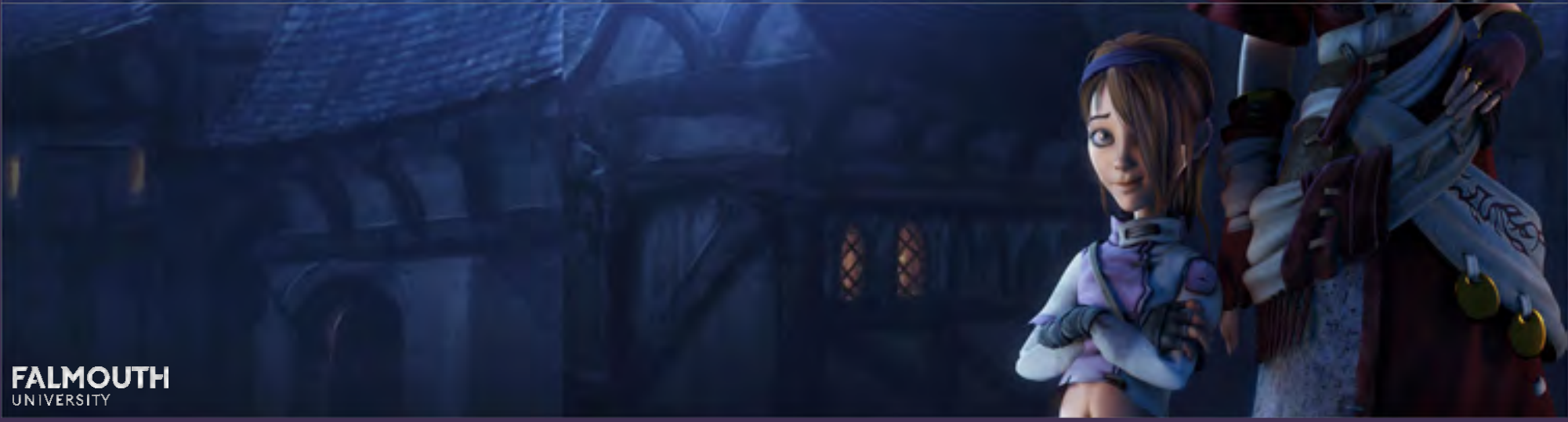

COMP702: Classical Artificial Intelligence

2: Authored Behaviour

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Agents

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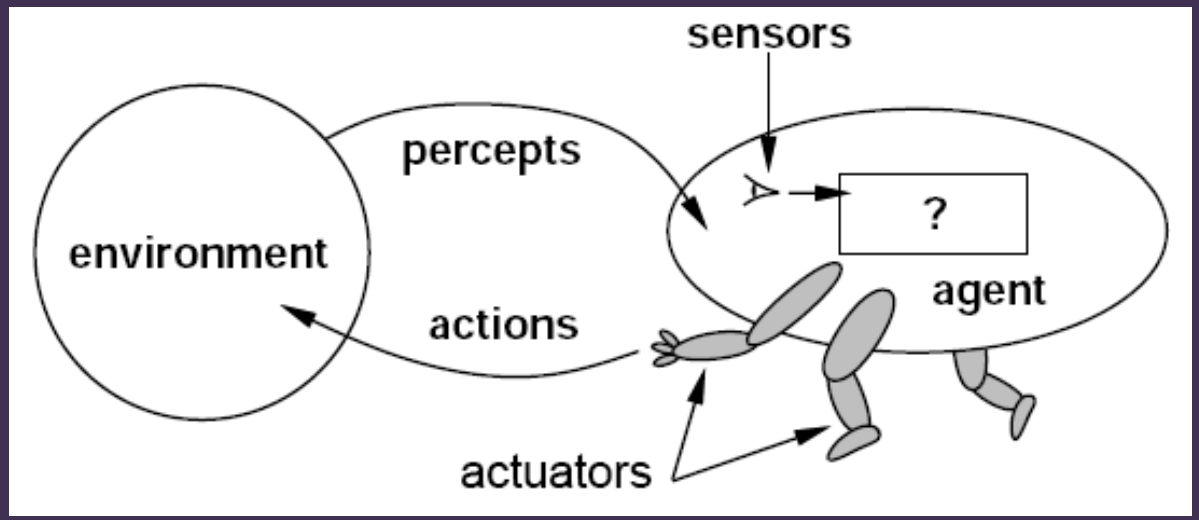

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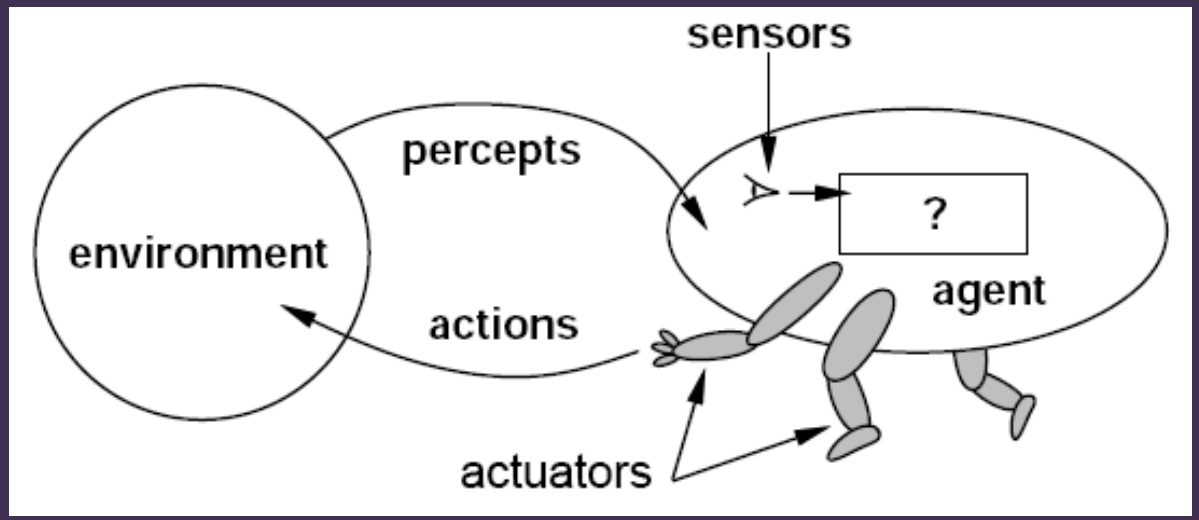

An **agent** is anything which perceives an **environment** through **sensors**, and acts upon that environment through **actuators**.

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- A **performance measure** evaluates a given state for how well it fits the goal

PEAS

For each example of an agent, what are the Performance measure, Environment, Actuators and Sensors?

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Types of environment

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- These properties influence the choice of AI architecture we use to build agents

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- E.g. a chess game is fully observable, a poker game is partially observable

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- **Cooperative**: all agents share the same performance measure
- **Competitive**: agents' performance measures are in opposition to each other (i.e. if one agent "wins", another "loses")

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- **Stochastic**: there is some aspect of randomness in determining the next state
- E.g. chess is deterministic; any board game involving dice rolls or random card draws is stochastic

Dynamicity

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- **Dynamic**: the environment changes constantly
- E.g. most board games are static, most (non turn-based) video games are dynamic

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- Continuous problems are hard so we sometimes **discretise** them

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- For the real world: technically **no** (but we have physics, sociology, economics etc to give us good approximations)

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- All(?) AI problems can be expressed in terms of creating an agent that optimises some performance measure in some environment
- Agent design boils down to: given a **percept** (and possibly some **memory** of past percepts/actions), choose the best **action** to take now

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Rule-based AI

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- Generally hand-coded and only modifiable by a programmer

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  - Frightened: move randomly

Ghost “personalities”

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- Red ghost: aim for Pac-Man

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- Orange ghost: aim for Pac-Man until 8 spaces away, then aim for corner

Ghost movement

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Ghost movement

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- Can only change direction at an intersection
- Can't reverse or stay still
- Therefore can't get stuck, despite imperfect pathfinding

Ghost behaviour

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Ghost behaviour

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- However, the combination of them leads to interesting gameplay and illusion of personality

Design lessons

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- Simple AI, when interacting with a player and each other, can give engaging results
- Bugs in AI don't always matter...

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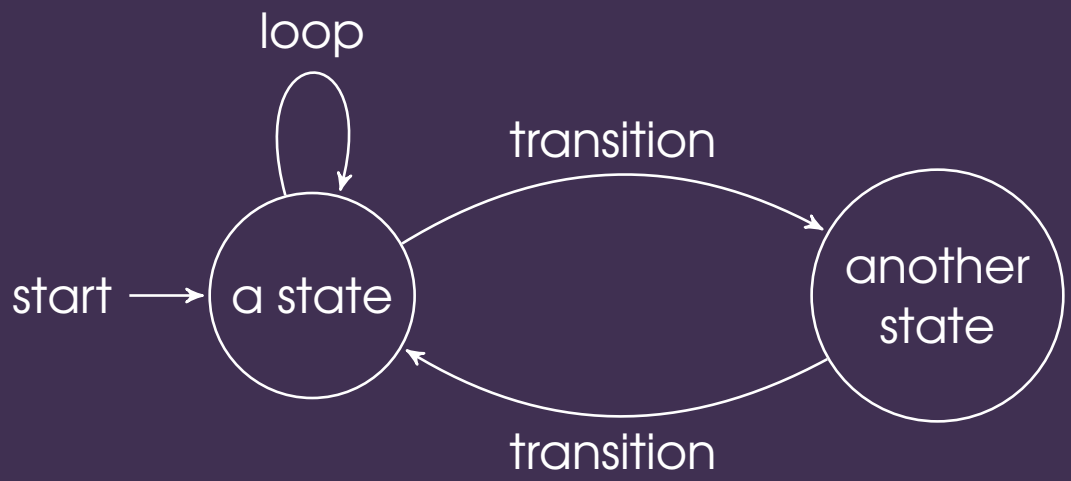
- Which state the FSM is in dictates what **actions** the agent takes

State transition diagrams



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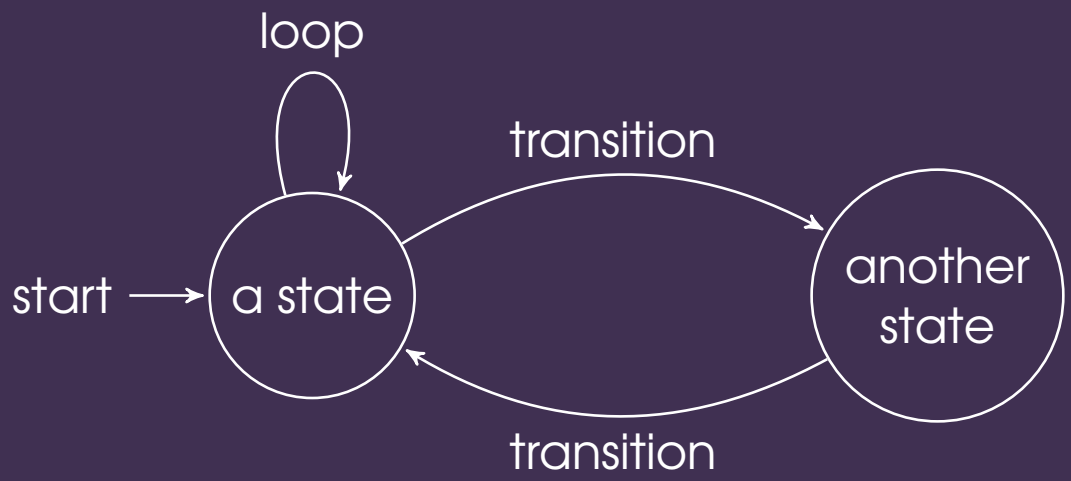

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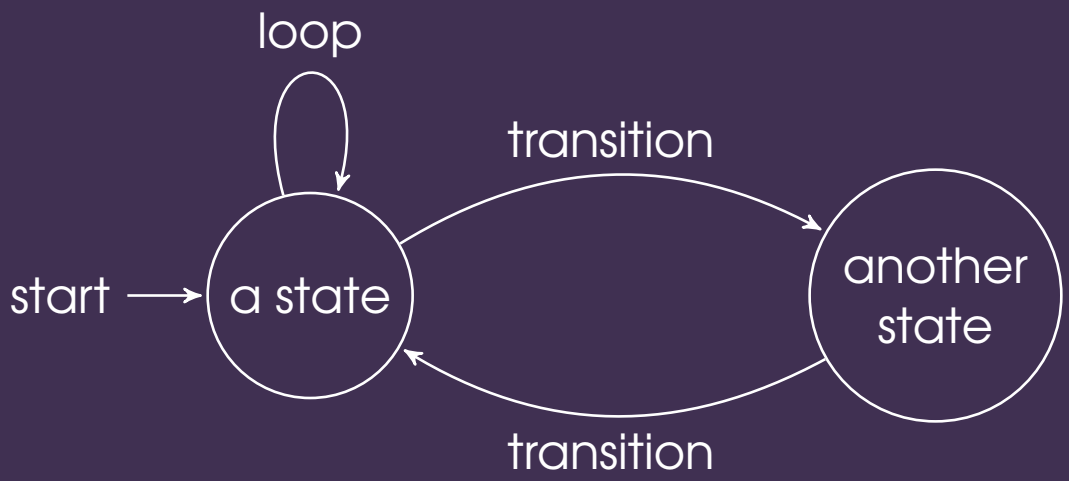

- FSMs are often drawn as **state transition diagrams**
- Reminiscent of **flowcharts** and certain types of **UML diagram**

Other uses of FSMs

As well as AI behaviours, FSMs may also be used for:

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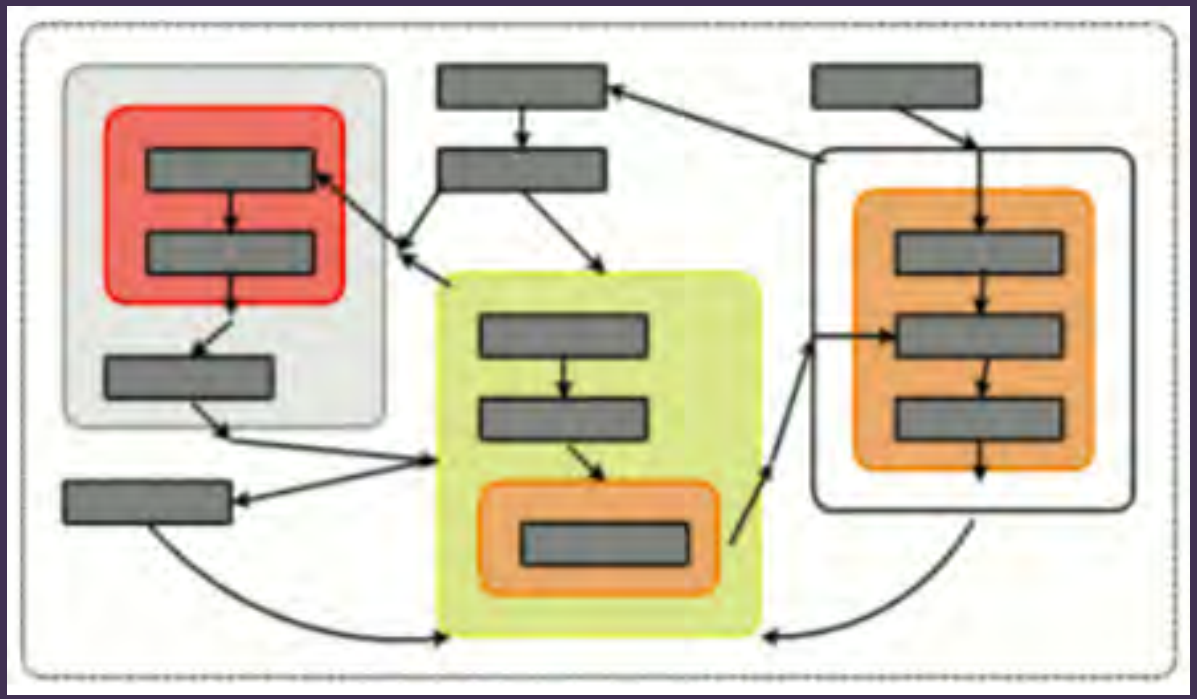
- Coroutine approach: encode your FSM logic as a procedure which runs as a coroutine (requires either refactoring logic into structured loops, or using `goto`...)

Hierarchical FSMs



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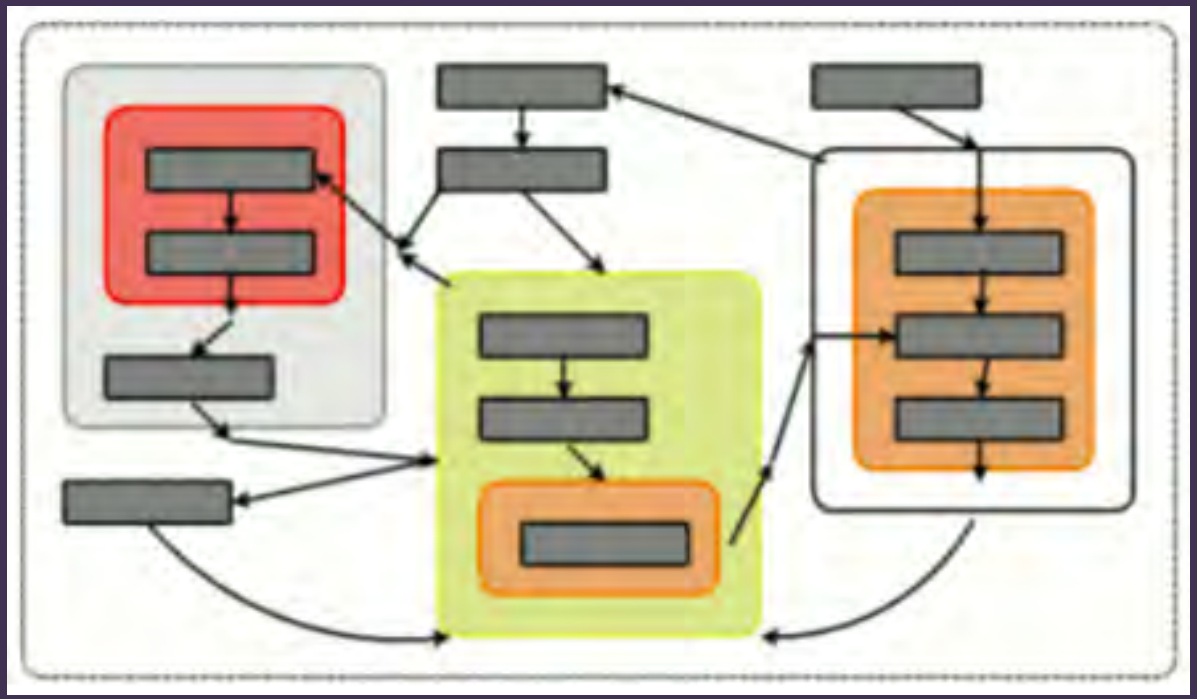

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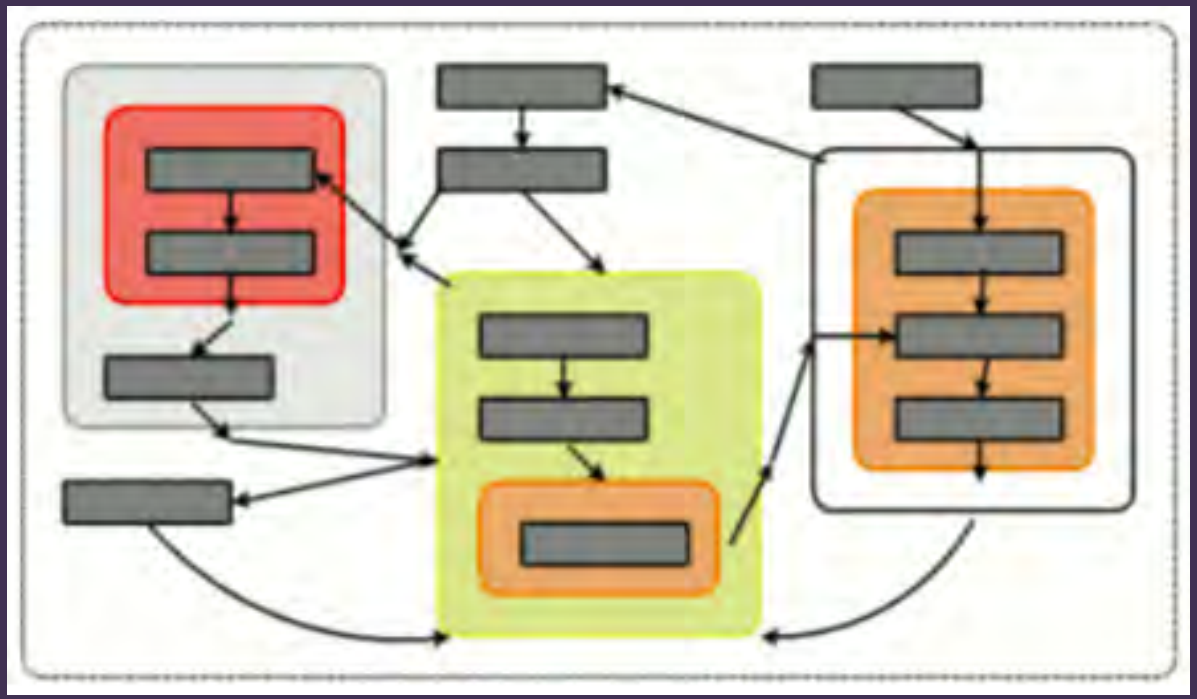

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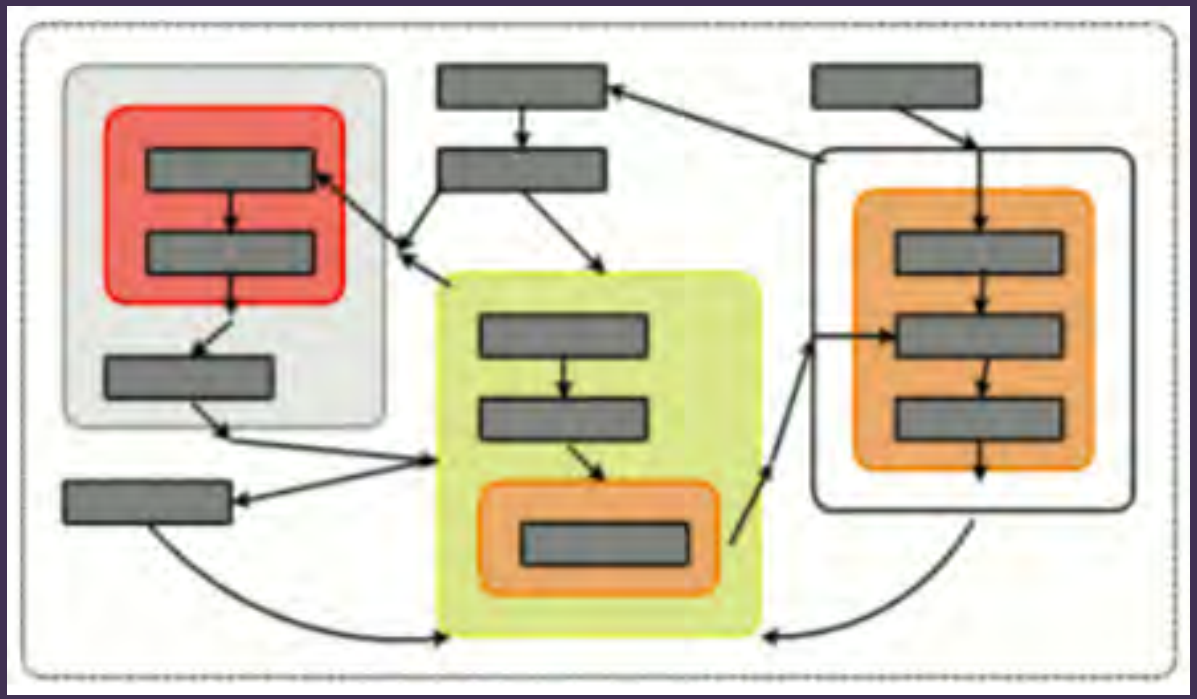

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- Designing complex behaviour with FSMs quickly gets unwieldy
- Hierarchical FSMs allow to group states into **super-states** to simplify defining transitions

Should you use FSMs?

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- FSMs are useful for designing simple AI behaviours
- Historically an important technique for game AI
- However other techniques such as behaviour trees are more flexible and better suited to designing complex behaviours

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Behaviour Trees

Behaviour trees (BTs)

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- A **hierarchical** model of decision making
- Allow **complex behaviours** to be built up from **simple components**
- Allow for **more complex** behaviours than FSMs
- First used in Halo 2 (2005), now used extensively
- Also used in robotics and other non-game AI applications

Using BTs

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- **Unity**: numerous free and paid options on the Asset Store e.g. Behavior Machine, Behavior Designer, Behave, RAIN

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- "Running" status allows nodes to represent operations that **last multiple frames**

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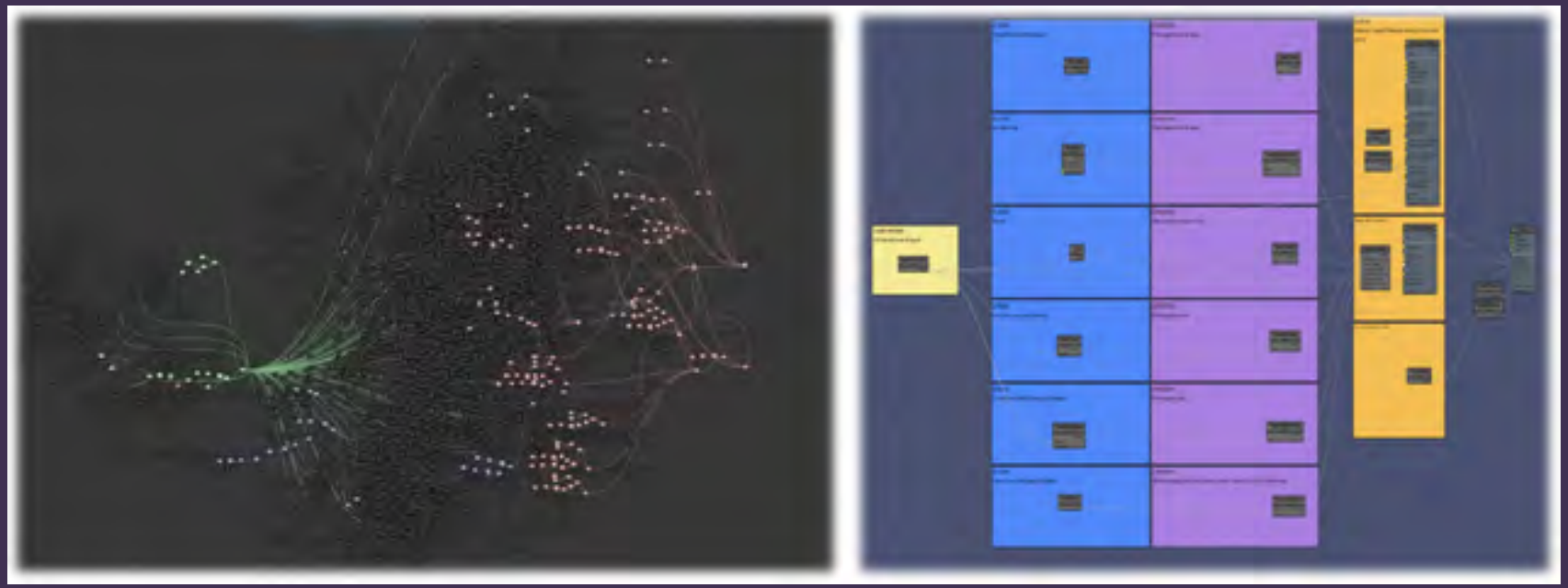
- (Shared blackboards mean that your AI has "telepathy" — this may or may not be desirable!)

BTs in The Division



http://www.gdcvault.com/play/1023382/AI-Behavior-Editing-and-Debugging