



Multiagent Systems:

A distributed, bottom-up approach to solving complex problems

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January 7, 2013

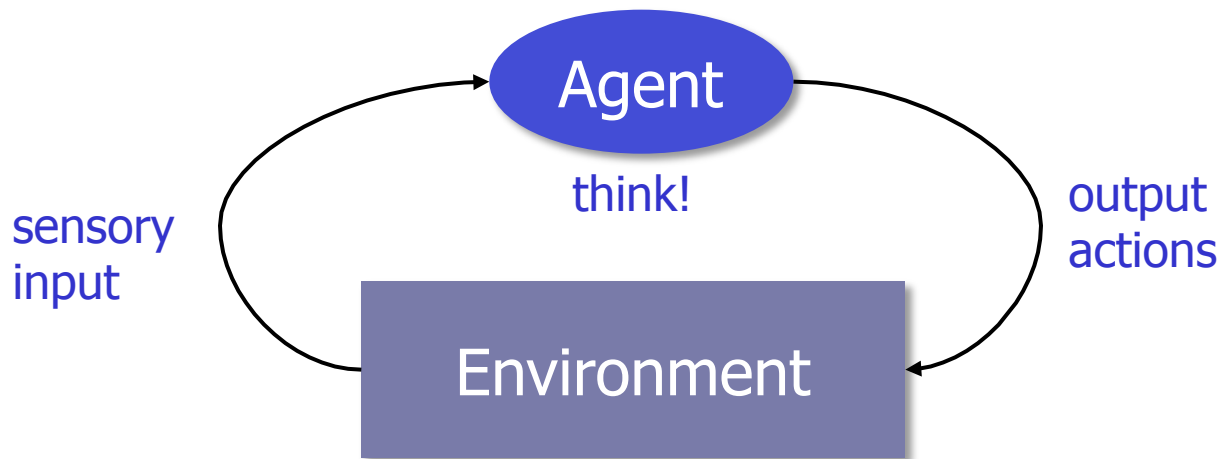
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A couple of episodes ... from Seinfeld

- <http://www.youtube.com/watch?v=e64nHicE1bY&feature=related>
- <http://www.youtube.com/watch?v=vZwnSrAvfrI>
 - 0:18 – 0:54

Agents

- What is an **agent**?
 - An agent is an entity that **takes sensory input from its environment, makes **autonomous** decisions, and carries out actions** that affect the environment
 - A thermostat is an agent
 - A calculator is *not* an agent



I think,
therefore I
am!



Intelligent Agents

- An intelligent agent is one that is capable of
 - flexible autonomous actions in order to meet its design objectives, where flexibility means:
 - Reactivity, Pro-activeness, and Social Ability
 - machine learning:

The acquisition of new knowledge and motor and cognitive skills and the incorporation of the acquired knowledge and skills in future system activities, provided that this acquisition and incorporation is conducted by the system itself and leads to an improvement in its performance.

Am I flexible?
Do I learn?



Am I
intelligent?

Complex Problems

- **Inaccessible** vs. **accessible**
 - Incomplete vs. complete data
- **Deterministic** vs. **non-deterministic**
 - Certainty vs. uncertainty
- **Episodic** vs. **non-episodic**
 - Each episode is independent or not
- **Static** vs. **dynamic**
 - Remain unchanged except by the performance of actions by the agent?
- **Discrete** vs. **continuous**
 - “Chess game” vs. “taxi driving”

There are too many scenarios to consider and some I don't even have a clue!



Why Agents?

- An agent-based solution is suitable if the problem is complex
- In other words, agents are used when you need to build a system that is adaptive to an uncertain, dynamic, and at times unexpected environment
 - So you can make full use of the **autonomous** property of an agent

Hmm ... Why do we hire an agent?



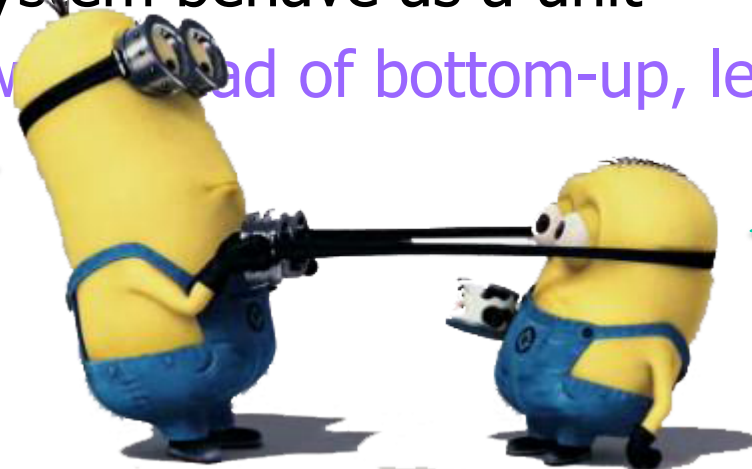
Multiagent Systems

- A multiagent system is a system where multiple agents perform a task better when working together
 - Interaction (communication)
 - Coordination and Collaboration (even via competition!)
 - Distribution of control and responsibilities
 - Customization, robustness, scalability
- Example: A group of basketball players who do not observe or communicate with each other is not a team—simply a group of individual agents.

To solve complex problems ...

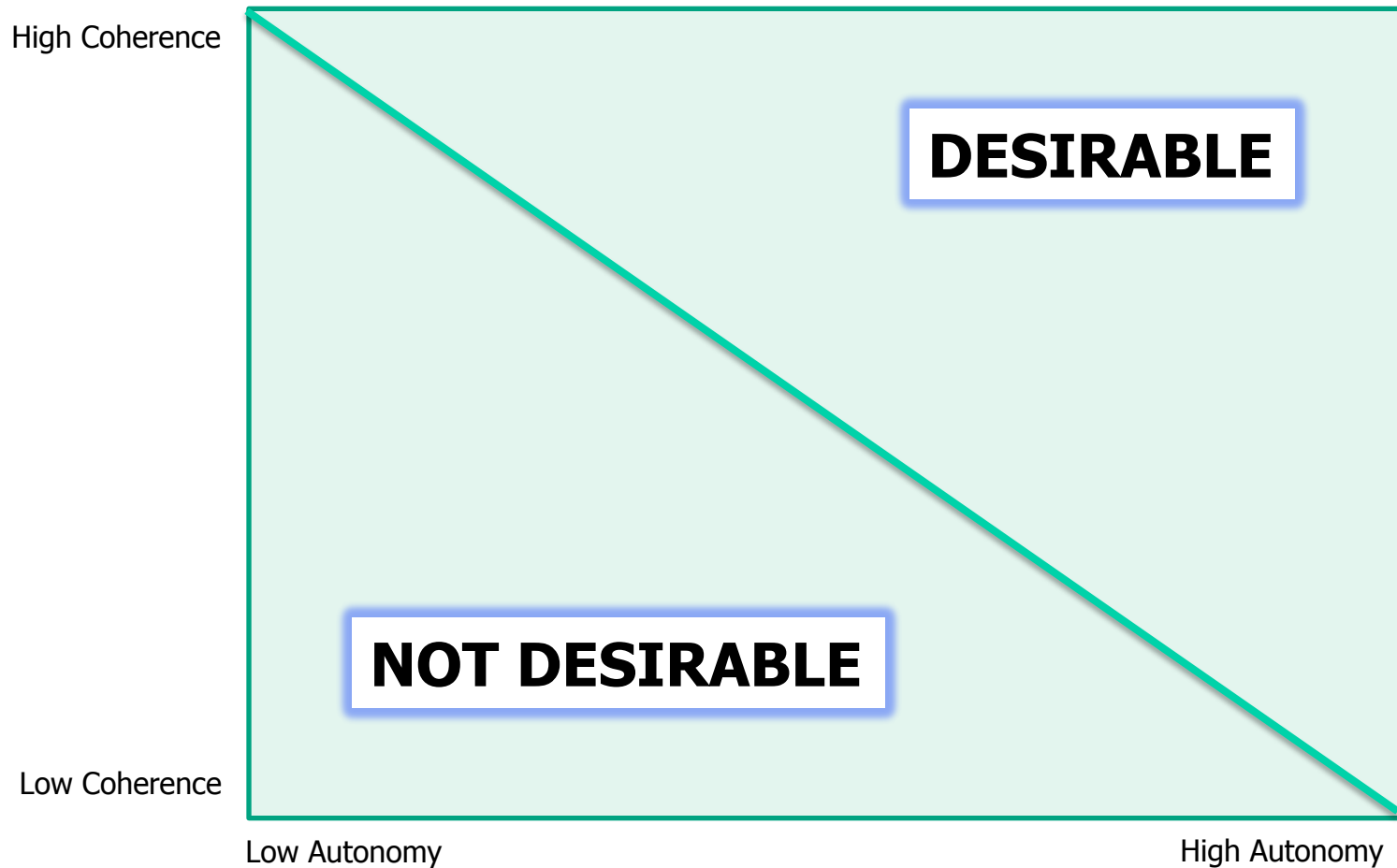
- Individual agents make **local** decisions with high autonomy to guarantee **efficient** solutions
 - Less reliant on other agents and no explicit global control
 - **BUT:** May lead to unexpected, “chaotic” results due to lack of coordination
- A multiagent system strives for **global coherence** to guarantee **effective** solutions
 - How well a system behave as a unit
 - **BUT:** top-down instead of bottom-up, less res

You do what I tell you to do!



But I know what I want and what to do!

Local Decisions vs. Global Coherence



My research ...

- **Computer-supported collaborative learning** agents collaborate on behalf of students
- **Smart grids** agents for power consumers
- **Ad hoc team formation** agents forming teams in disaster emergency response
- **Sensing and fusion** agents manage data and information
- **Intelligent user interfaces** agents model users, customize services to support team formation and goal accomplishment

Research funded by the National Science Foundation (NSF): DMI-0441249, ESI-0513405, IIS-0632642, DBI-0743783, CNS-0829647, SES-1132015, SBES-1228937, a NSF Graduate Research Fellowship grant, and Microsoft Research

Credit and References

- Minion Pictures

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