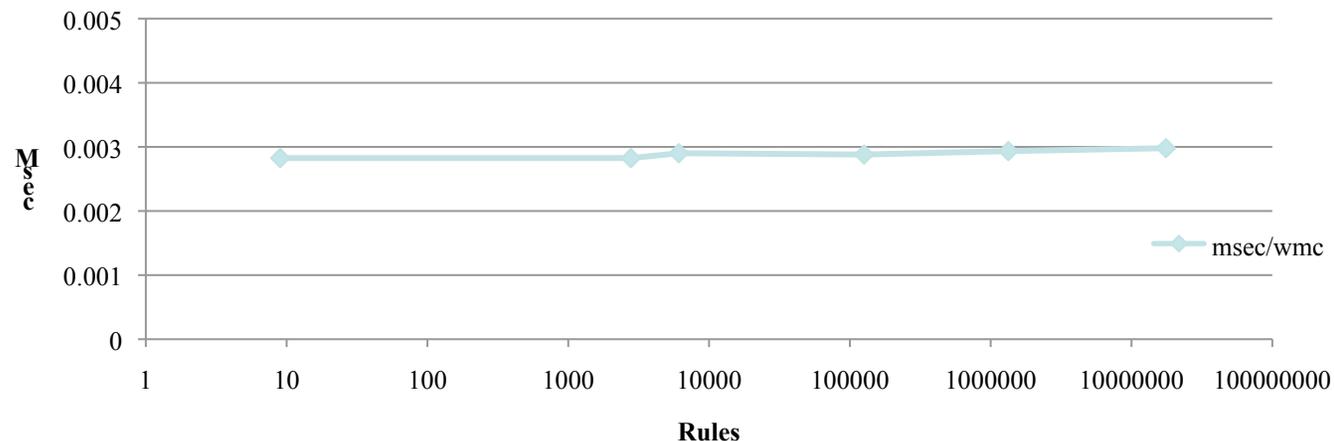
- ▶ Can Soar run for a long time?
  - Very simple knowledge base (44 rules): 5 billion decisions  $\approx$  7 years
  - Simple knowledge base (6092 rules): 1 billion



# Stress testing the Soar Architecture (2)

- ▶ Can Soar run with very large knowledge bases?
  - Over 17 million rules for 10 million decisions

**Blocks World**



# NDU AI Presentation



Glen Van Datta: May 2010  
gvandatta@trionworld.com

**TRION**  
WORLDS

# Trion Worlds Team

## Who is Trion? (founded in 2006)

- Collectively the most experienced MMO and online Publisher in the world. From Top Executives to Quality Assurance
- Provider of one of a kind 3.0 Generation MMO Platform
  - Base Platform, includes technology, deployment, customer support
  - 3 – AAA Premium MMOs under development

## Talent Diversity

- We have collectively Published, designed, implemented, tested and supported over 1,000+ games & online titles
- We have deployed, operated and supported over a dozen MMOs.
- Includes skills and fresh perspectives from disparate industries like gaming, telecom, media, education hardware and government/military



# AI Considerations

## AI Types

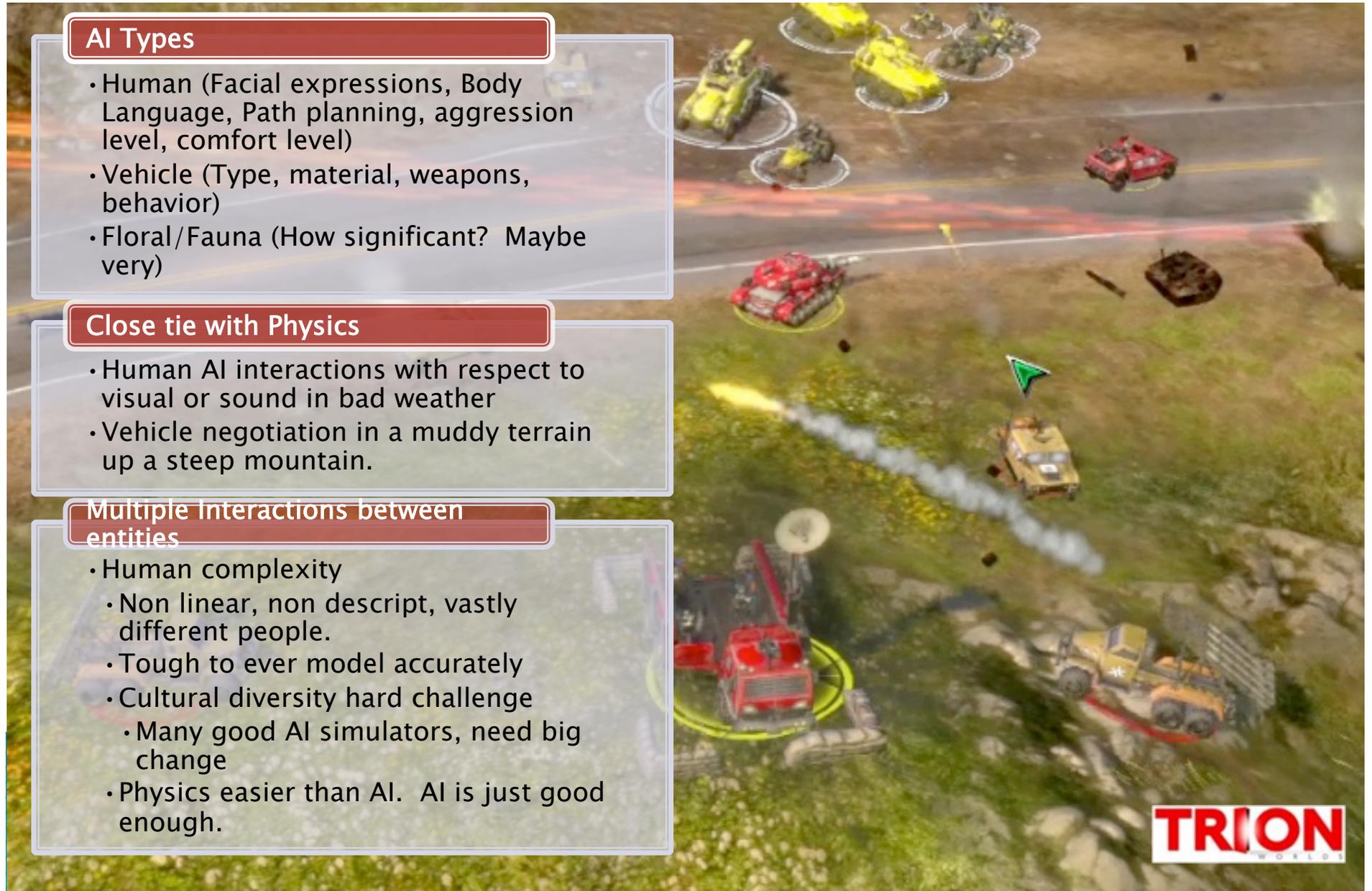
- Human (Facial expressions, Body Language, Path planning, aggression level, comfort level)
- Vehicle (Type, material, weapons, behavior)
- Floral/Fauna (How significant? Maybe very)

## Close tie with Physics

- Human AI interactions with respect to visual or sound in bad weather
- Vehicle negotiation in a muddy terrain up a steep mountain.

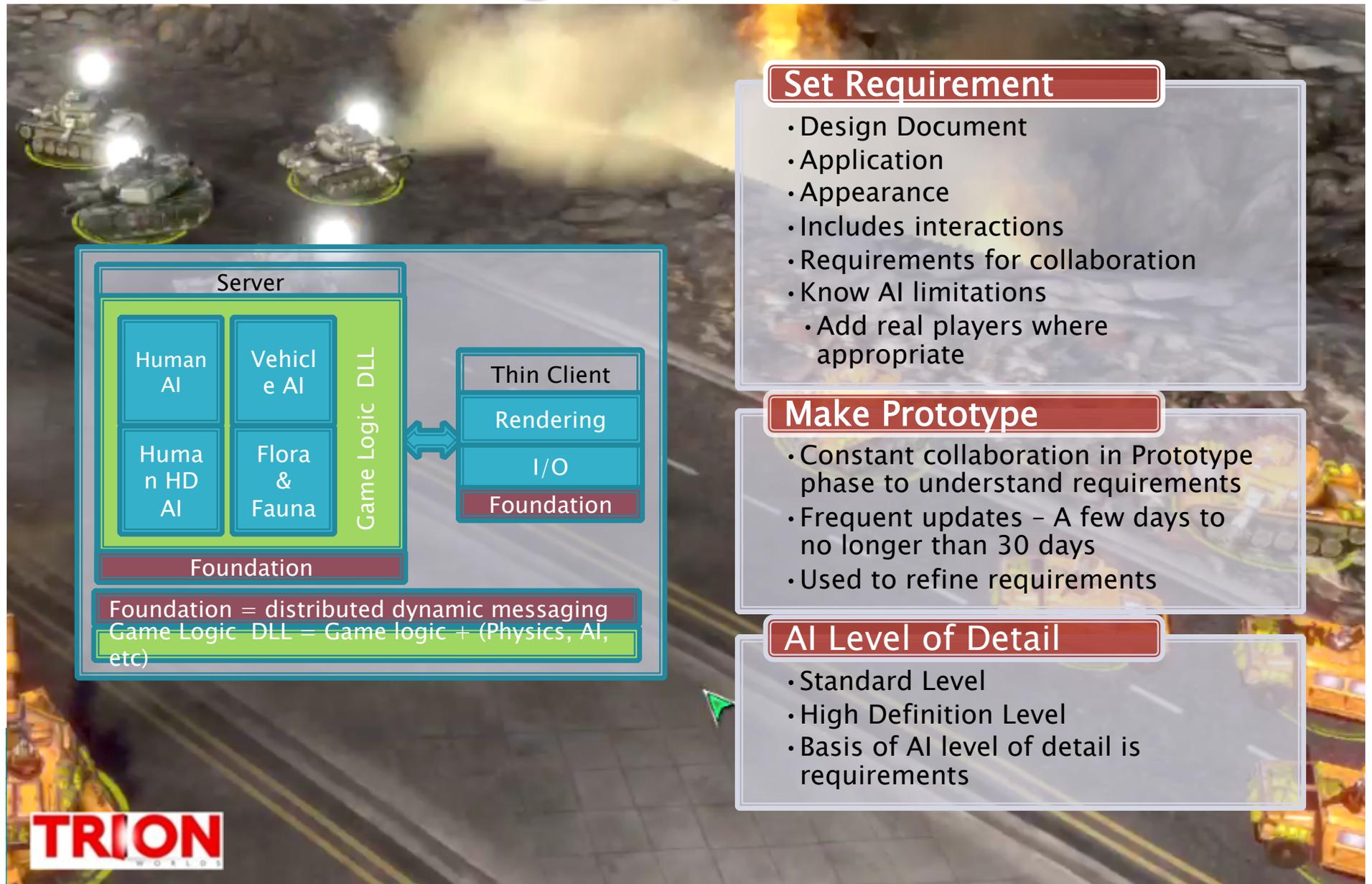
## Multiple Interactions between entities

- Human complexity
  - Non linear, non descript, vastly different people.
  - Tough to ever model accurately
  - Cultural diversity hard challenge
    - Many good AI simulators, need big change
- Physics easier than AI. AI is just good enough.





# Your AI thought process



## Set Requirement

- Design Document
- Application
- Appearance
- Includes interactions
- Requirements for collaboration
- Know AI limitations
  - Add real players where appropriate

## Make Prototype

- Constant collaboration in Prototype phase to understand requirements
- Frequent updates – A few days to no longer than 30 days
- Used to refine requirements

## AI Level of Detail

- Standard Level
- High Definition Level
- Basis of AI level of detail is requirements

Thank  
You!



**TRION**  
WORLDS

# Modeling complexity in Virtual Environments

LTG (R) Bob Wood  
U.S. Army

Federal Consortium for Virtual Worlds  
Conference  
National Defense University  
14 April 2010



# Changing Nature of Warfare and the Environment

We Will face Combination of Conventional and Irregular Warfare



## CONVENTIONAL

- State threat has not gone away
- Decisive military action still matters
- Legal/doctrine based
- Hierarchical



## HYBRID WARFARE

## IRREGULAR

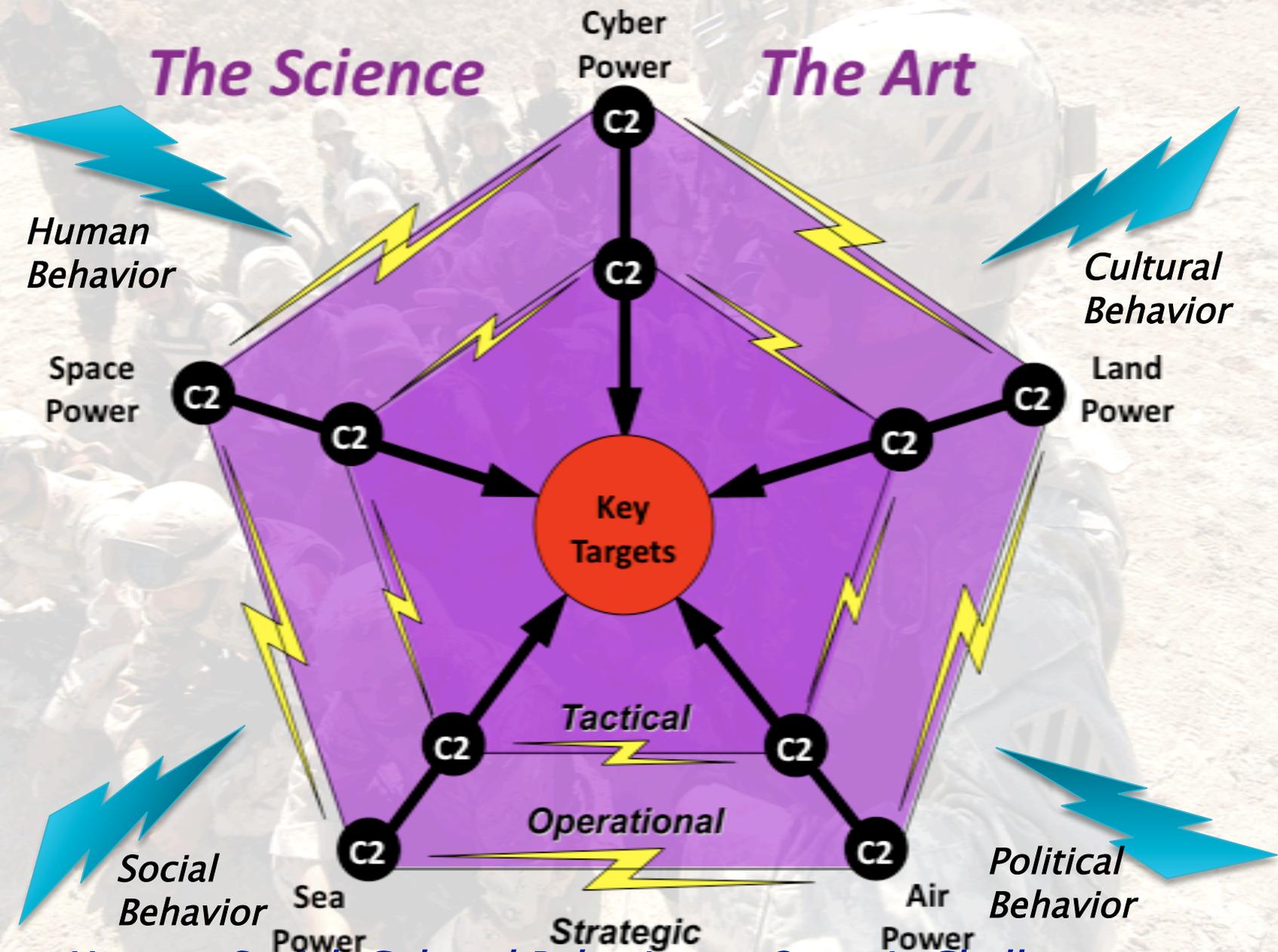
- Population base is key
- Seeks strategic effects through tactical action
- Attacks asymmetrically
- Does not follow rules of war
- Globally networked, cellular-based

## UNIQUE ASPECTS

- Individual goal is to kill and die
- Global aspirations, will and patience to achieve it

## ENVIRONMENT

- Increasing globalization and awareness of gap between haves and have nots
- Increased access to technology and weapons of mass destruction
- Increased empowerment of the individual



*Human, Social, Cultural Behavior – Organic Challenges to Deterministic Planning*

# An Organic Model

LINES OF INFLUENCE OR LINES OF ATTACK

LINES OF INFLUENCE OR LINES OF ATTACK



LINES OF INFLUENCE OR LINES OF ATTACK

LINES OF INFLUENCE OR LINES OF ATTACK

LINES OF INFLUENCE OR LINES OF ATTACK

# Desired Characteristics Within Defense Virtual Space

## Agent Characteristics

- Agility in Thought & Action
- Adaptive Red and Blue Force
- Finite Capacity
- Diverse Capabilities
- The Environment as Actor

## Virtual World Characteristics

- ✓ Whole of Government action is routinely accomplished
- ✓ All actions communicate intent, alter perceptions, form narrative
- ✓ Intelligence about culture, coalition, enemy, environment is key
- ✓ Act by, through, and with changing coalition partners
- ✓ New capabilities are quickly fielded and integrated



# Questions

- ▶ **Application** – what are the most important applications of agents in games and virtual worlds.
- ▶ **Appearance** – How important is the visual appearance of a character in a game or virtual world.
- ▶ **Functionality** – What are the most important facilities that an agent should have, and how detailed.. should they be?
- ▶ **Interactivity** – how essential is it to be able to interact with an agent? What is most important? Gesture, voice, text,.
- ▶ **Realism** – How far are we from having the Turing test agent? Do we really need that or do we just need enough realism to get by?

