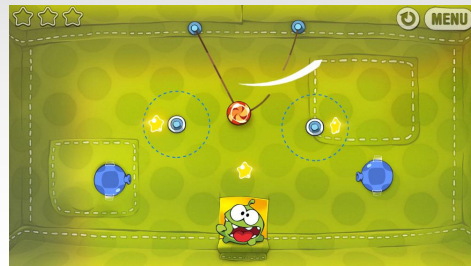# CPSC 436D
Video Game Programming

Basic Gameplay

© Alla Sheffer

Gameplay

```
// start
if (!walking && wantToWalk)
{
    PlayAnim(StartAnim);
    walking = true;
}

// walk loop
if (IsPlaying(StartAnim) && IsAtEndOfAnim())
{
    PlayAnim(WalkLoopAnim);
}

// stop
if (walking && !wantToWalk)
{
    PlayAnim(StopAnim);
    walking = false;
}
```
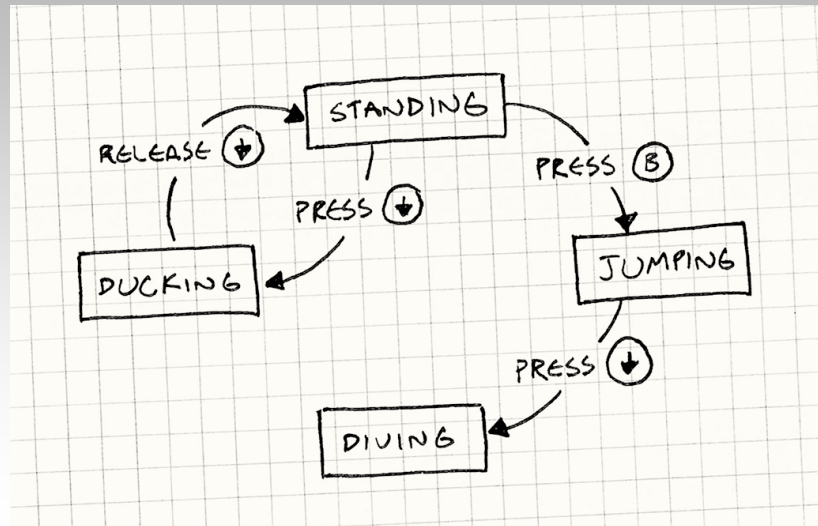
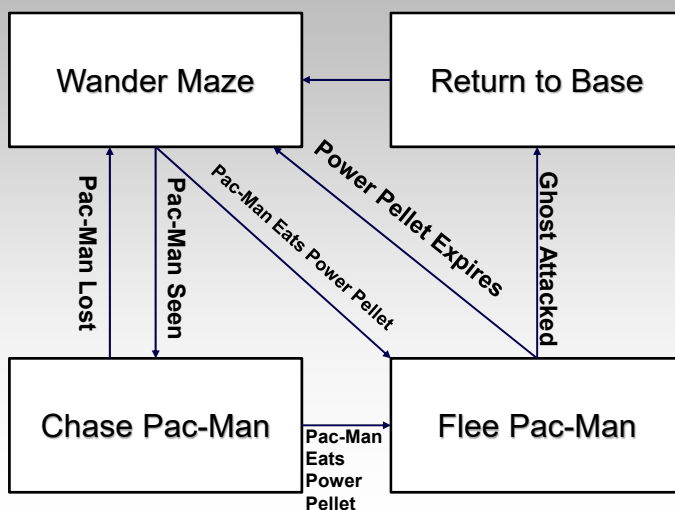From http://twvideo01.ubm-us.net/o1/vault/gdc2016/Presentations/Clavet_Simon_MotionMatching.pdf

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Finite State Machines: States + Transitions
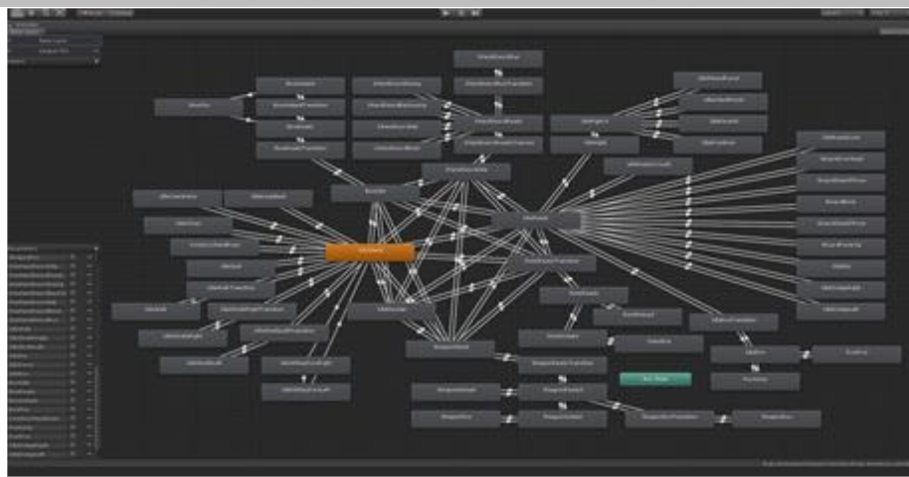

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FSM Example: Pac-Man Ghosts

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FSMs:

- ***Each frame:***
  - Something (the player, an enemy) does something in its state
  - It checks if it needs to transition to a new state
    - *If so, it does so for the next iteration*
    - *If not, it stays in the same state*
- ***Applications***
- Managing input
- Managing player state
- Simple AI for entities/objects/monsters etc.
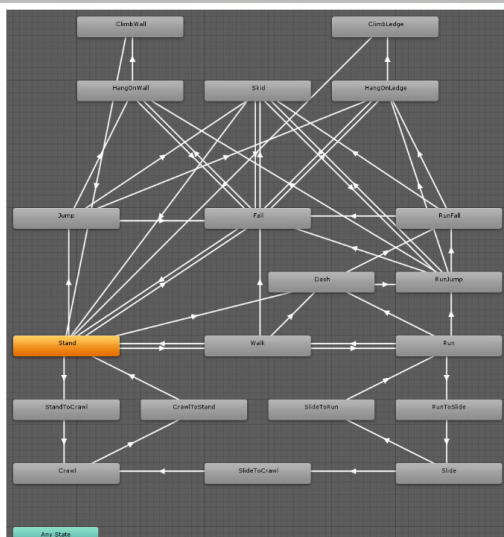

FSMs: States + Transitions

FSMs: States + Transitions

```
if (speed > 3.0f)
{
    PlayAnim(RunAnim);
}
else if (speed > 0.0f)
{
    PlayAnim(WalkAnim);
}
else
{
    PlayAnim(IdleAnim);
}
```

FSMs: Failure to Scale

No way to do long-term planning

No way to ask "How do I get here from there?"

No way to reason about long-term goals

FSMs can get large and hard to follow

Can't generalize for larger games

Behaviour Trees: How To Simulate Your Dragon

Start!

Guard Treasure

Get More Treasure

Post Selfies To Facebook

Is there a thief?

Make thief flee!

Condition Node

Instruction Node

Fly to Castle!

Steal treasure!

Treasure light enough to get home?

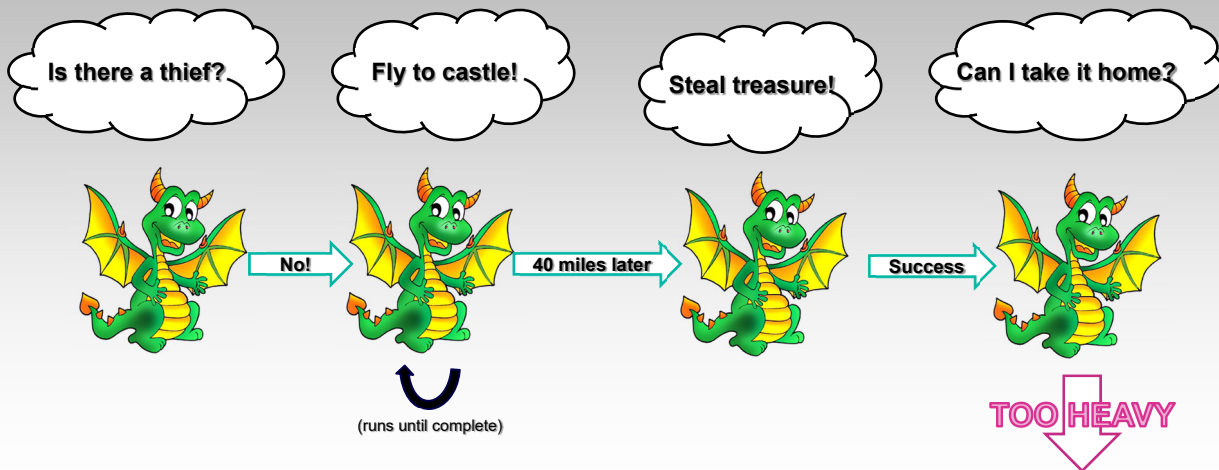**Take treasure home!**

© Alla Sheffer

Behaviour Trees

- ***Each frame:***
- Visit a node
- See if any **higher priority** nodes now run
  - *If so, execute them instead*
- See if my currently running node fails
  - *If so, return to the root of the behaviour tree! Start again!*
- See if the currently running node is done
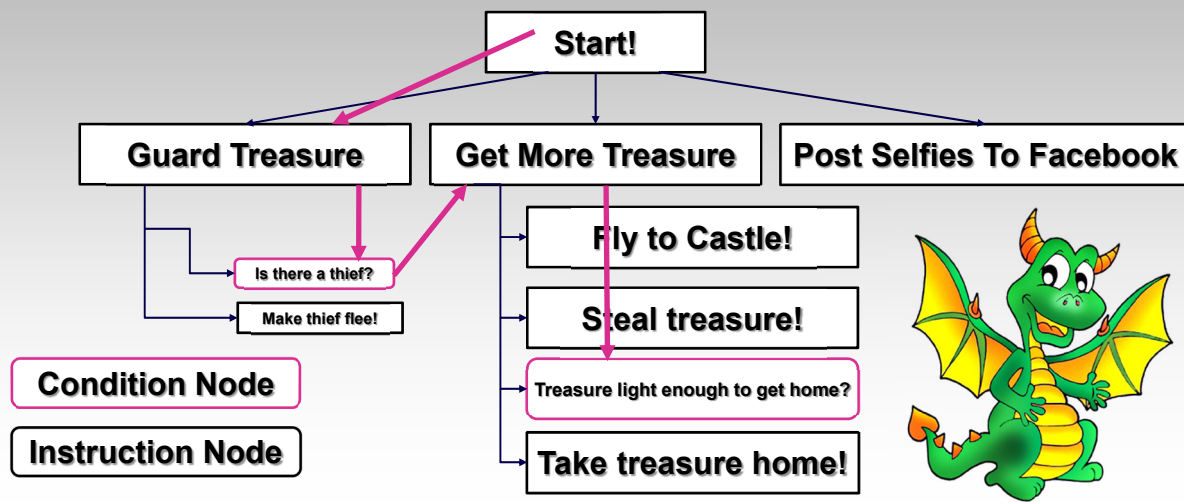 - *If so, run the **lower priority** node in the current branch of the tree*

© Alla Sheffer

Start!

Is there a thief? — No! — Fly to castle! — 40 miles later — Steal treasure! — Success — Can I take it home?

(runs until complete)

TOO HEAVY

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Behaviour Trees: How To Simulate Your Dragon

Start!

Guard Treasure | Get More Treasure | Post Selfies To Facebook

Is there a thief?
Make thief flee!

Fly to Castle!
Steal treasure!
Treasure light enough to get home?
Take treasure home!

Condition Node

Instruction Node

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Behaviour Trees are Modular!

- Can re-use behaviours for different purposes
- Can implement a behaviour as a smaller FSM
- Can be data-driven (loaded from a file, not hard coded)
- Can easily be constructed by non-programmers
- Can be used for *goal based programming*