Game AI!

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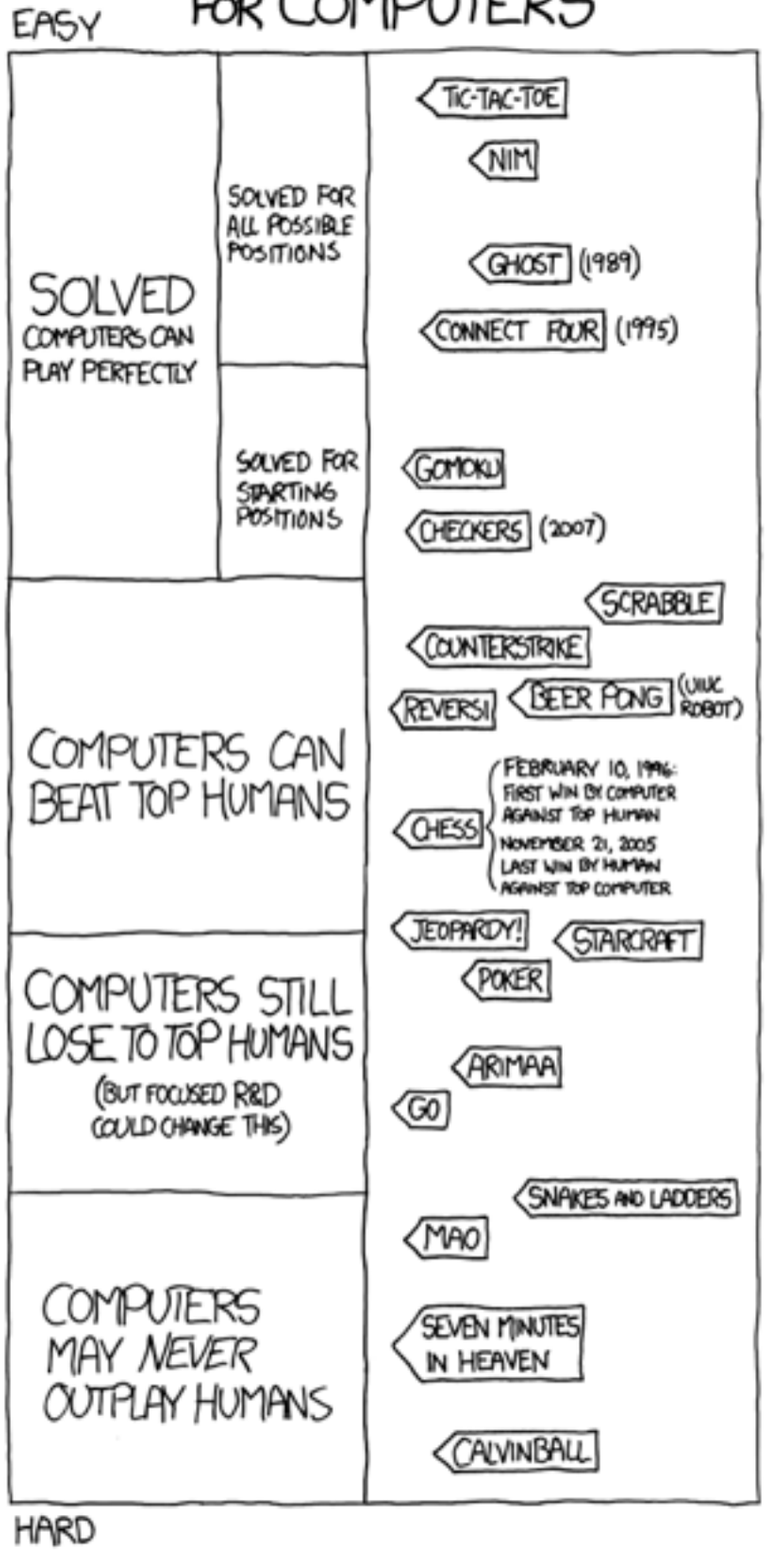
What is AI?

- Getting a computer to do something that a “reasonable person” would think requires intelligence.

DIFFICULTY OF VARIOUS GAMES FOR COMPUTERS



Is Game AI this? (No.)

- AI in games
- John Laird and Michael van Lent (2000): Games are perfect test-beds for “human level” AI
- AI should play games as if human
  - Vision
  - Decision making in real-time
  - Handling uncertainty
  - Learning
  - Opponent modeling
- These are hard problems that can be solved in very general ways
- Some are directly relevant to computer game dev.

Us vs. Them (Academic vs Game AI)

- Resource limits
- Fun vs. smart: goal is not always to beat the player
- Optimal/rational is rarely the right thing to do

Then, what is Game AI?

- AI for games
- Ways in which AI can—and is used to—enhance game play experiences
- In the game development industry, AI is the set of tricks and techniques to bring about a particular game design
- “Game AI is game design”

So, Game AI is...

- How a game design can be brought into existence through the application of algorithms that are often thought of as intelligent
- About making the entities/opponents/agents/companions/etc. in games appear intelligent
  - Illusion of life
  - Believable agents/characters

Goals. AI vs Game AI

- AI:
  - Think like a human
  - Act like a human
  - Think rationally
  - Act rationally
- Game AI:
  - To support the player's experience in a game
  - Make game entities "look smart" to the player

(NOT) The Goal of Game AI

- http://www.youtube.com/watch?v=VHulOnbZpvQ
- http://www.youtube.com/watch?v=ojQ3GBYikkk
- http://www.youtube.com/watch?v=EEOTtUlx7fQ

The actual goals of Game AI

- Defeat the player
- Make non-player characters (NPCs)—opponents, companions, etc.—look convincing
  - Believable characters
- Make game more enjoyable
- Play like a human
  - Unreal 2K Bot tournament

Why use AI in games?

- Automation—because you need other people to do things, but don't always have those people
- Opponents
- Companions
- NPCs (shopkeepers, farmers, villains, background)
- Fancy Stuff!
  - Level designer
  - Dungeon master
  - Plot writer
  - Game designer

The secret to Game AI

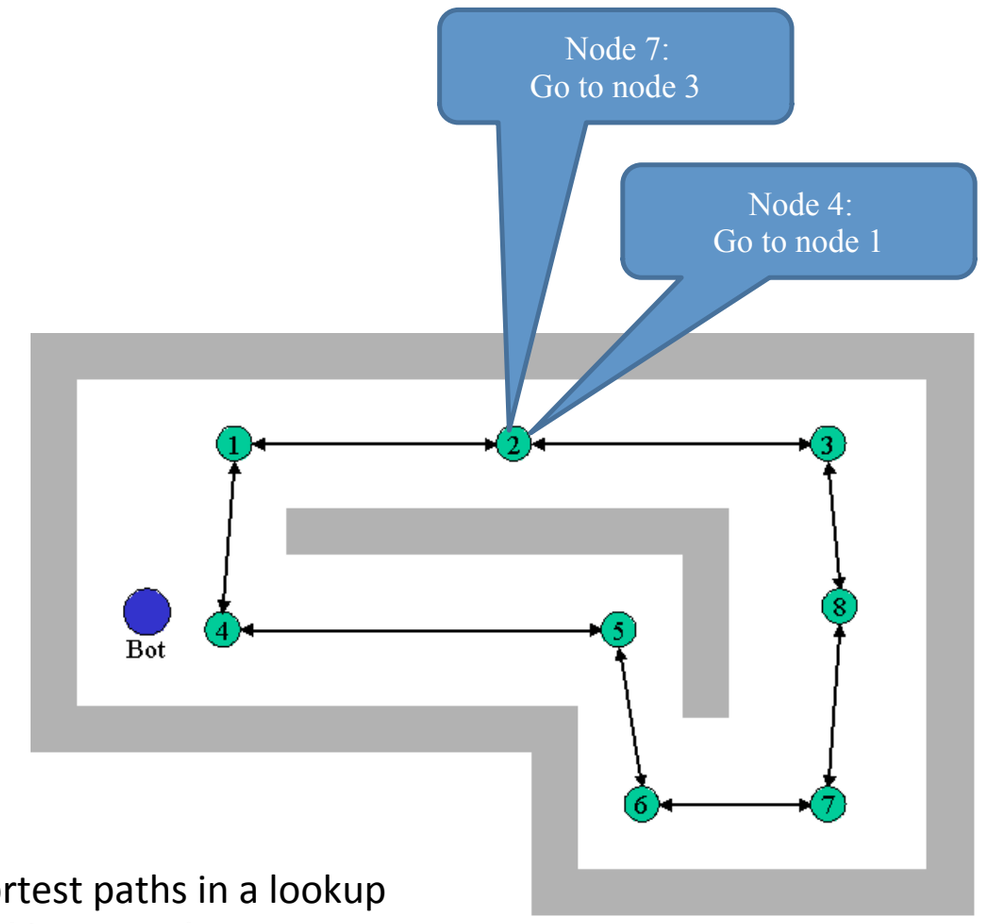
HACKING!

Common AI Tricks

- Move before firing – no cheap shots
- Be visible
- Have horrible aim (being Rambo is fun)
- Miss the first time
- Warn the player
- Attack “kung fu” style
- Tell the player what you are doing (especially companions)
- React to own mistakes
- Pull back at the last minute
- Intentional vulnerabilities or predictable patterns

Techniques : Pathfinding

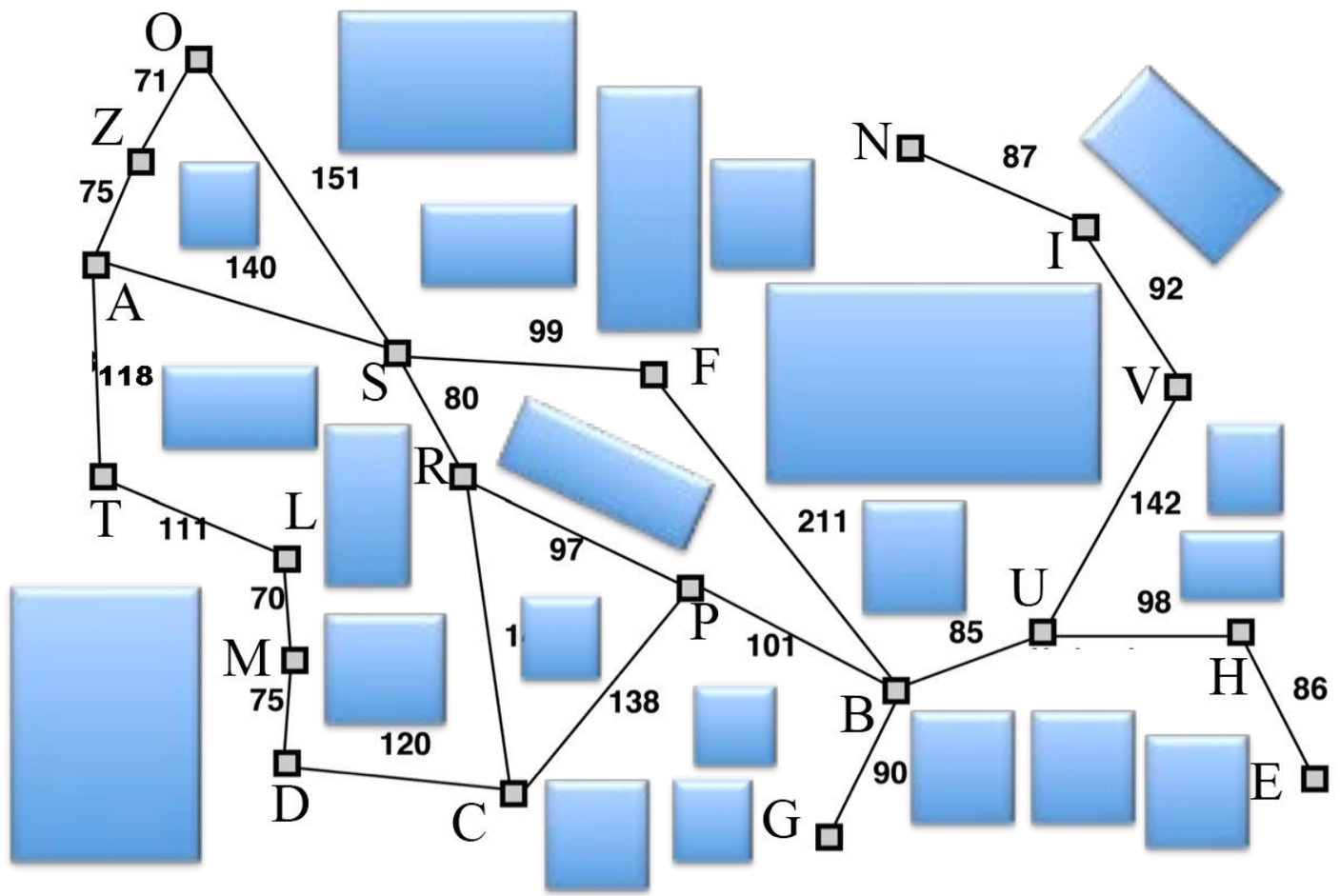
Pre-compute



* Store all pairs shortest paths in a lookup table when the level is created.

Techniques: Pathfinding

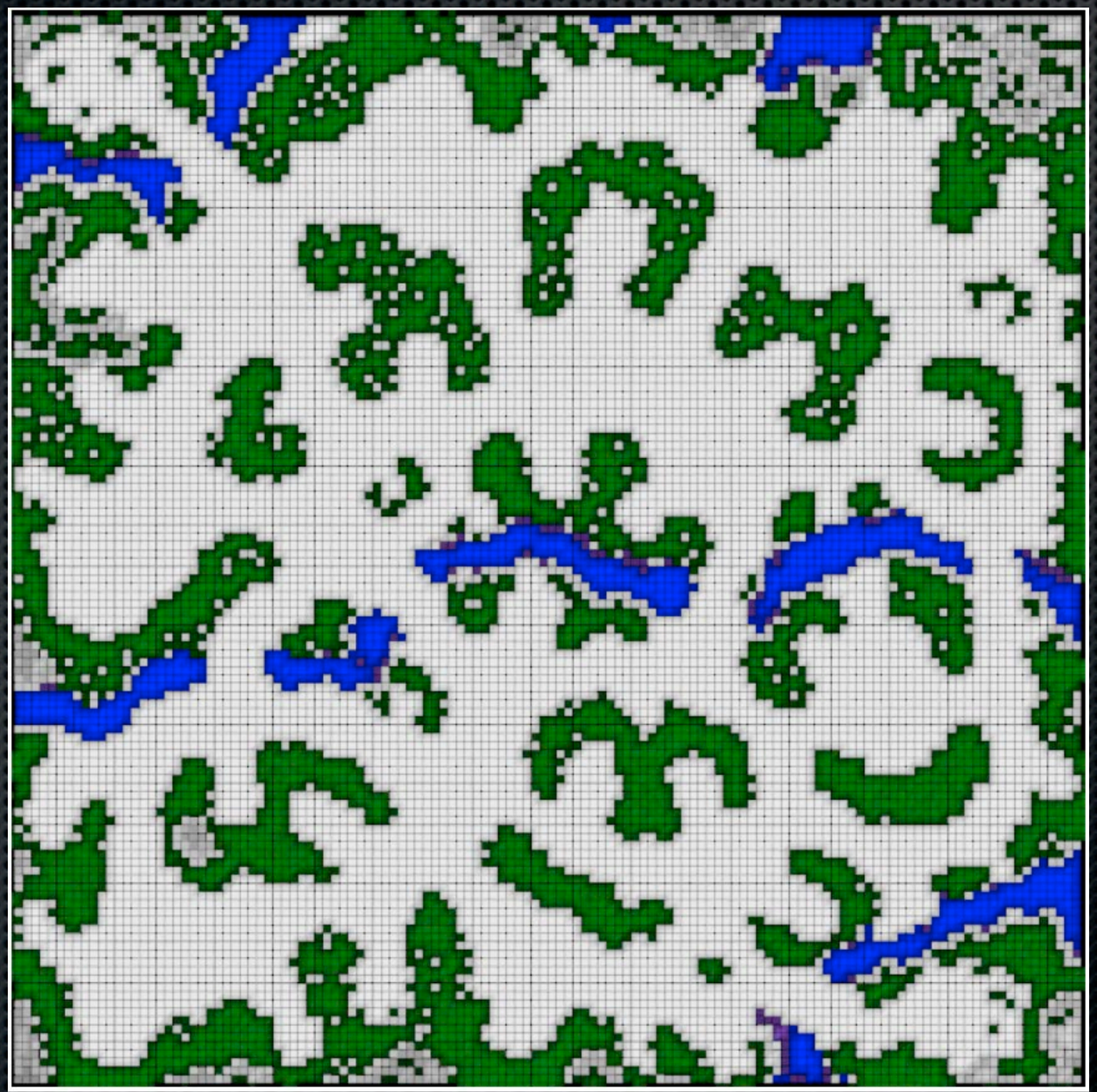
A	366
B	0
C	160
D	242
E	161
F	176
G	77
H	151
I	226
L	244
M	241
N	234
O	380
P	100
S	253
T	329
U	80
V	199
Z	374



Techniques: A*/Heuristics

- Find best path from a single source to a single destination
- State space: set of all states, and neighbor relations
- Heuristic function:
  - We have some knowledge about how far away any given state from the goal, in terms of operation cost
  - For navigation: Euclidean distance(?)
- Search, probably A*
- Advantage: Navigation network can change
- Non-admissible heuristics give designer control

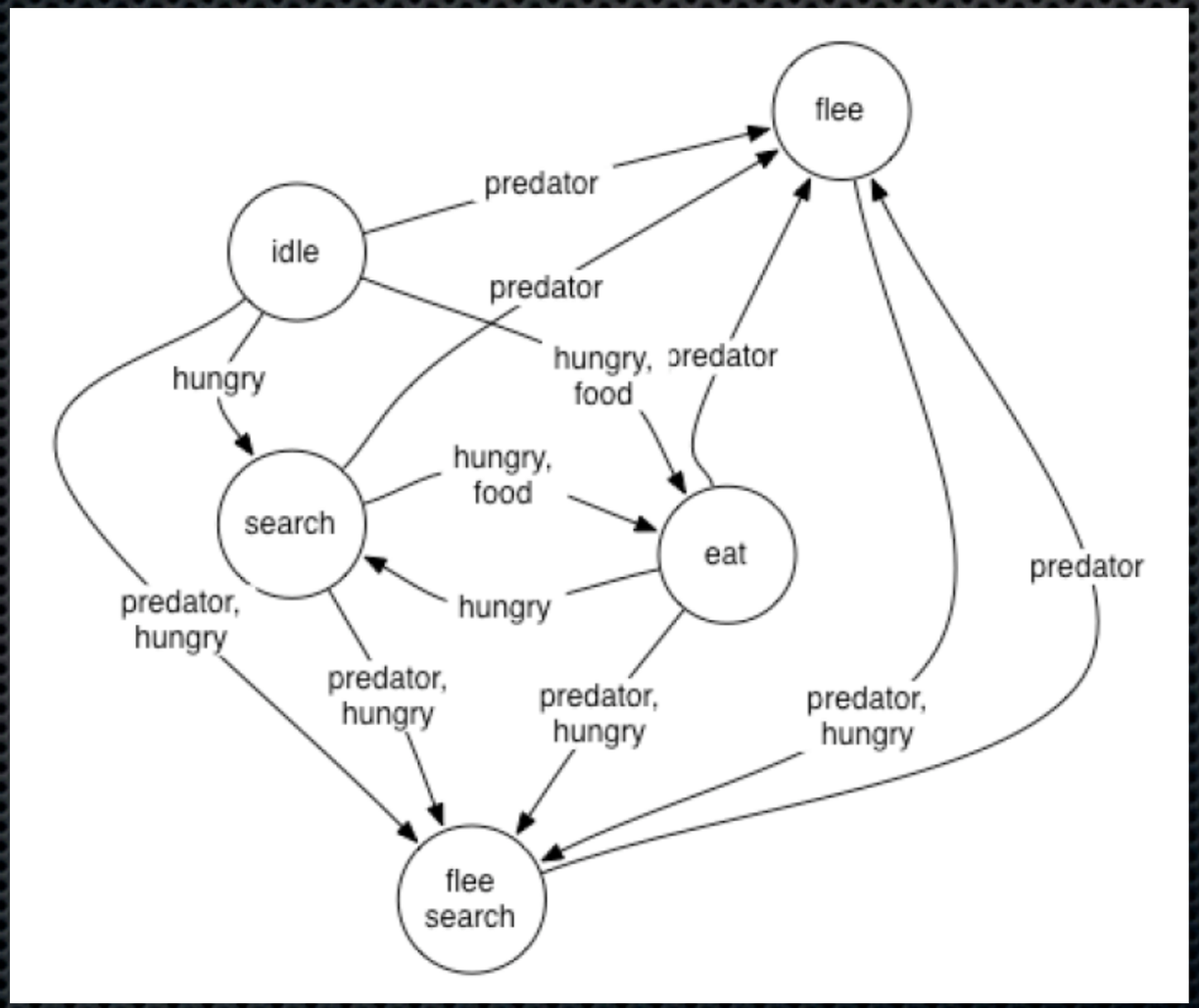
Techniques: Pathfinding



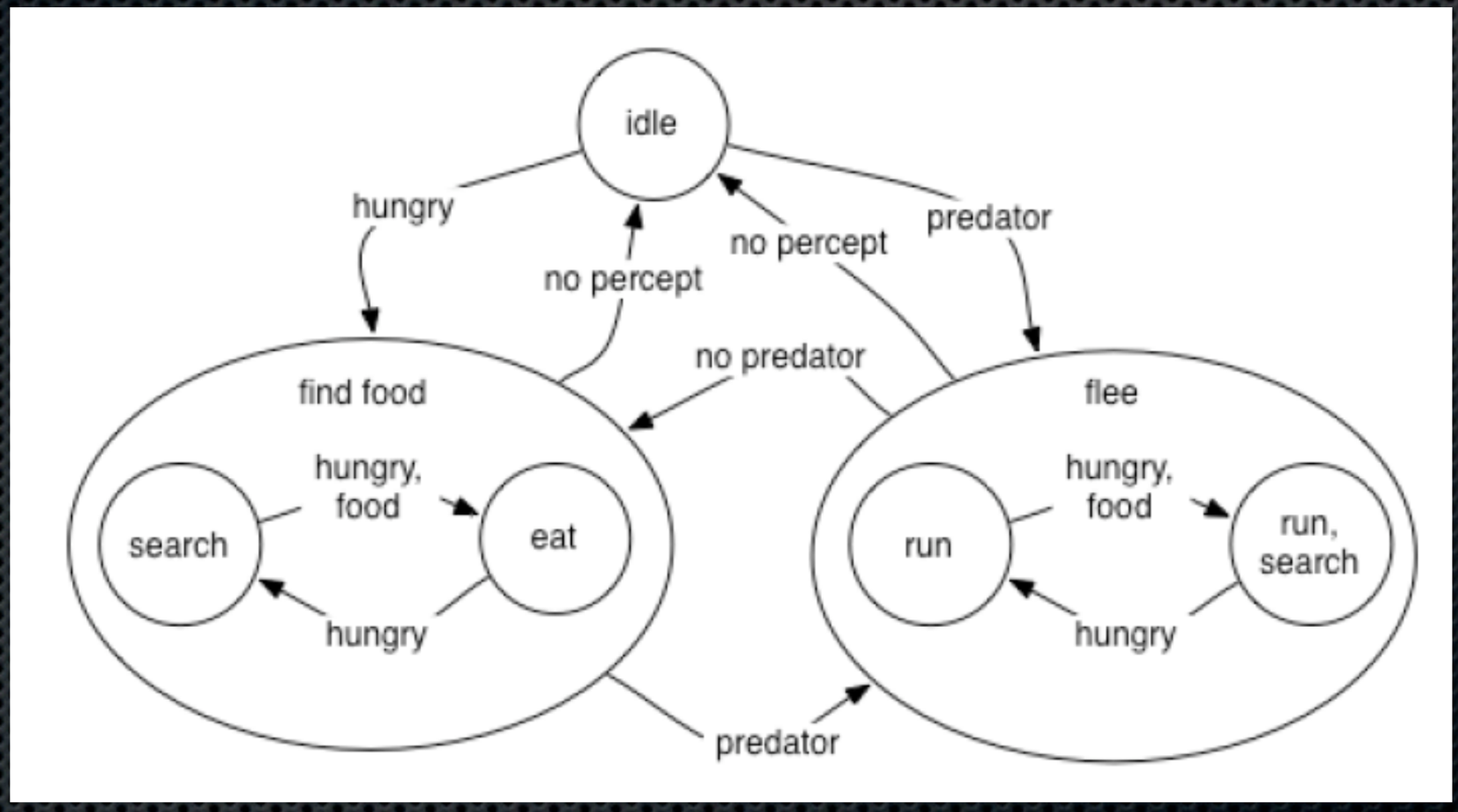
Techniques: Decision Making

- Classic AI: making the optimal choice of action (given what is known or is knowable at the time) that maximizes the chance of achieving a goal or receiving a reward (or minimizes penalty/cost)
- Game AI: choosing the right goal/behavior/animation to support the experience
- Decision-making must connect directly to animation so player can see the results of decision-making directly (explainable AI)
  - What animation do I play now?
  - Where should I move?

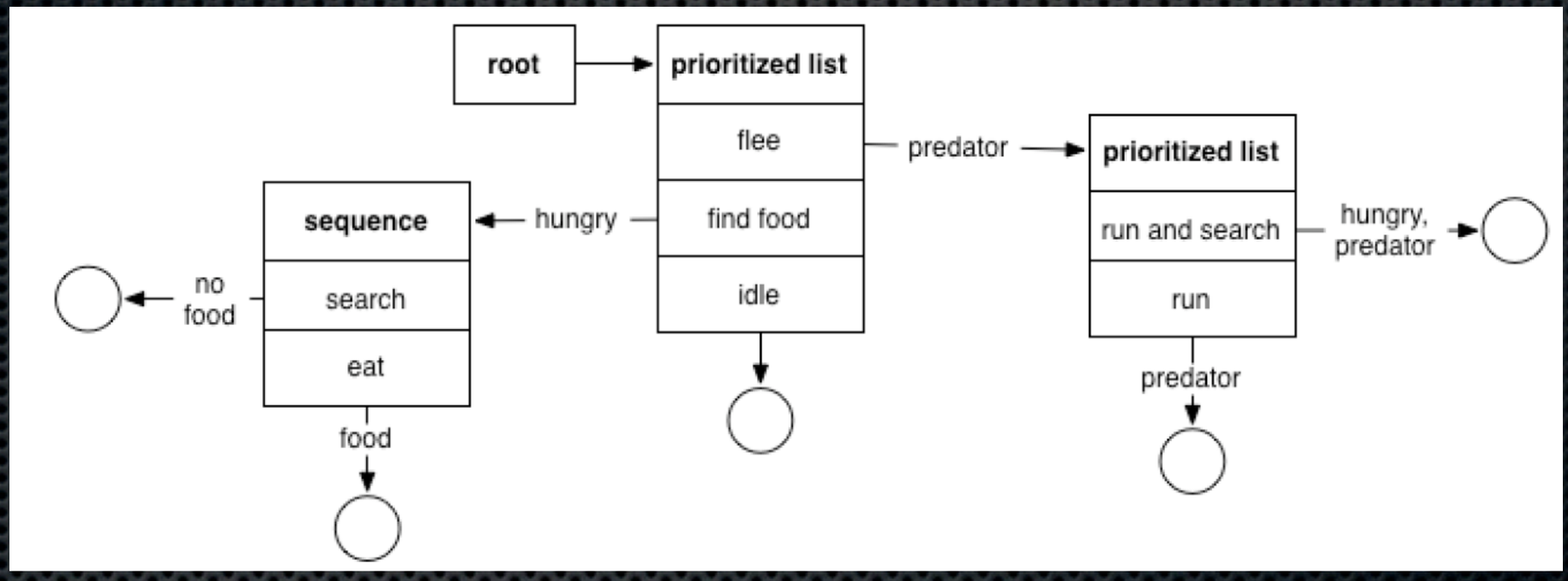
Techniques: Decision Making



Techniques: Decision Making



Techniques: Decision Making



Techniques: Planning

- Motivation: more realism
  - Agents should be motivated by goals
- FSM vs. planning
  - FSM tells the agent what to do
  - With planning, agent is given a goal and figures out what to do

Techniques: Planning

- Decouple goals and actions
  - Can create new character types (mimes vs. mutants)
  - State machines become unmanageable by design team
- Dynamic problem solving
  - Ability to re-plan when failure occurs

Examples

- http://www.youtube.com/watch?v=0s3d1LfjWCI&feature=fvwrel
- http://www.youtube.com/watch?v=V06nEHw70b4

Techniques : PCG

- AI Can also help make the design of the game better.
  - Automated/Assisted Level Generation
  - Dynamic Difficulty Adjustment
  - Quest Generation

Techniques: PCG

- Player modeling of inputs and responses can lead to a tailored gameplay experience.
- Using PCG techniques on level generation might create more interesting levels, customized levels too.
- Story generation can lead to interesting new quests.
- Using PCG can increase replay value greatly.

Techniques: PCG

- Risky!
- Content can be really random if not controlled enough.
- Algorithms can crash or not find any solution.
- Meaningless content. (i.e really stupid side-quests)

Techniques: PCG

- The biggest hurdle: Evaluation.
- Optimality vs Performance. (Non trivial tasks are NP-Hard)

Examples!

- http://www.youtube.com/watch?v=FR9xI0GgrBY
- http://www.youtube.com/watch?v=lowW0HyZhTg

Other uses of AI in Games

- Social Simulations
- Emotional Modeling
- Interactive Storytelling / Drama Management
- Dialogue Generation