Logic Agents

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A **Logic Agent** (Knowledge-based Agent) is one that uses some sort of **knowledge representation** and can **infer** new knowledge about the world through **reasoning**.

Knowledge is represented as sentences using some sort of a language called a knowledge representation language.

If a sentence is a given and it is not inferred from other sentences, it is called ***an axiom***.

Sentence 1
Sentence 2
Sentence 3

Sentence 4

Inference is the process of deriving new knowledge (sentences) from known (old) sentences.

The ***Knowledge Base*** of a Logic Agent is the knowledge that the agent "knows" about the world, represented as a set of sentences.

Sentence 1
Sentence 2
.
.
Sentence n

Example: The Wumpus World!

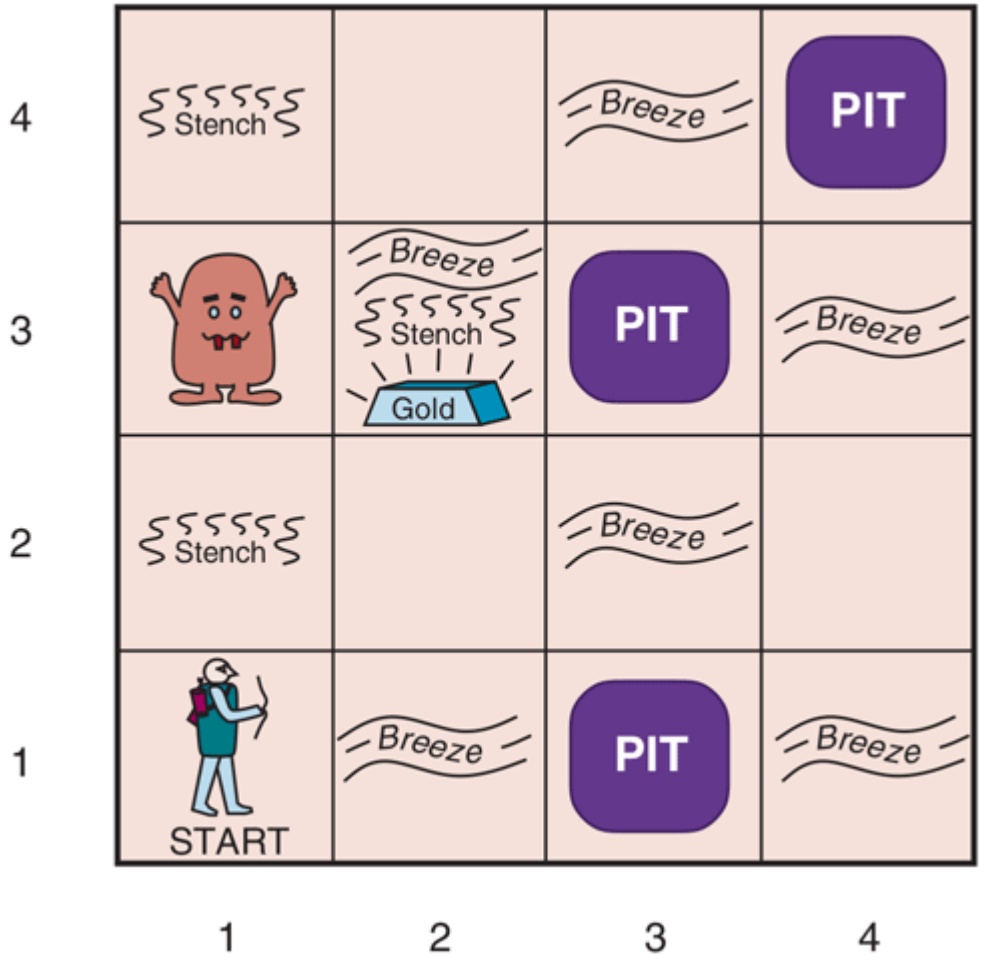


Fig 7.2, Russell & Norvig's Textbook

Example: The Wumpus World!

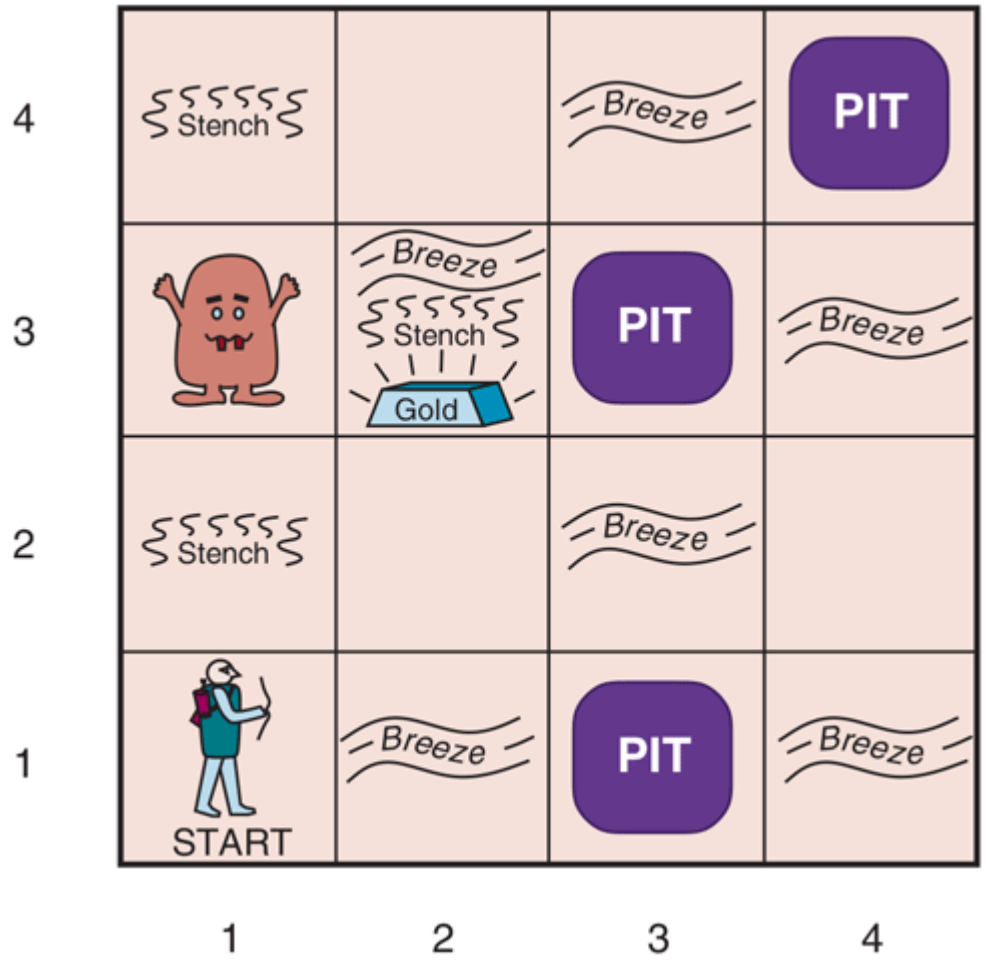
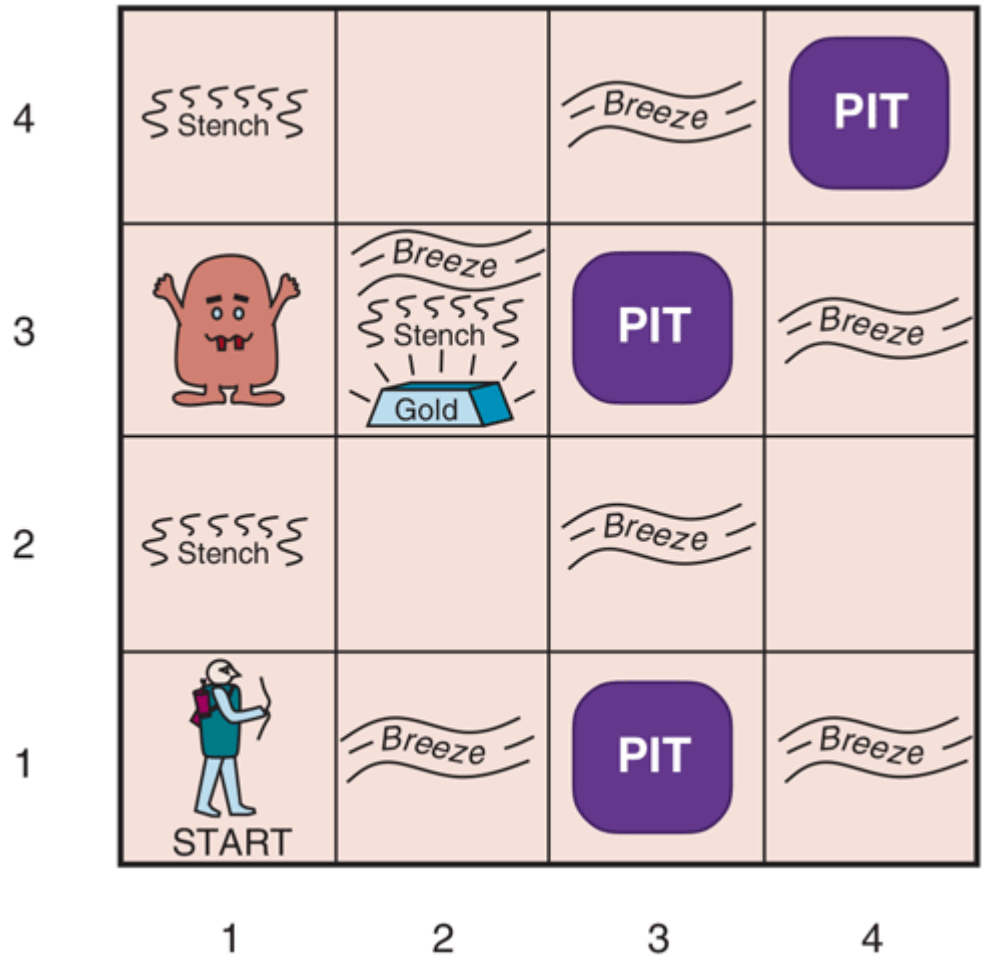


Fig 7.2, Russell & Norvig's Textbook

- **Environment:** A 4×4 grid of rooms, with walls surrounding the grid. The agent always starts in the square labeled [1,1], facing to the east. The locations of the gold and the wumpus are chosen randomly, with a uniform distribution, from the squares other than the start square. In addition, each square other than the start can be a pit, with probability 0.2.

Example: The Wumpus World!



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- **Performance measure:** $+1000$ for climbing out of the cave with the gold, -1000 for falling into a pit or being eaten by the wumpus, -1 for each action taken, and -10 for using up the arrow. The game ends either when the agent dies or when the agent climbs out of the cave.

Example: The Wumpus World!

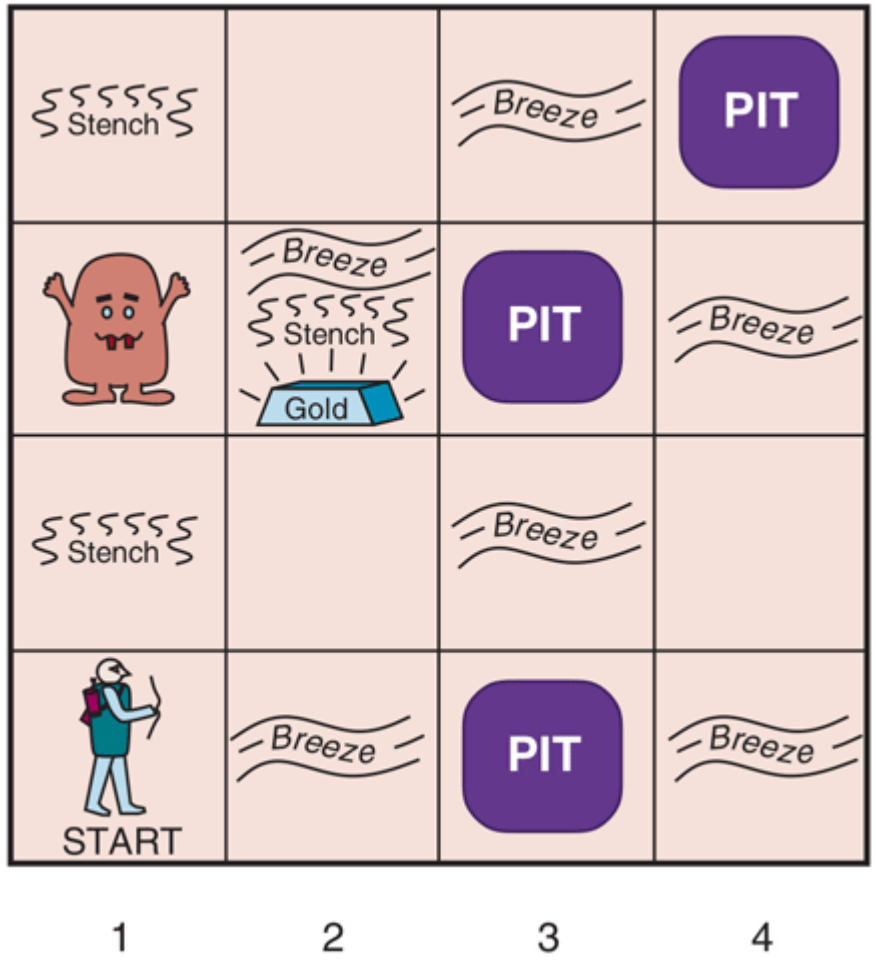
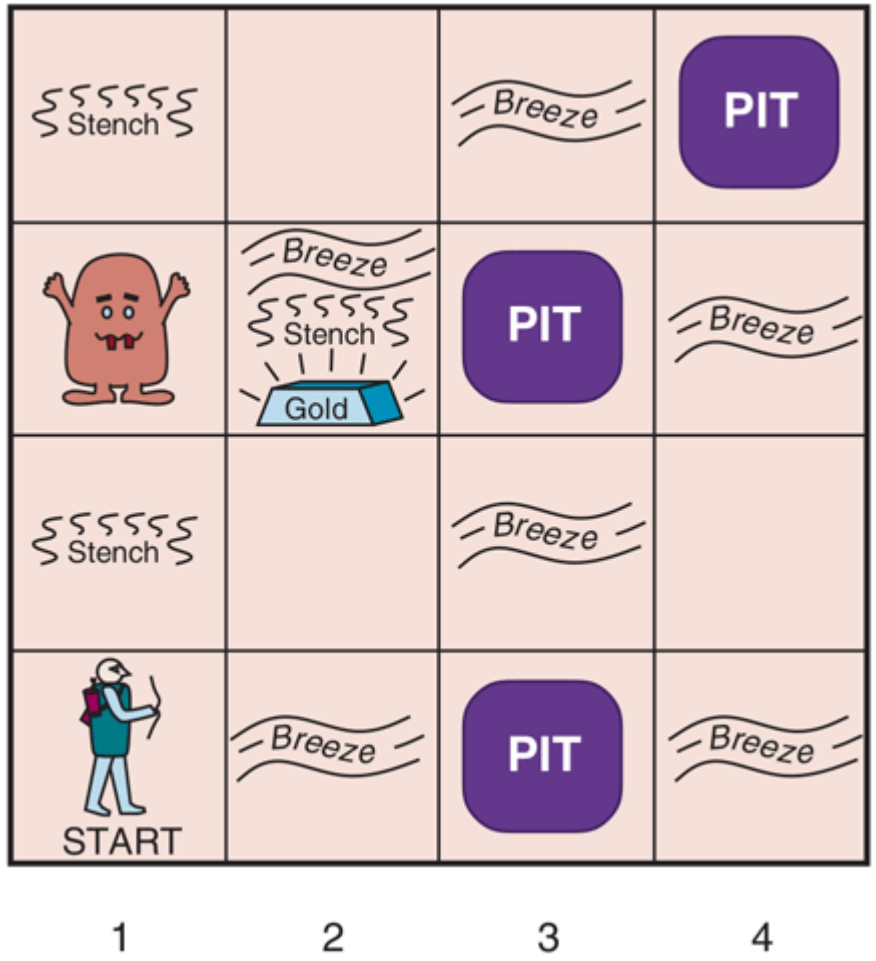


Fig 7.2, Russell & Norvig's Textbook

- **Actuators:** The agent can move *Forward*, *TurnLeft* by 90°, or *TurnRight* by 90°. The agent dies a miserable death if it enters a square containing a pit or a live wumpus. (It is safe, albeit smelly, to enter a square with a dead wumpus.) If an agent tries to move forward and bumps into a wall, then the agent does not move. The action *Grab* can be used to pick up the gold if it is in the same square as the agent. The action *Shoot* can be used to fire an arrow in a straight line in the direction the agent is facing. The arrow continues until it either hits (and hence kills) the wumpus or hits a wall. The agent has only one arrow, so only the first *Shoot* action has any effect. Finally, the action *Climb* can be used to climb out of the cave, but only from square [1,1].

Example: The Wumpus World!



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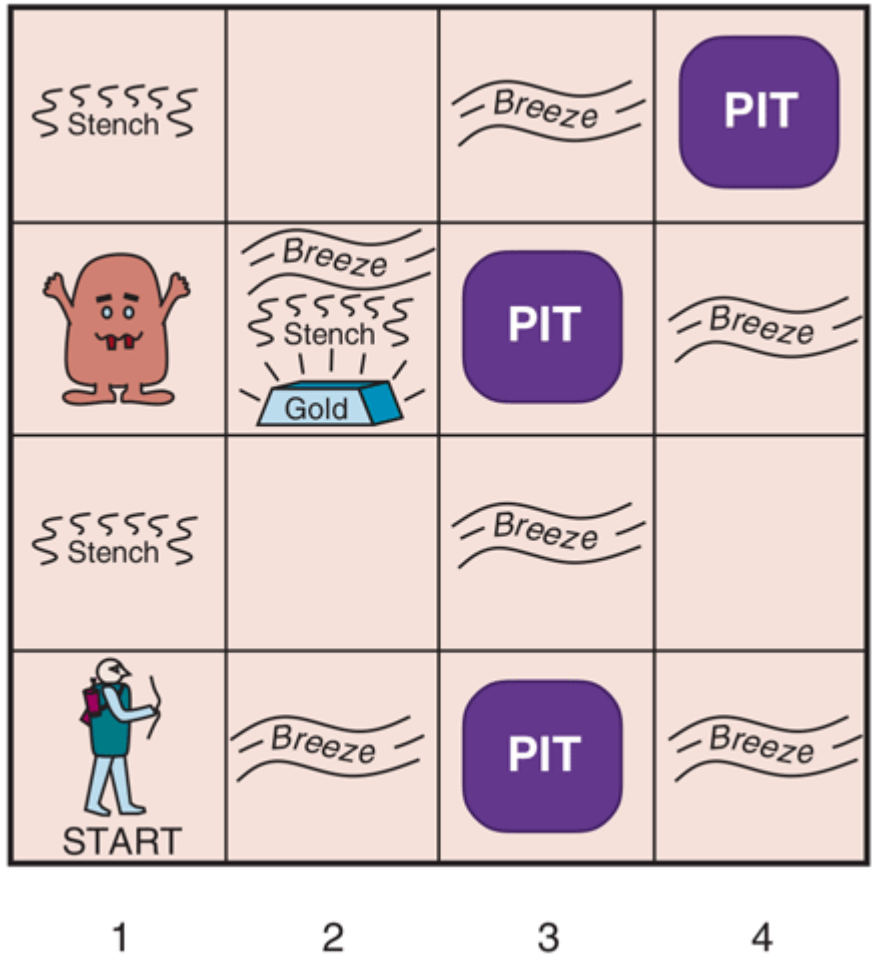
- **Sensors:** The agent has five sensors, each of which gives a single bit of information:
  - In the squares directly (not diagonally) adjacent to the wumpus, the agent will perceive a *Stench*.[59]
  - In the squares directly adjacent to a pit, the agent will perceive a *Breeze*.
  - In the square where the gold is, the agent will perceive a *Glitter*.
  - When an agent walks into a wall, it will perceive a *Bump*.
  - When the wumpus is killed, it emits a woeful *Scream* that can be perceived anywhere in the cave.

Example: The Wumpus World!



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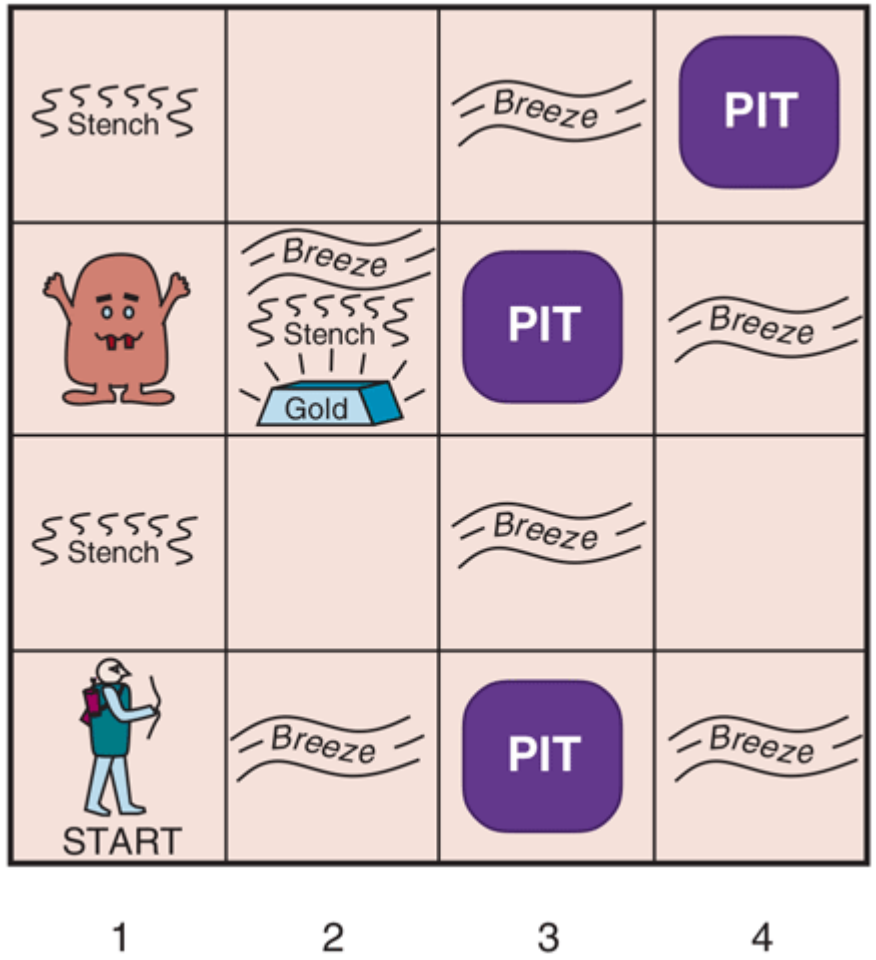
The agent starts at square [1,1] and is ignorant about the surrounding squares. It needs to use its **knowledge base** (what different percepts mean) and **logic** rules to **infer** what lies in the surrounding squares and plan the next move.

Example: The Wumpus World!



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If the agent takes this action:

- Move forward to square [2,1],

- What can they infer from what they perceive?
- What would their next ***rational*** move be?
- How did you know which move is rational?
- How did you reach this conclusion about this move? ***(Hint: Inference & Reasoning!)***

How do we build AI systems that can reason?

By using Logic Rules for Representation and Reasoning.