



# Where are We?

- Programming Assignments
  - scripting
  - scripting with goal analysis
  - rule-based programming
    - simple game
    - setting with multiple tasks/goals ('Tofu Deathmatch')



# Where are We?

- What do all the approaches have in common?
  - We took an animat approach
    - reactive
    - only window to the world in through the “senses” – no access to the total global game state.
    - *embodiment*



# Where are We?

- Reactive Behavior
  - reflexive behavior – take current sensory input and mapping it to behavior without spending much time thinking about *optimality*.
- Embodiment
  - self-contained entities incorporating sensory input, behavior generating, and behavior effecting subsystems to act intelligently\*

\* P. M. Todd, "The animat approach to intelligent behavior," *Computer*, vol. 25, pp. 78-81, 1992.



# Searching and Planning

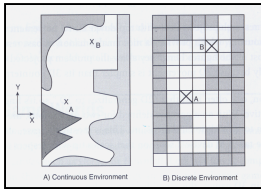
- Instead of taking an animat approach we will take a more traditional AI approach:
  - total access to game state
  - identify a global goal
  - search for the *optimal* way to achieve this goal
  - plan a sequence of actions to satisfy this goal



# Planning & Navigation

- Basic assumptions

- we are given a global navigation target
- we have knowledge of the global layout of our environment
- the environment is given in a discrete representation (so far we have only considered continuous representations)



- Goal

- given our current location and given the location of our navigation target
- search for an optimal path to reach this target
- plan the actions necessary to travel from our current location to the desired target
- respect obstacles!



Diagram illustrating a 512x512 tick environment. The environment is a square grid with a total size of 512 ticks. A starting point is marked with a red square and a blue arrow. A navigation target is marked with a green square and an 'X'. The environment contains several obstacles represented by black rectangles. A label '64x64 ticks' points to a small square region in the top-left corner. A label 'Starting Point' points to the red square. A label 'Navigation Target' points to the green square. A bracket on the right side indicates the total size of the environment is 512 ticks.

A 10x10 grid world environment. The environment contains several obstacles represented by black rectangles: a vertical bar at column 3 (rows 4-8), a horizontal bar at row 3 (column 4 to 8), a horizontal bar at row 6 (column 5 to 8), and a horizontal bar at row 9 (column 1 to 3). A red square with a right-pointing arrow is located at (1, 4), representing the start state. A green square with an 'X' is located at (6, 5), representing the goal state. An orange line indicates a path from the start state to the goal state, passing through (2, 4), (2, 5), (3, 5), (3, 6), (4, 6), (4, 7), (5, 7), (5, 8), and (6, 8). A blue line segment is at the bottom left, and a green line segment is at the bottom center.

## A\* Pathfinding Algorithm