



## What is Game AI?

- It consists of non-playable characters (**NPCs**) or **other entities** that the player interacts with which help enhance the gaming experience.
- These NPCs are **programmed** to react to the **player's behavior** in the game.

## Game AI Algorithms

- Some Types of Game AI Algorithms:
  - Basic Decision Making Tree
  - Finite State Machine
  - Monte Carlo Search Tree
- Usually programmed with **conditional statements**.
- Can be **simple** or **complex** statements.

## Simple Algorithm (Basic Dec. Tree)

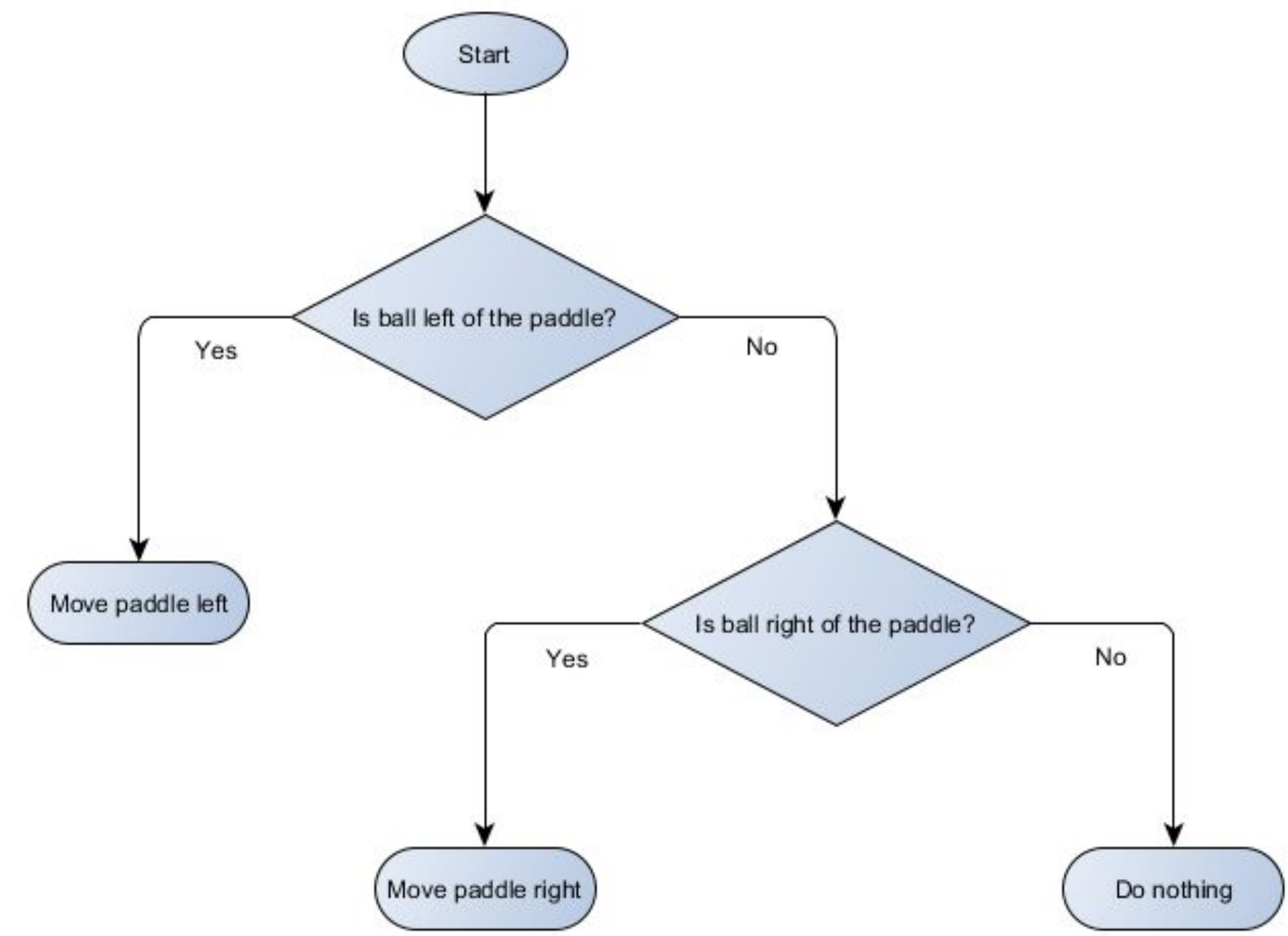


Fig. 1: Pong Paddle Algorithm [9]

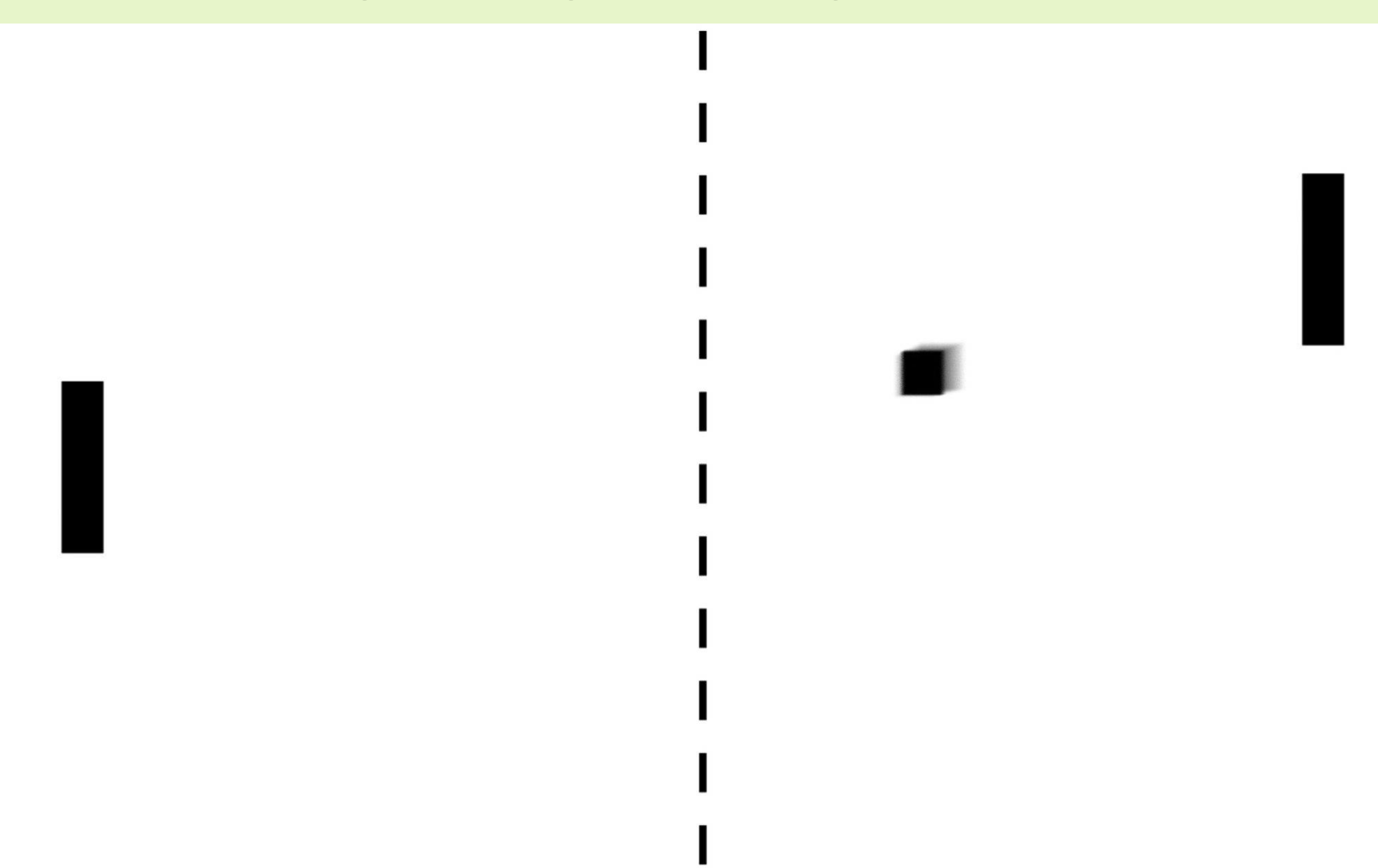


Fig. 2: In-Game View of Pong [4]

## Complex Algorithms

### Finite State Machine (FSM)

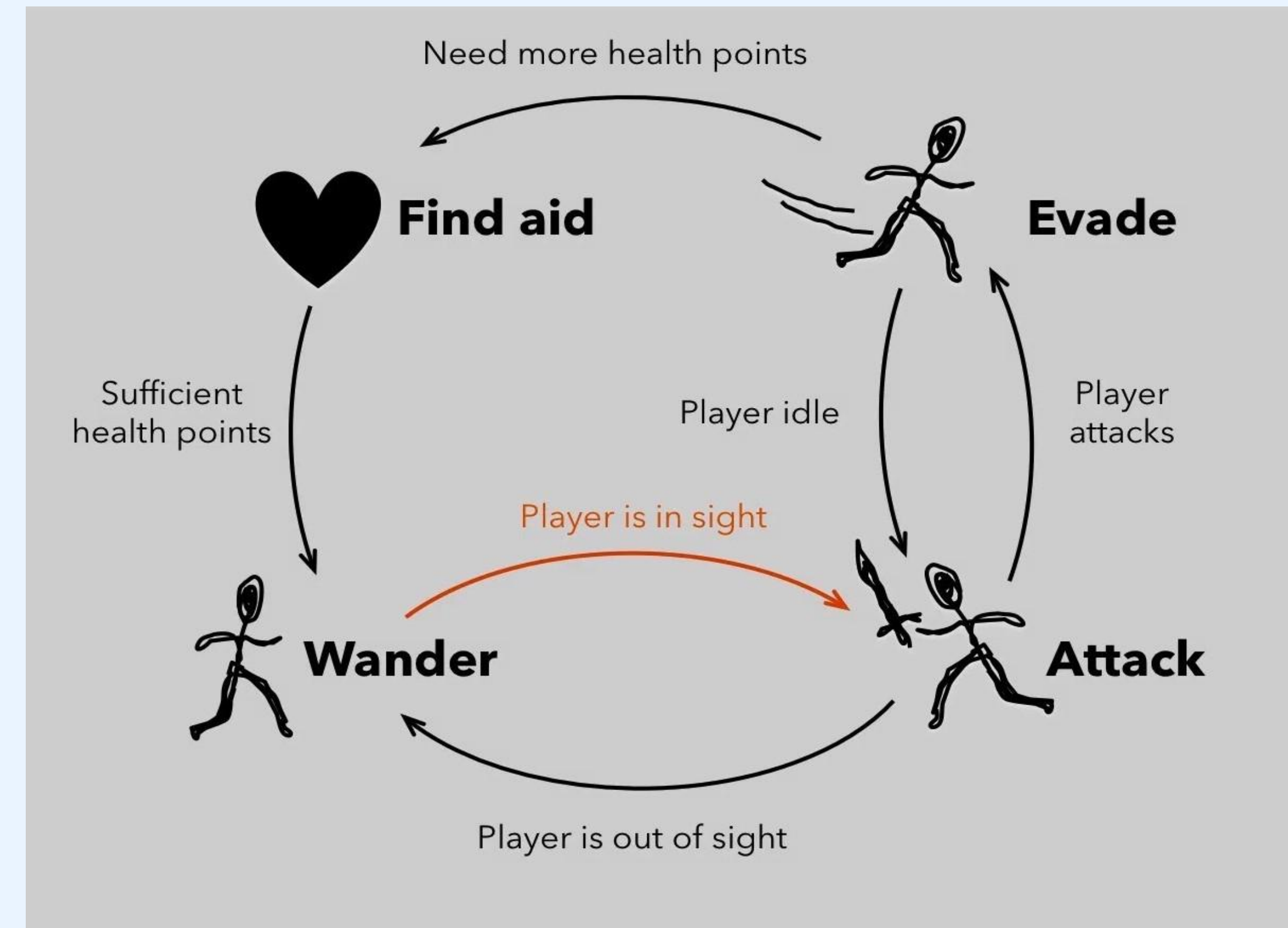


Fig. 3: Simplified Finite State Machine Algorithm [1]

- Game industry started implementing it in the **90s** [1].
- Draws from automata theory and turing machines (**CSE 103**).
- Computer **switches** between **states** depending on the **input signal**.
- NPCs** change their **behavioral state** depending on their **current state** and the **actions** of the **player**.
- Over time, NPC behavior can become **predictable**.

### Famous Example

- Shooter games like **Call of Duty** employ this technique to program its **enemy AI**.



Fig. 4: FSM AI in Action [2]

### Monte Carlo Search Tree (MCST)

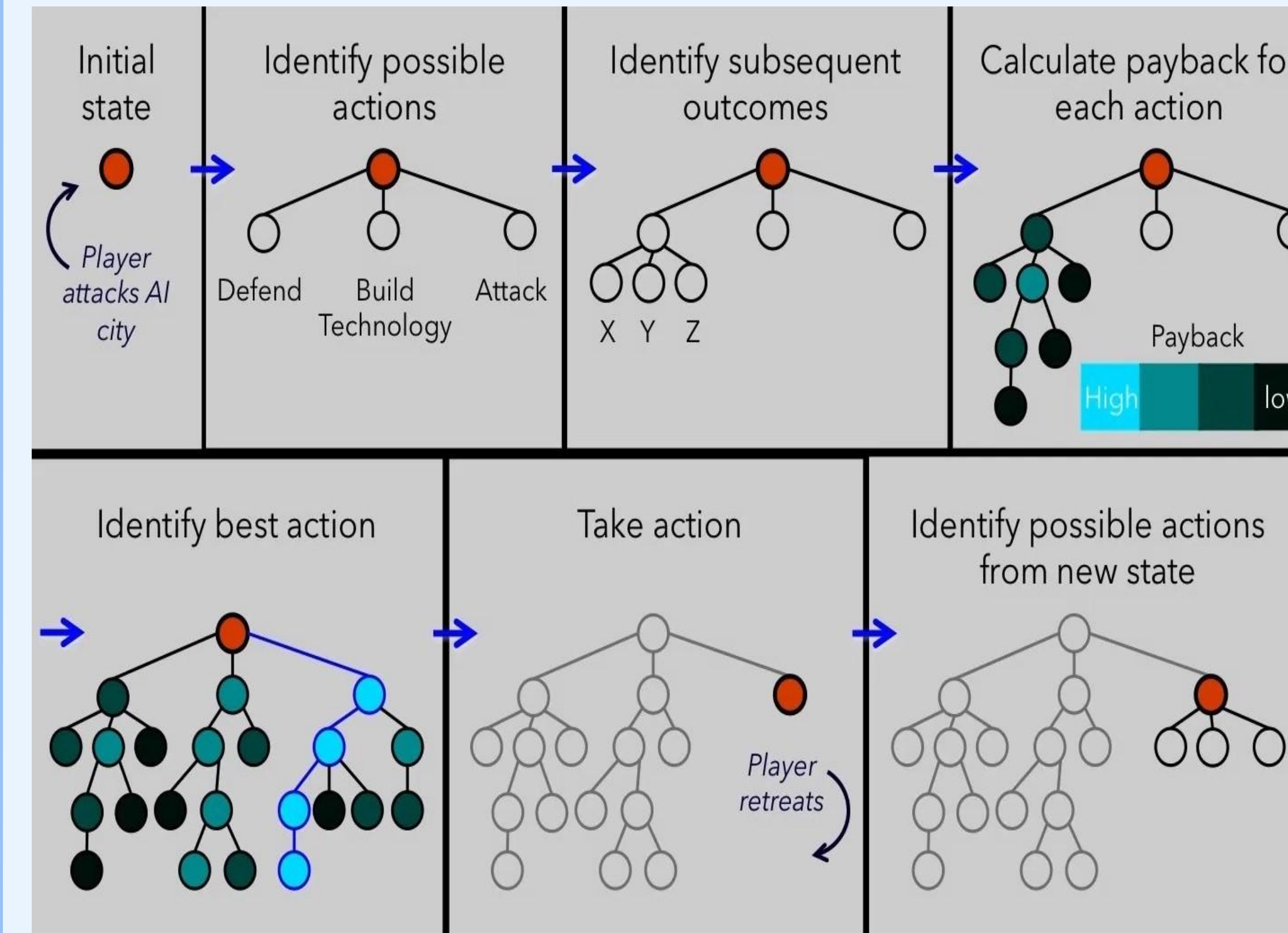


Fig. 5: Simplified MCST Algorithm [1]

- Used in a strategy game's AI in **2013** [7].
- Similar to the widely known **bfs** and **dfs** algorithms in computer science.
- Works by considering **all possible options** to choose the best one while **dynamically labeling** strong paths for use in **future situations**.
- Widely used in strategy games, where **unpredictability** is the core aspect of the genre.

### Famous Example

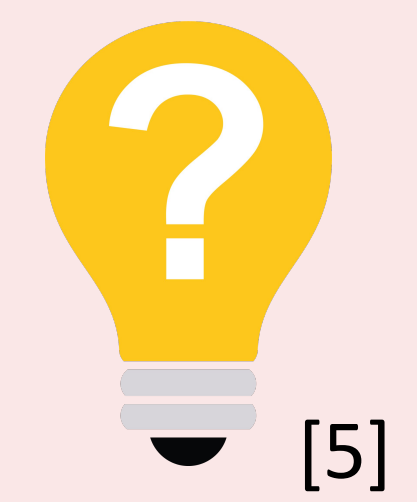
- In **Rome II**, the **AI decides** the best tasks for enemy **armies, kingdom development, diplomacy**, and etc.



Fig. 6: Total War: Rome II Gameplay [10]

## Is it Really AI?

- Not really**. It was just named **AI** because it **feels like** it is being controlled by a human.
- Most game AI and NPCs are **extensively pre-programmed** to react to player inputs.
- Usually **does not** have the **true learning** capabilities that are present in modern AI.



## Uses of Modern AI in Games

- To improve **graphics** by making in-game imagery as **realistic** as possible.
- To **prevent cheating** in online multiplayer games through AI-powered software.



Fig. 7: Mass Effect Legendary Edition Image Upscaling [6]

## Future Work

- As AI continues to improve, games will also continue to **improve in the areas of**:
  - Graphics
  - Cheating Detection
  - Generative AI
  - Much More!

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