National Centre for Computer Animation

Sprite Engines 2

Fear is the path to the dark side. Fear leads to anger. Anger leads to hate. Hate leads to suffering. I sense much fear in you.

ES Overview

- Introduction to ES
- **2D Graphics in Entertainment Systems**
- Sound, Speech & Music
- 3D Graphics in Entertainment Systems

Sprite Engines

- 2D Moving Images
  - Timers & linear interpolation
- 2.5D animation systems
  - Layering
  - Parallax Scrolling
- Advanced Concepts
  - Per-Pixel Collision
  - Particle Systems

2D Moving Images

Motion is created by showing a quick sequence of images.

- smooth motion requires about 15 frames/second
- film uses 24 frames/second
- TV on PAL uses 25 frames/second
- TV on NTSC uses 30 frames/second

Timers & Interpolation

Why use a timer?

- on computers frame-rates cannot be guaranteed to be constant
- animation is supposed to run independent of frame-rate

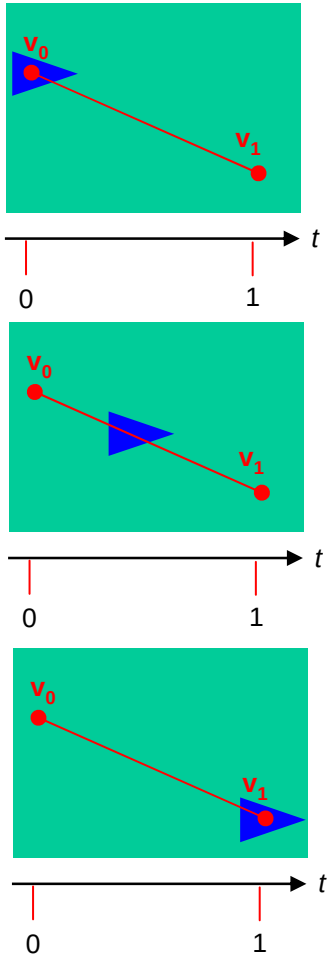
How does it work?

- time needed for drawing a frame is measured
- this allows for a calculation of how much an object needs to be moved (*by linear interpolation*)

To find a position V between a starting position V_0 and an end position V_1 at timestep *t* we can use the following formula:

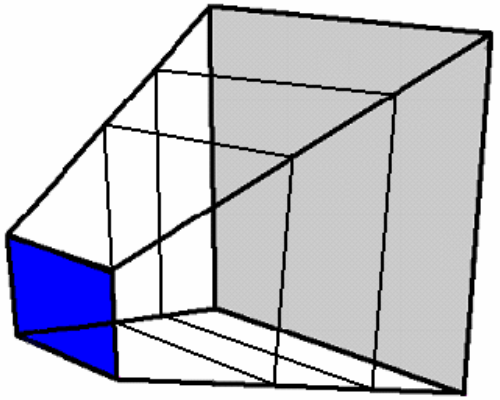
$$V_{(t)}=V_0(1-t) + V_1 t \quad \text{if } 0 \le t \le 1$$

Instead of just linearly interpolating values, an ease-in (*animation slowly speeding up at the start*) and ease-out (*animation slowing down at the end*) might be desirable. For this the trigonometric functions (*sin and cos*) can be useful.

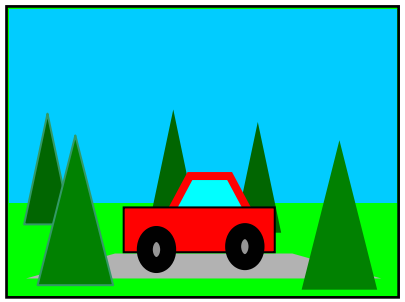


2.5D Animation

If 2D images are used for creating the illusion of 3D, one possibility are 2.5D scenes:



several layers as seen from the camera

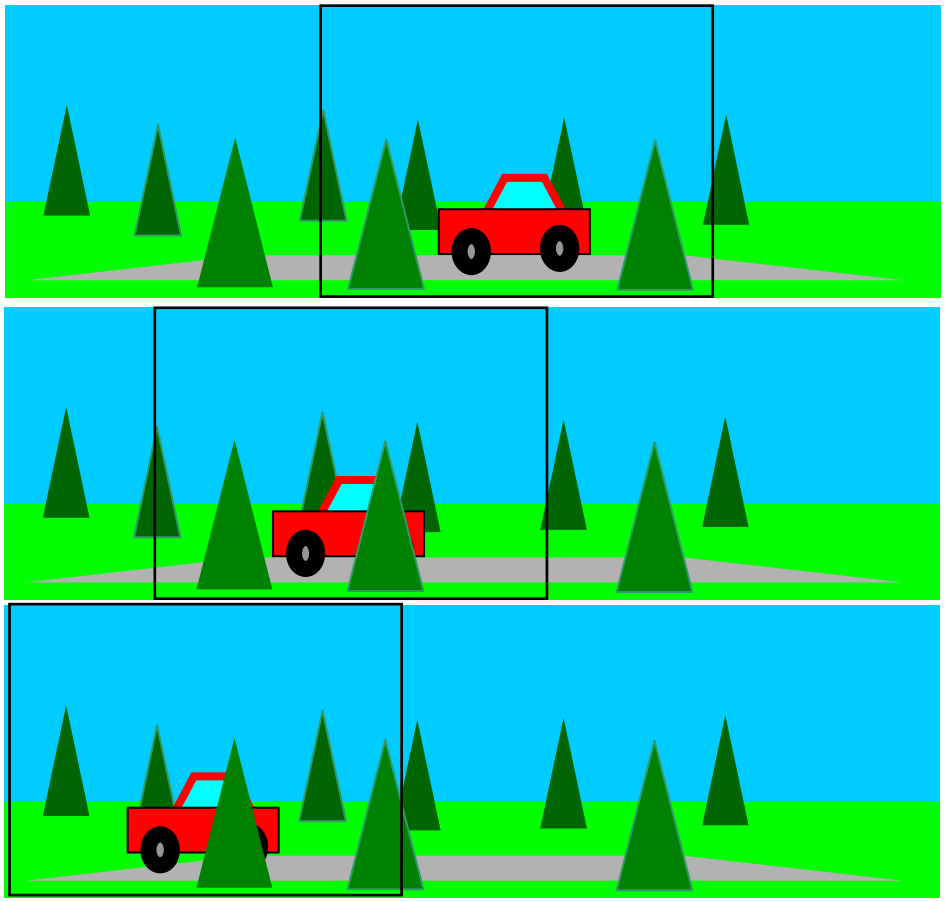


Layers:

- images are drawn back-to-front
- more distant images are drawn smaller (*mip-mapping may be used to avoid scaling errors/artefacts*)
- closer images are drawn larger

Scrolling

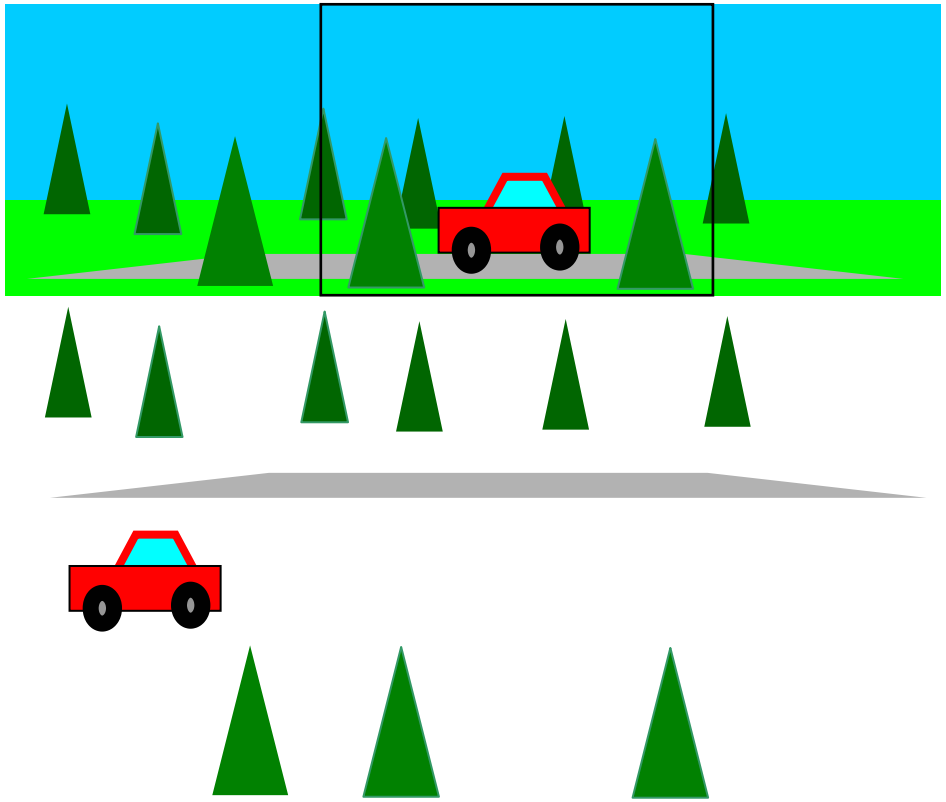
If the animation of objects is achieved by moving the background past an object (*rather than moving the object past the environment*) this is called **scrolling** (*from screen rolling*).



Parallax Scrolling

Parallax scrolling enhances the illusion of depth by moving more distant layers at a slower speed past the viewer than more closer layers.

- background image + sprites
- scenery back object layer
- road layer
- game object
- scenery front object layer

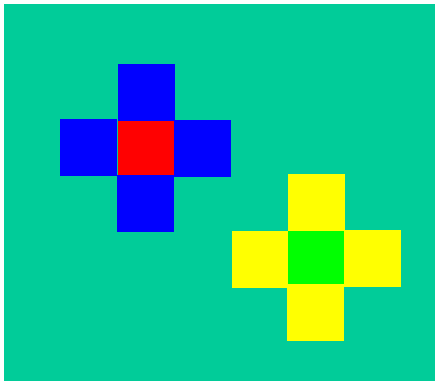


see: http://joesparks.shockwave.com/production/swf/p2_treesdemo1.swf

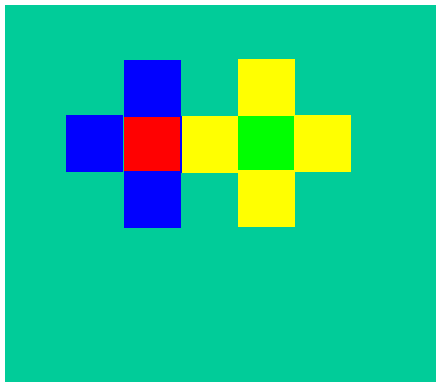
Per-Pixel Collision

- Per-Pixel Collisions are calculated by comparing a sprite's pixels that are being drawn with the colours of the pixels of the background that they are drawn onto (*i.e. the pixel values of already drawn objects that they are drawn onto*). A collision has occurred if the pixel that is drawn onto is not of the "empty" background colour.

no collision

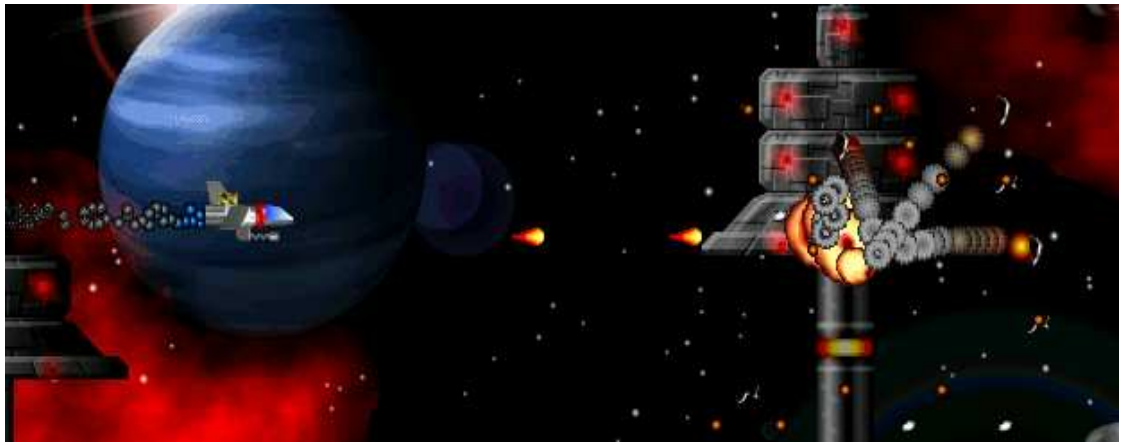


collision



Particle Systems

- Several objects (*sprites*) are emmitted from the same spot, animating according to pre-defined rules
- Each object has an age (*if it reaches the maximum, it dies/disappears*)



Very good for explosions.