Animation

Digital Multimedia, 2nd edition
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Chapter 8

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Animation

- *The creation of moving pictures one frame at a time*
- Literally 'to bring to life'
- e.g. make a sequence of drawings on paper, in which a character's position changes slightly in each drawing
- Photograph drawings in sequence, using movie camera that advances one frame at a time
- Play back resulting film – character will move

Traditional Methods

- Drawings/paintings on paper
- 1440 drawings for every minute of film
- Cel
- Painted or scratched film
- Cut-outs
- Clay animation (Claymation)
- etc

Captured Animation

- Computer + video camera + traditional technique
- *Frame grabbing* – record each frame to disk
- Save as QuickTime &c, edit non-linearly like video
- Can also use scanner or digital still camera, or create each frame in a graphics program (e.g. Painter)

Digital Cel

- Use layers (e.g. in Photoshop) like sheets of acetate in traditional cel animation

- e.g. static background on one layer, moving simple object on a layer in front of it. Make the object move by repositioning the layer

- More complex cases, just need to change those layers where movement or other change occurs between frames

Sprite Animation

- Store a single copy of all static elements and moving objects (*sprites*) and a description of how the objects move

- Each sprite can be a collection of images called *sprite faces*, which can be substituted in sequence to produce composite motion

- e.g. walk cycle

Key Frame Animation

- Traditional: key frames drawn by chief animators at important points in the animation

- In-between frames drawn by less skilled animators

- Computer-based: key frames drawn explicitly

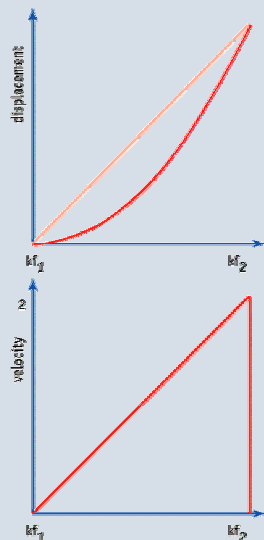- In-between frames *interpolated* by software

Linear Interpolation

- Constant velocity

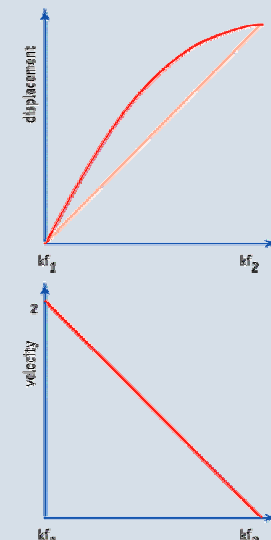- Motion begins and ends instantaneously
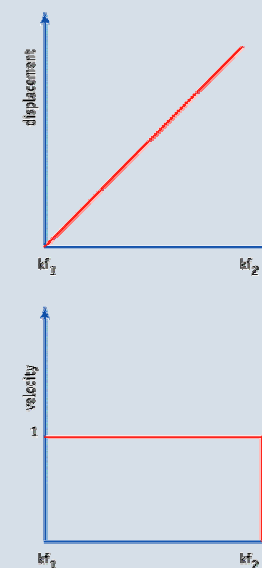
Easing In

- Object accelerates, gradual transition from stasis to motion

Easing Out

- Object decelerates, gradual transition from motion to stasis

Animated GIFs

- Sequence of images can be stored in a single GIF file, and displayed one after another by a Web browser or other software

- No browser plug-in required

- Can specify looping, delay between frames

- 256 colour palette

- No sound

SWF

- Popular Web animation format

- Usually generated by Macromedia *Flash*

- Vector animation format

- Motion represented as numerical operations on vector data

- Can also include bitmapped images (e.g. as backgrounds)

Flash

- *Timeline* – graphical representation of sequence of frames

- Key frames – drawn/copied from previous and transformed

- Simple frames – hold on previous key frame

- *Stage* – sub-window in which frames are created by drawing with vector tools

- Can also import bitmaps as objects, add text

Symbols

- Reusable objects stored in a library

- Graphic symbols

- Button symbols (for interactivity)

- Movie clip symbols (self-contained animations within a movie)

- Create *instances* by dragging on to stage

- If symbol is edited, all its instances updated

Motion Tweening

- Motion tweening

- Object is placed in a key frame

- Create Motion Tween

- Object is turned into a symbol

- Add key frame at end of tweened sequence and move or transform object

- Motion in intermediate frames is interpolated (*tweened*)

Shape Tweening

- Also called *morphing*

- Shapes of graphical objects are transformed in between key frames

- Have to generate the interpolated frames, so resulting SWF is bigger than when motion tweening is used

Motion Graphics

- Like time-based graphic design

- Move, transform, alter layers of a bitmapped image between frames

- Apply *time-varying* filters and effects

- AfterEffects supports linear and Bézier interpolation in both space and time (rate of change)

- Can have new effects that only make sense in time, e.g. shatter, particle effects

3-D Animation

- "Easy to describe but much harder to do"

- Properties of 3-D models (shape, size, position, rotation, surface characteristics, etc), light sources and cameras are numerically defined

- Animate a scene by changing the numbers, rendering a new frame, changing further …

- Can make objects move, or move the camera

- Requires 3-D visualization and animation skills and great amount of processing power

Inverse Kinematics

- Useful for animating *jointed structures*, especially limbs of human or animal figures

- Model must obey *kinematic constraints*

- e.g. if upper arm moves, lower arm and hand must move with it

- *Inverse* kinematics follows chain in reverse (easier for the animator)

- e.g position the hand, then compute motion of the rest of the arm move to accommodate it

Virtual Reality

- Strictly, an immersive sensory experience of a synthetic world

- Head-mounted displays, data gloves, haptic interfaces, etc

- More modestly, 3-D graphic that can be explored

- Draggable panorama, objects that can be moved round, etc

- VRML, QuickTime VR