



The Future Role of Computer Games

...from a game society, military and
academic perspective

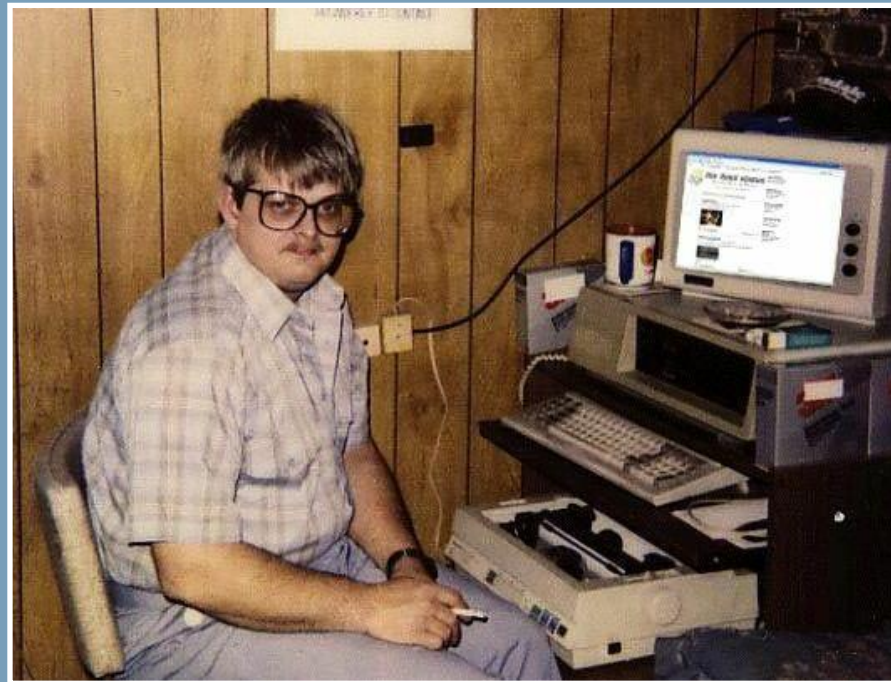
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- Computer Games for **training** and **entertainment**:
 - Computer Games and entertainment
the **game society** perspective
 - Computer Games and human training:
the **militarily** perspective
 - Computer Games and machine training:
the **academic** perspective
- The future role of computer games: **a unified view**

Computer Games and Entertainment

The Game Society Perspective



"Computer Games should be entertaining"

Computer Games and Entertainment

The graphical revolution



HEALTH 100

AMMO 6



Computer Games and Human Training

The Military Perspective



“Computer Games are suitable simulation environments for human training”

Computer Games and Human Training

Marine Doom



Computer Games and Human Training

America's Army



Opponent Artificial Intelligence

- “Game AI” not very smart
 - Simple (often static) rule-based systems
 - Game Society: “Game AI doesn’t have to be smart, it needs to be Entertaining!”
- “Academic AI” to the rescue!
 - Academics (AI researchers) are typically interested in designing truly (human-level) intelligent AI

The Academic Perspective



"Computer Games provide rich virtual worlds and are challenging test-beds for artificial intelligence research"

Complexity of Computer Games

- Decision complexity
- Uncertainty
- Multi-Agent
- Real-time decision making



- Promoting machine learning systems for Computer Games:
 - Bayesian Learning
 - Neural Networks
 - Case-based Reasoning
 - Genetic Algorithms
 - Reinforcement Learning
 - ...

Reinforcement Learning (RL)

- Learning task in RL: machines iteratively learn a **policy**, i.e., learn what **actions** in a given environmental **state** maximize a certain **reward** signal
- Interesting framework for Computer Games
 - Machines learn without explicit knowledge about the game dynamics (model-free)
 - Machines learn while game is being played

Reinforcement Learning in Computer Games



Reinforcement Learning in Maastricht

Ponsen, Spronck, and Tuyls (2006).
Hierarchical Reinforcement Learning in
Computer Games. ALAMAS'06



- Learn to navigate (move to goal while avoiding enemies)
- Simple task "solved" with low-level planning without knowledge

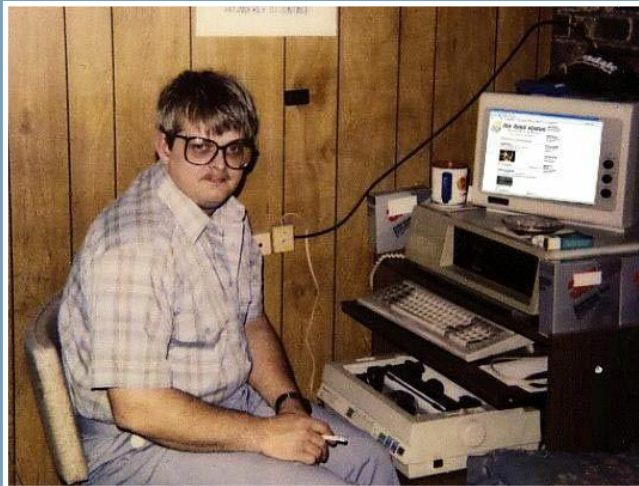
Ponsen, Spronck (2004). Improving
Adaptive Game AI with Evolutionary
Learning. CGAIDE'04



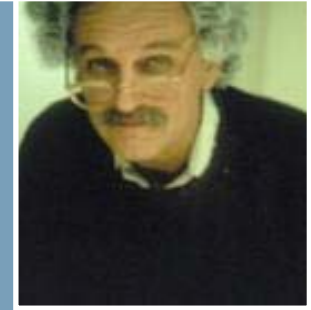
- Learn to win complete games
- Complex task "solved" with high-level planning with knowledge (evolved tactics)

Future Role of Computer Games: a Unified View

Academics will design truly intelligent machines that can be adequately put to the test in computer games



Computer Games



AI technology

Challenge Problems & Funds



Computer Games



The computer game society will continue to produce more realistic and entertaining games that will replace television and movies as a primary pass time for consumers



Military benefits from both: more realistic training environments and smarter AI technology (e.g., intelligent autonomous military systems)

Future or Present?

- DARPA's **Transfer Learning** project: focus on developing intelligent systems capable of applying knowledge or skills learned in previous tasks to novel tasks
- Transfer Learning capabilities mainly evaluated in Computer Games using **TIELT**: middleware tool for evaluating decision systems in (gaming) simulators

