Animation

Digital Multimedia, 2nd edition

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Chapter 8

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

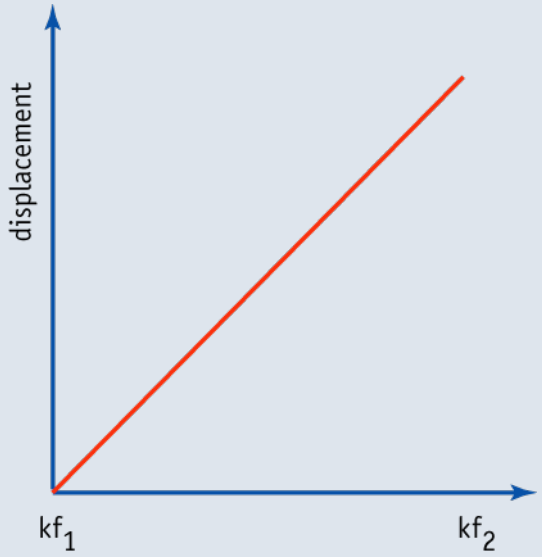
- Store a single copy of all static elements and moving objects (*sprites*) and a description of how the objects move
- Each sprite can be a collection of images called *sprite faces*, which can be substituted in sequence to produce composite motion
  - e.g. walk cycle

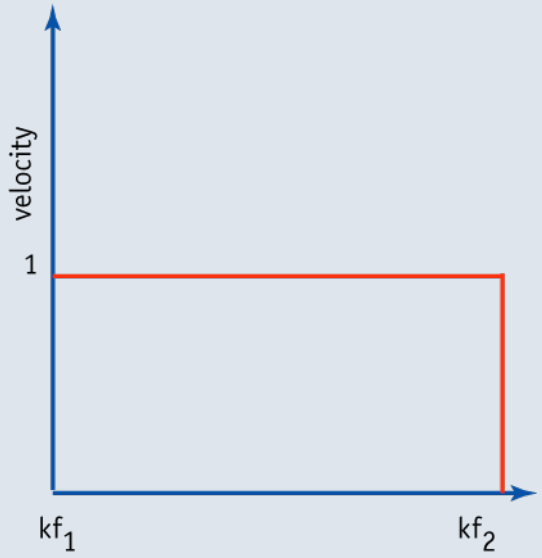
Key Frame Animation

- 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

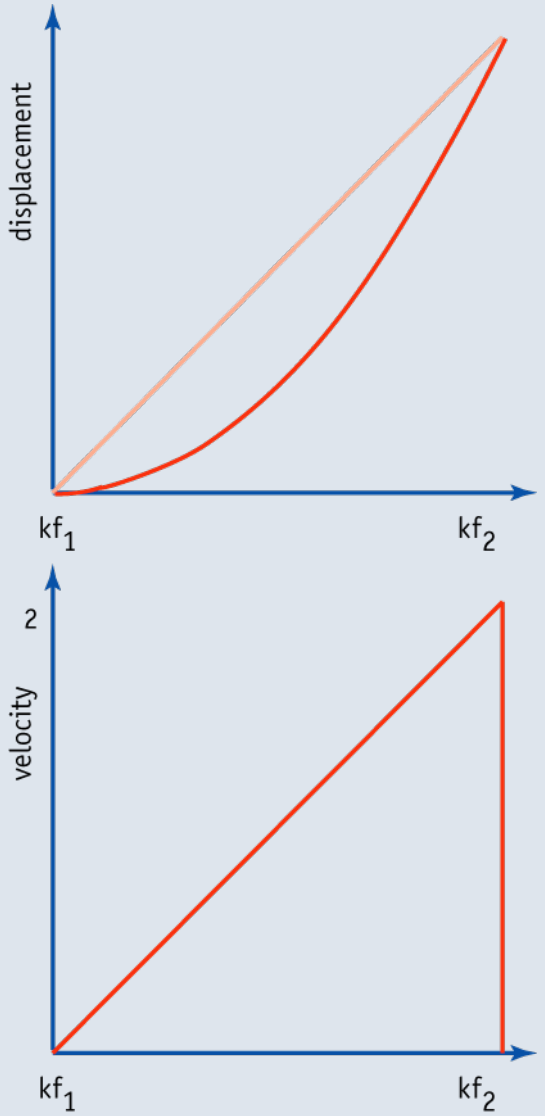
- Constant velocity
  - Motion begins and ends instantaneously





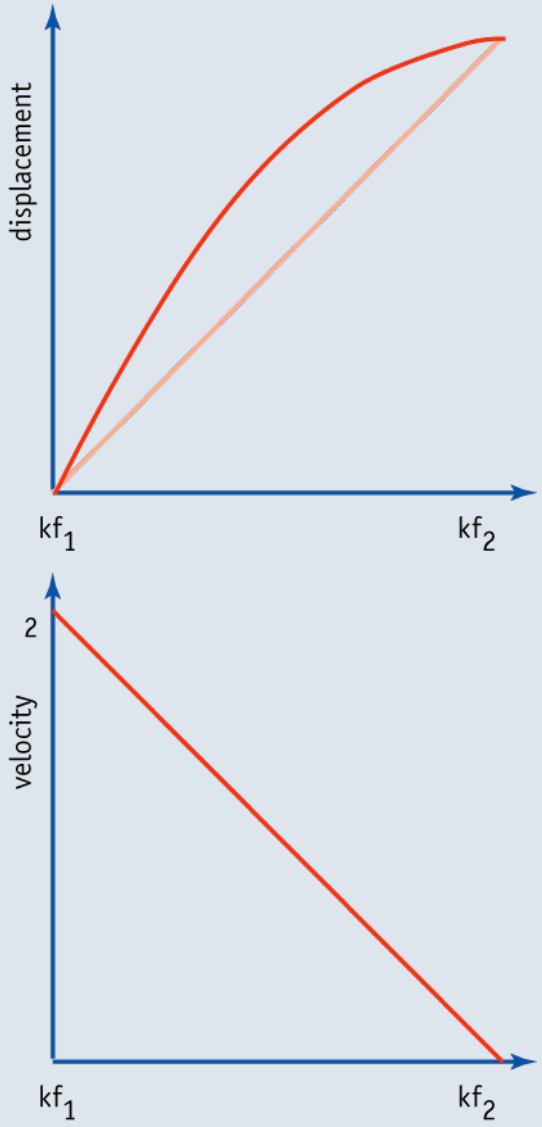
Easing In

- 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