PURDUE CS47100

INTRODUCTION TO AI

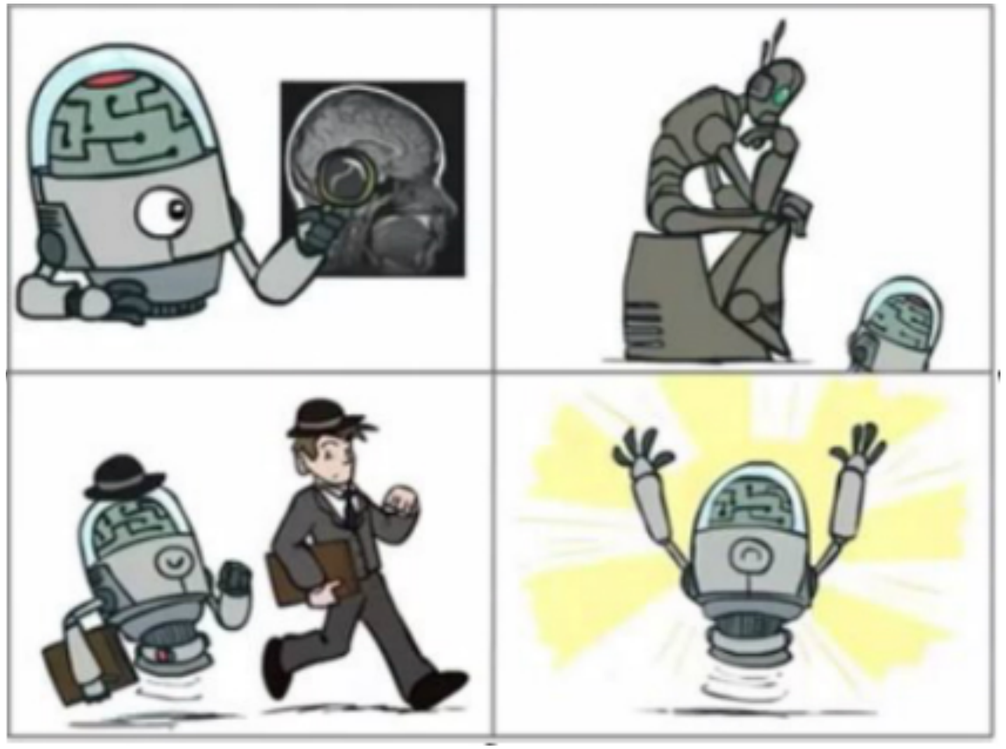
ANNOUNCEMENTS

- Programming assignments will use the Berkeley Pacman project
  - You need to be very familiar with Python programming!
- Slides are posted to BrightSpace: Content->Slides
- Videos are posted to BrightSpace: Content->Course videos

WHAT IS ARTIFICIAL INTELLIGENCE?

The science of making machines intelligent by making machines…

Think humanly



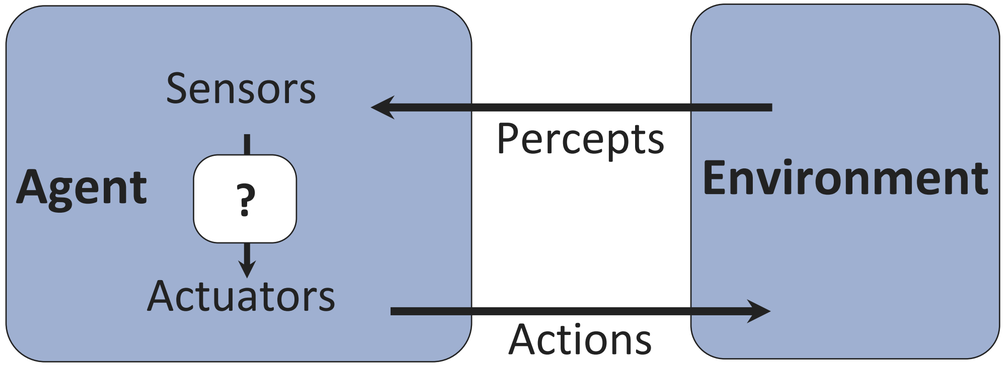
Think rationally

Act humanly

Act rationally

Construct rational agents that can perceive and act to achieve their goals, given their beliefs

AI AS AN AGENT



- An agent ***perceives*** its environment through ***sensors*** and ***acts*** upon it through ***actuators***
- The ***agent function*** maps percept sequences to actions
- It is generated by an ***agent program*** running on a ***machine***

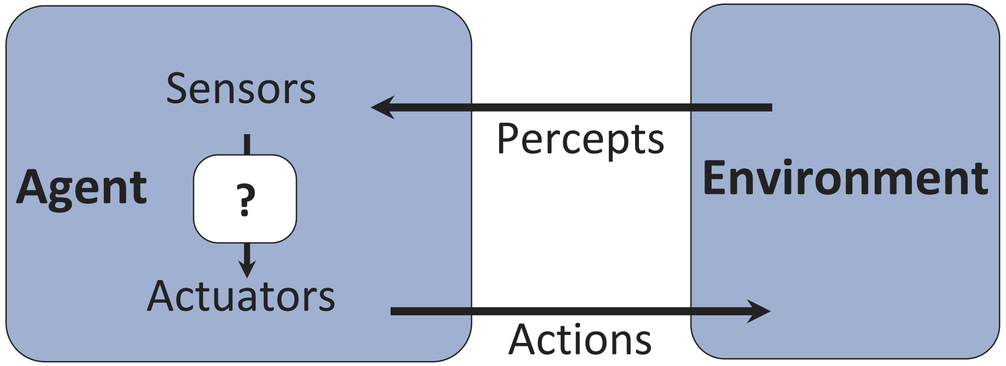
SPECIFY THE TASK ENVIRONMENT: PEAS

- **P**erformance measures: How desirable is the sequence of environments the agent has experienced?
- **E**nvironment: What are the key elements in the surroundings of the agent that can influence the agent?
- **A**ctuators: What allows the agent to take actions?
- **S**ensors: What allows the agent to perceive its surroundings?

AUTOMATED TAXI: PEAS

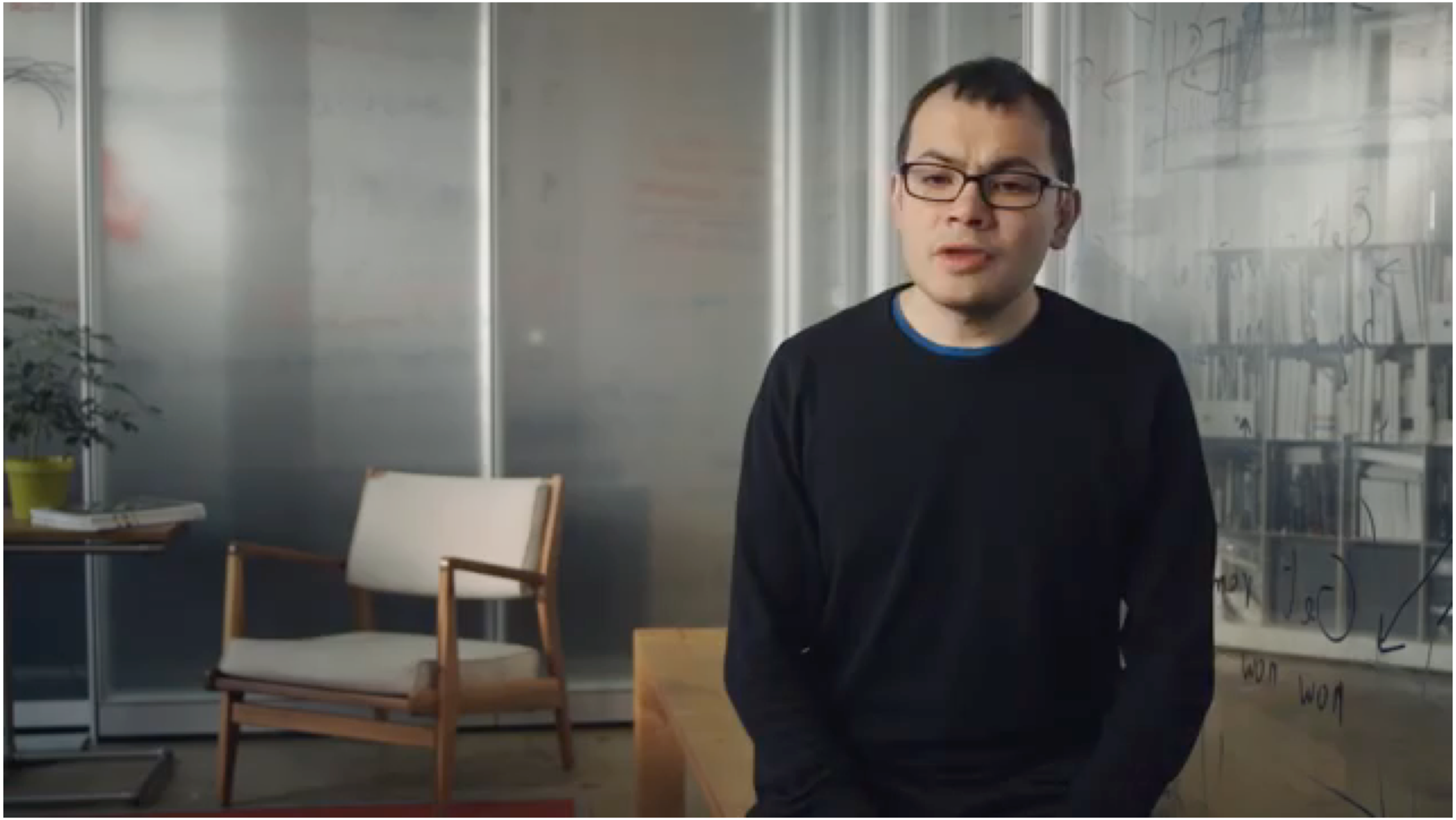
- Performance measures:
  - Arrive at destination safely, fast, comfortably, profit maximizing
- Environment:
  - Streets, other traffic, customers, weather, police, pedestrians…
- Actuators:
  - Steering, break, gas, display/speaker…
- Sensors
  - Cameras, radar, speedometer, GPS, engine sensors…

WHAT IS A RATIONAL AGENT?



For each possible percept sequence, a rational agent should select an action **that is expected to maximize its performance measure**, given the evidence provided by the ***percept sequence*** and whatever ***built-in knowledge the agent has about the environment***.

DESIGNING AGENT TO PLAY GAMES



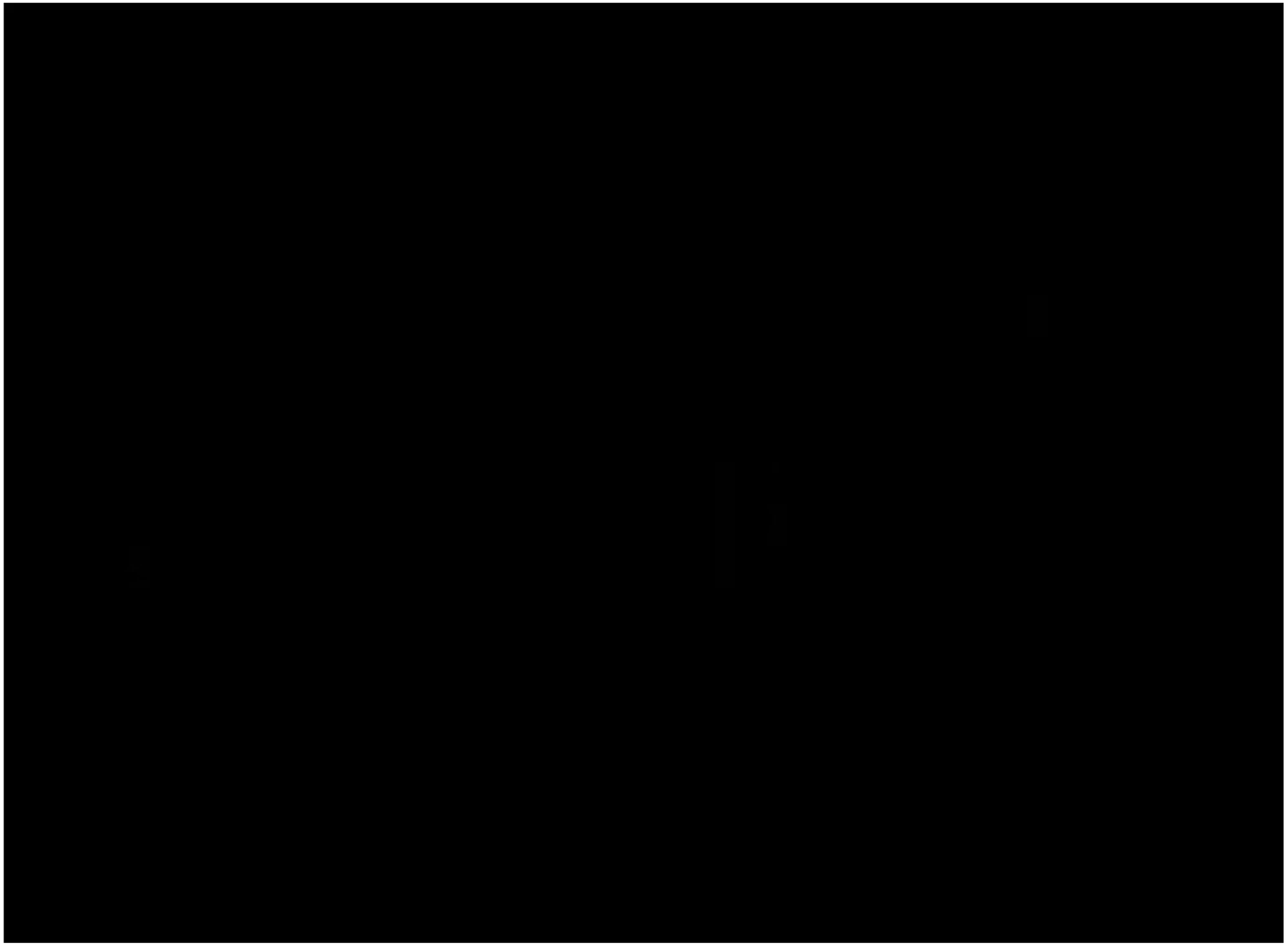
DESIGNING AGENT TO PLAY GAMES: ENVIRONMENT CHARACTERISTICS

- **Fully observable:** the agent's sensors give it access to the complete state of the environment at any point in time
- **Multi-agent:** there are two agents in the game (the AI agent and its opponent)
- **Deterministic:** the next state of the environment is completely determined by the current state and the action executed by the agent
- **Static:** the environment itself does not change with the passage of time
- **Discrete:** the environment has a discrete set of precepts and actions
- **Known:** the rule underlying the environment's evolvement is known

DESIGNING AGENT TO PLAY GAMES: ALGORITHM COMPONENTS

- Representation of the state of the environment
- Set of actions available
- Planning the agent's possible actions
- Reasoning about opponent's possible actions
- How to choose between actions?

DESIGNING AUTONOMOUS ROBOTS/CARS



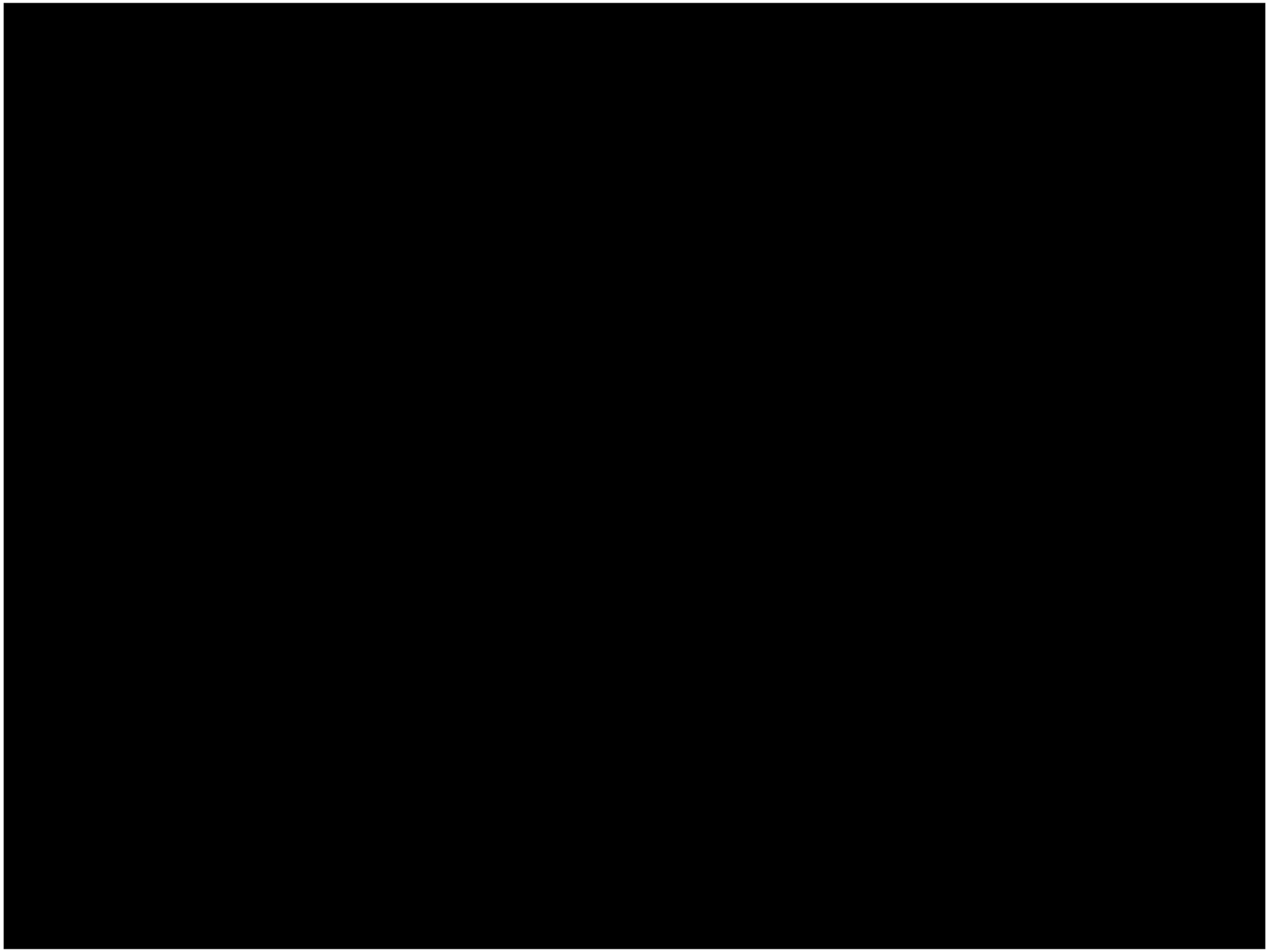
ENVIRONMENT CHARACTERISTICS: HOW IS SOCCER DIFFERENT FROM CHESS?

- **Fully observable?** Partially observable!
- **Multi-agent?** More than two agents!
- **Deterministic?** Stochastic!
- **Static?** Can be dynamic!
- **Discrete?** Continuous!
- **Known?** Can be unknown!

DESIGNING AUTONOMOUS ROBOTS/CARS: ALGORITHM COMPONENTS

- Representation of the state of the environment ***based on incomplete observations***
- Set of actions ***and associated outcomes***
- Planning sequences of actions ***with limited horizon***
- Reasoning about ***multiple*** opponents actions
- How to choose between actions and ***learn to act in new (unseen) situations***

DESIGNING AGENT FOR SPEECH SYNTHESIS

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ENVIRONMENT CHARACTERISTICS: HOW IS SPEECH SYNTHESIS DIFFERENT FROM GAME PLAYING?

- Fully observable?
- Multi-agent? Single agent!
- Deterministic?
- Static? Can be dynamic!
- Discrete?
- Known?

DESIGNING AGENT TO SYNTHESIZE SPEECH: ALGORITHM COMPONENTS

- Representation of the state of the environment, ***including the prior knowledge about it***
- Set of actions (e.g., pronunciations)
- No reasoning about opponents or effects of actions
- Need to choose between actions
  - How to choose?
  - Generalize to new situations?