

Steering Behaviours – Part 1

Seeking, Fleeing and Wandering



Steering Behaviours

- Steering Behaviours are a well known method of locomotion for artificial autonomous agents
 - Modular, simple and reactive
- First proposed by Craig Reynolds
 - *“Flocks, herds and schools: A distributed behavioral model” (SIGGRAPH 1987)*
 - Used in games, film and simulation



Steering Behaviours

- Autonomous Agents for games purposes are A.I. entities that:
 - Have a position, velocity and heading
 - Can sense the environment around them
- Steering Behaviours are a way of calculating a force to apply to the agent's velocity
 - There are many different behaviours that each apply a force in different ways:
 - Seek, Flee, Pursue, Evade, Arrive, Wander, Avoid and many more
- We will spend time investigating the common behaviours

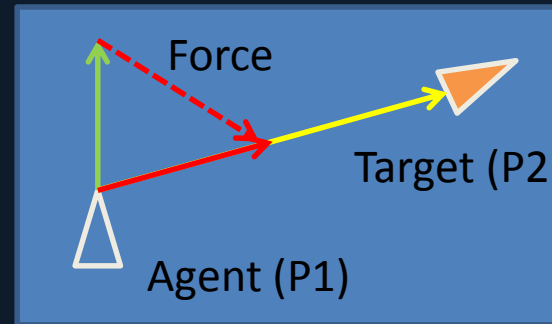
Seek Behaviour

- Perhaps the simplest behaviour, Seek calculates a force to drive an autonomous agent towards a target
 - We calculate a vector from the agent to its target
 - We then scale the vector by our maximum velocity (scalar)
 - Finally we subtract the agent's current velocity (vector) from the vector to obtain the force require to change the agent's direction towards its target

- Example:

$$V = \text{normalise}(P2 - P1) \times \text{maxVelocity}$$

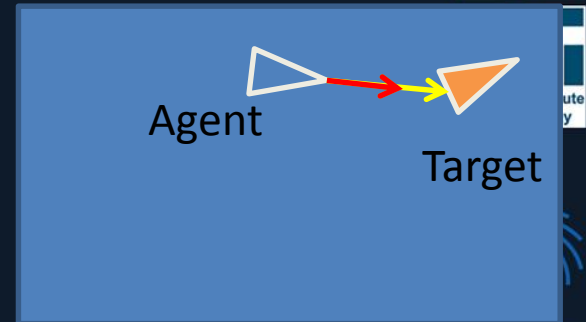
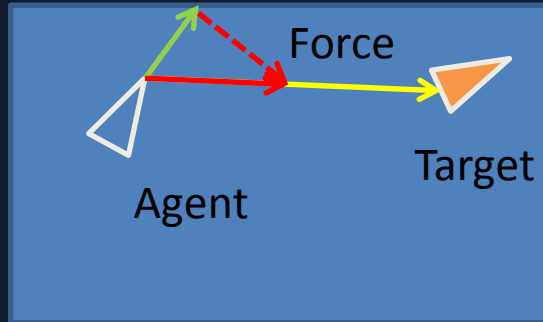
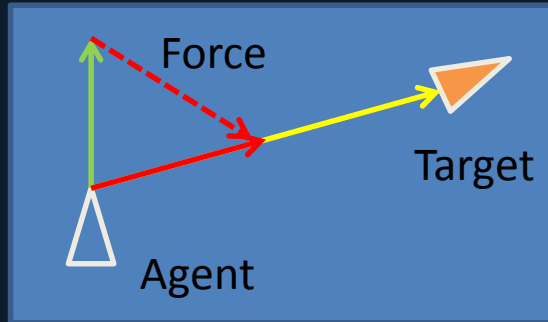
$$\text{Force} = V - \text{CurrentVelocity}$$



Seek Behaviour

- Once we have calculated the Force for the Steering Behaviours we simply apply that Force to the agent's velocity and update the agent's position with this new velocity

$\text{Velocity} += \text{Force} * \text{deltaTime}$
 $\text{Position} += \text{Velocity} * \text{deltaTime}$
 $\text{Heading} = \text{normalise}(\text{Velocity})$



Flee Behaviour

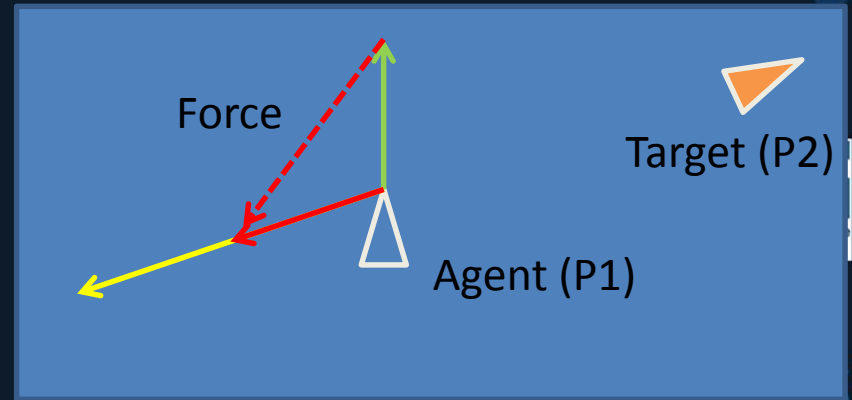
- Flee is the exact opposite to Seek
 - Instead of a vector towards the target we calculate a vector away from the target

- Example:

$$V = \text{normalise}(P1 - P2)$$

x maxVelocity

$$\text{Force} = V - \text{CurrentVelocity}$$



Untargeted Motion

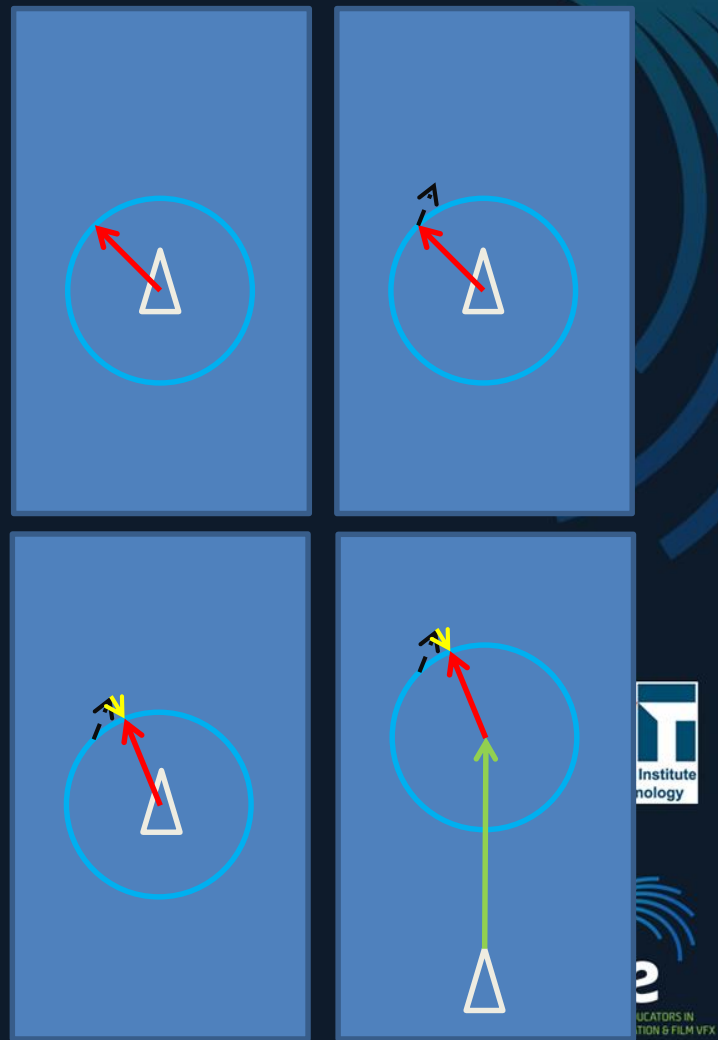
- Seek and Flee are great behaviours that can be used for various situations
 - Fish fleeing a Shark
 - A soccer player seeking the ball
- But not all behaviours need to have a specified target
 - Fish aren't always fleeing a shark!
 - People may wander aimlessly through a shopping mall

Wander Behaviour

- Wander is a behaviour that tries to mimic random movement
 - Such as a fish swimming in a tank, or an ant walking
- Wander works by seeking towards a randomised target on the edge of a sphere located in front of the agent
 - We need four variables:
 - Wander Radius of the sphere
 - Wander Distance of the sphere in front of the agent
 - A Wander Jitter amount used to randomise the target
 - The previous frame's Wander Target to start with

Wander Behaviour

- The process is:
 - Start with a random **target** on the edge of the sphere with a set **radius** around the agent
 - Add a randomised vector to the target, with a magnitude specified by a **jitter** amount
 - Bring the target back to the radius of the sphere by normalising it and scaling by the radius
 - Add the agent's heading, multiplied by an **distance**, to the target
- We then simply use the target for a Seek behaviour



Wander Behaviour

- The result of the wander behaviour is that the agent seeks to a constantly moving target in front of it
 - The bigger the sphere's radius / closer it is to the agent, the more the agent turns
 - The smaller the sphere / further in front of the agent, the less the agent turns
 - The larger the jitter amount the more erratic the agent turns
- With lots of Wandering agents it can look like a crowd of people moving about

Summary

- Steering Behaviours are a way to give autonomous agents locomotion
- Behaviours can be turned on and off
 - Agent Wanders
 - If agent close to enemy then Flee
 - If agent close to food then Seek
- In the next topic we will look at more behaviours
 - We will also look at ways to combine behaviours to run simultaneously