ARTIFICIAL INTELLIGENCE 4 GAMES

DAVID R. WINER

FEBRUARY 8 2018

UPDATES

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- IDA* (variant of A*)
- Division Schemes
- Hierarchical Pathfinding
- *Getting Started: Behavior Trees*

COURSE CONTENT

AI for games:

- AI Methods
  - *Ad-Hoc Behavior Authoring (FSMs, Behavior Trees, Utility, Decision Tree)*
  - *Steering Behavior (seek, arrive, align, wander, pursue, pathfollow)*
  - *Tree* Search (*Dijkstra, A*,* **Division Schemes**, Minimax, MCTS)
  - Planning (STRIPS, HSP, POP, HTNs)
  - Learning (Evolutionary, Supervised, Unsupervised, Reinforcement)
- Ways of using AI in games
  - Playing games
  - Generating content
  - Modeling players

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Admissible heuristics are ones that always underestimate (and therefore are optimal)

https://www.youtube.com/watch?v=g024lzsknDo
https://www.youtube.com/watch?v=X3x7BlLgS-4

A* HEURISTIC ON HEXAGONAL GRID

https://www.redblobgames.com/grids/hexagons/#distances

https://github.com/pgeerkens/HexGridUtilitiesForGames

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Increment depth to 2, and repeat

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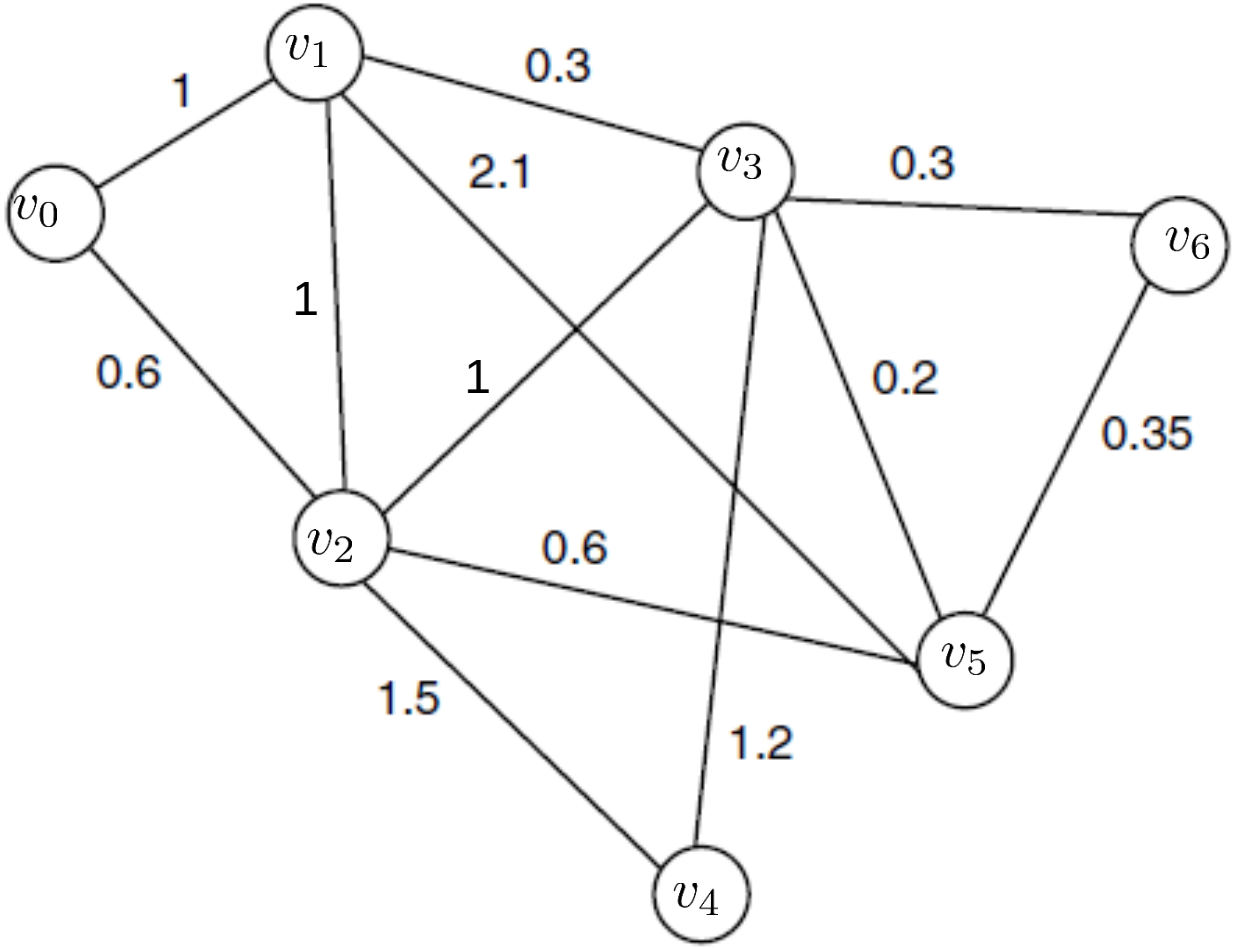
Good for when the search space is large and the proximity to the solution is not known

Good when memory is limited (only needs a stack of nodes which represents the branch of the tree current being expanded, just like DFS)

ID-DFS



IDA*

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Iterative Deepening A*

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Perform A* and suppose the nodes below the depth limit have no child.

If succeed, great, otherwise, perform again with new depth limit that is calculated from the last iteration.

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- Don’t need a sorted search frontier (priority queue)
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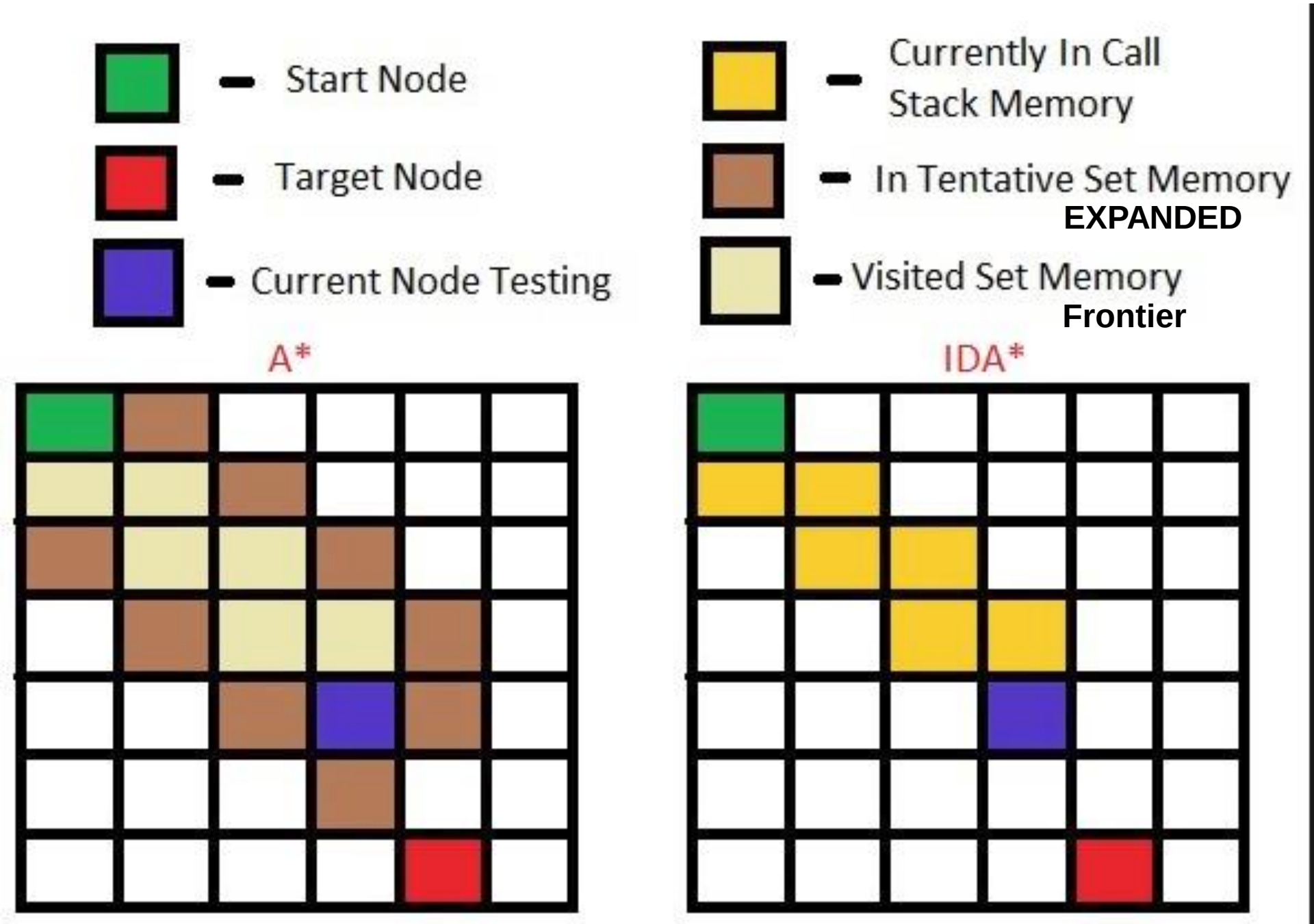
Start Node
Target Node
Current Node Testing
Currently In Call Stack Memory
In Tentative Set Memory
EXPANDED
Visited Set Memory
Frontier
A*
IDA*

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Disadvantages:

- Memory not usually an issue
- Does not exploit the heuristic as heavily

VARIANTS OF PATHFINDING

Pathfinding on Nav Meshes

- Daniel Brewer. Tactical pathfinding on a navmesh. Game AI Pro: Collected Wisdom of Game AI Professionals, page 361, 2013
- Paul Tozour and I. S. Austin. Building a near-optimal navigation mesh. AI Game Programming Wisdom, 1:298–304, 2002

Jump Point search on grids

- Daniel Damir Harabor and Alban Grastien. Online Graph Pruning for Pathfinding on Grid Maps. In AAAI, 2011.

Hierarchical A*

- Adi Botea, Martin Muller, and Jonathan Schaeffer. Near optimal hierarchical path-finding. ¨ Journal of Game Development, 1(1):7–28, 2004.
- Nathan Sturtevant. Memory-Efficient Pathfinding Abstractions. In AI Programming Wisdom 4. Charles River Media, 2008.

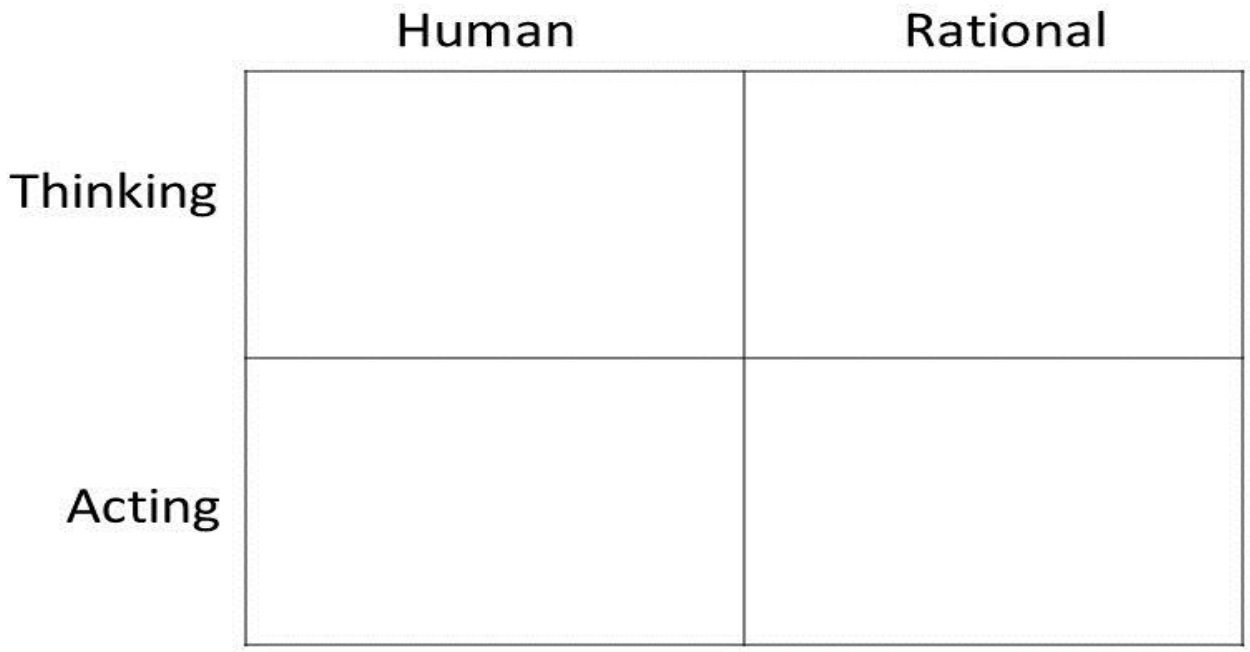
https://www.youtube.com/watch?v=u_GmHXJ3Ti0

NEXT TIME

Feb 15th

Minimax

Approaches to A. I.



This model from Russell and Norvig.

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	Human	Rational
Thinking	Behavior is explained by human-like cognition	Behavior explained by rational thought
Acting	Behavior is like a human's in this situation	Behavior is rational in this situation

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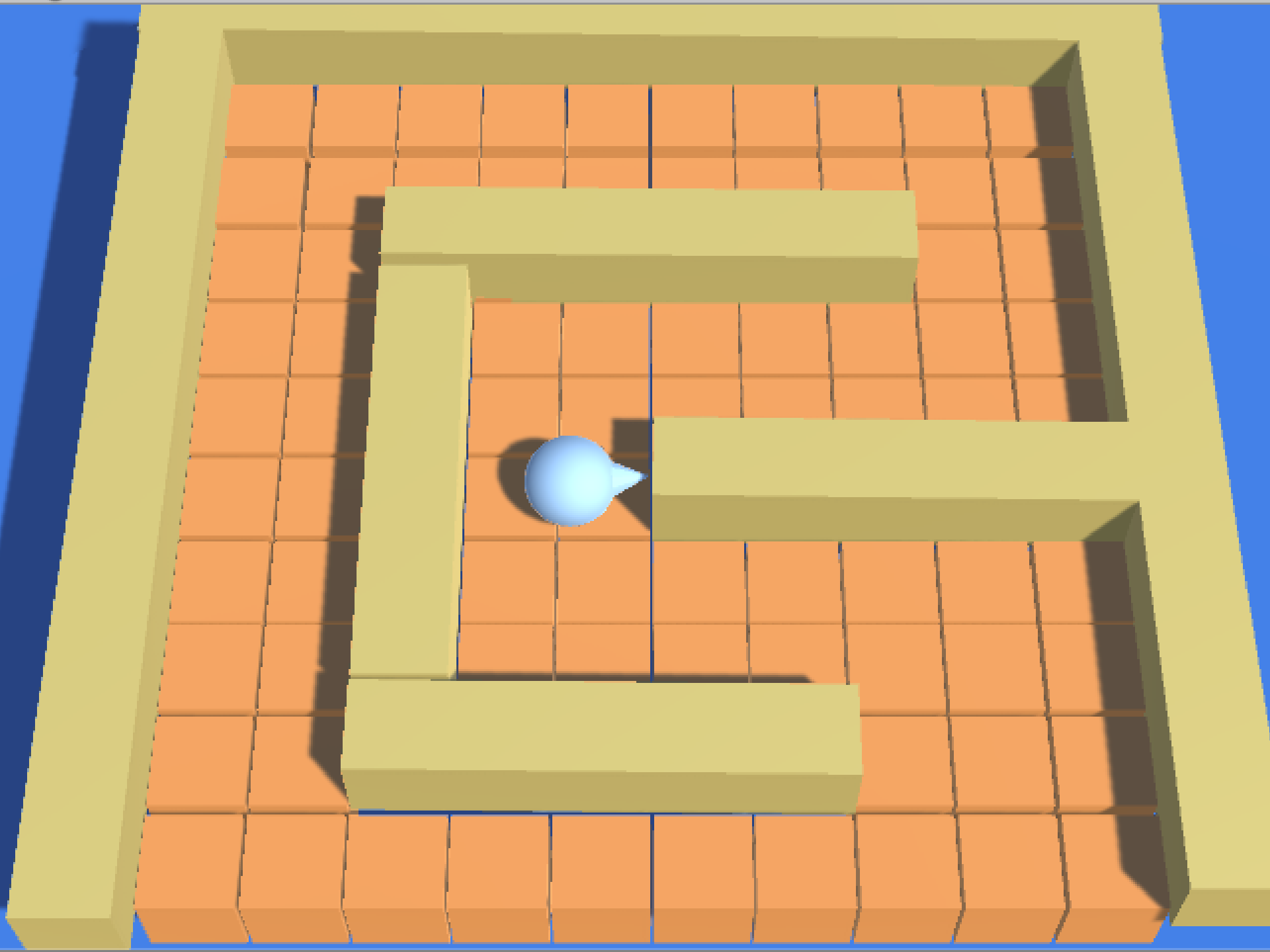
Optimal behavior is rational, sometimes. Sometimes more rational



EVOLUTIONARY LEARNING WITH STEERING

https://www.youtube.com/watch?v=BhsgLeY_Q-Y