

Artificial intelligence and robots

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Plan for today

- Beginning of robotics
- Beginning of AI
- Problems
- Solutions
- Revival of intelligent robotics
- RoboCup
- Other initiatives

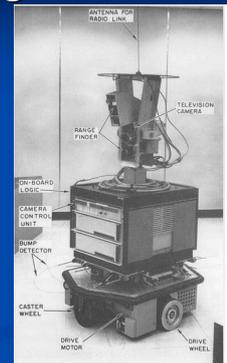
Beginning of robotics

- Rossum Universal Robots (RUR): Karel Capek
- Cybernetics: Norbert Wiener
- Turtles: Grey Walters

Autonomy

Beginning of AI

- Dartmouth 1956
- Sensing
Thinking
Acting
- SRI Shakey 1969
- Lots of others

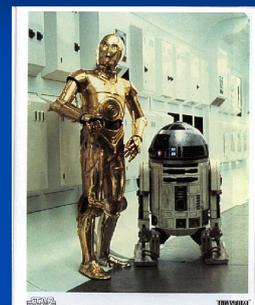


Flakey, SRI



Why don't we build "real" robots?

- Mechanics
- Sensing
- Control and actuation
- Intelligence



Solutions

- Distribution of tasks
- Layered, hierarchical control
- Hybrid nature of control
- Faster computers
- Anytime algorithms (better to do anything than to do nothing)
- Reasoning needs not to be perfect

Kismet - emotions



Kismet - emotional expressions



What is artificial intelligence

- Models of human intelligence
- Artificial intelligent creatures

Robocup - robot football



Humanoids play football as well



Aibo play football



RoboCup

- FOOTBALL
- Simulation
- Small size
- Medium size
- Humanoid
- Four-legged
- RESCUE
- Simulation
- Robots
- Humanoid
- RC Junior
- Other contests: FIRA

More RoboCup



More humanoids

Impressions of IJCAI'05

Vadim Bulitko



Problems

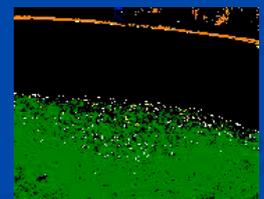
- Kids easily learn to see or to go
- Kids learn abstract ideas much later (playing chess, using a map, ...)
- Robots (computers) have no problems with the latter ...



Seeing is hard



- Find five positions on the field



- What do I really see?

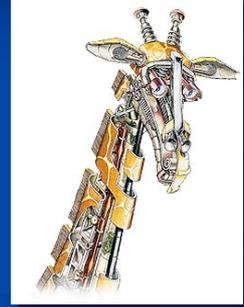
Seeing is hard, part 2



- Find the b/w ball and score a goal

Can AI exist at all?

- Can intelligence be artificial?
 - The Chinese room argument
- Can life be artificial?
 - At least there are people claiming they do research on that topic!



Rodney Brooks MIT AI Laboratory

Roughly every fifty years humanity solves a great mystery of science. We have a chance to solve such a mystery now:

How does the human mind work?

There are many corollary questions:

Brooks' questions:

- Where does the mind reside?
- What is the nature of memory?
- What are the roles of emotions?
- What sort of representations does the brain use?
- What does our visual system compute?
- How did evolution shape us?
- How do we learn?
- What is consciousness?

Keys to intelligence:

- self-adapting perceptual systems, motor systems and language-related modules
- (in contrast to reasoning, planning and knowledge representation)

What is intelligence?



- Can an ant colony be intelligent?
- Warrior ants
 - > 500 000 ants / colony
 - Temperature control
 - Raids with 200 000 workers
 - Less than 100 000 neurons!

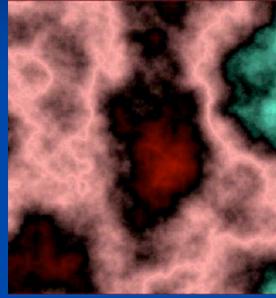
Collective intelligence

- A single ant is not intelligent
- A system: more than sum of its parts
- How about brain?
- How about artificial systems?
- Have we chosen the wrong way?



Chaos and intelligence

- Ant colonies are slightly chaotic
- Does intelligence require chaos?
 - Creativity involves randomness
- A chaotic mind in a stable world?
 - Can we manage in chaotic world?



Low-cost robotics

- Multitude of cheap platforms
- Possibility to work with groups of robots
- RoboCup
- LEGO technology
- BASIC-stamp-based systems
- ...