



IMGD 1001 - The Game Development Process: Animation

by

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(with lots of input from Mark Claypool!)



New Artistic Courses

□ **AR 1100. ESSENTIALS OF ART.**

This course provides an introduction to the basic principles of two and three-dimensional visual organization. The course focuses on graphic expression, idea development, and visual literacy. Students will be expected to master basic rendering skills, perspective drawing, concept art, and storyboarding through both traditional and computer-based tools.

□ **AR 1101. DIGITAL IMAGING AND COMPUTER ART.**

This course focuses on the methods, procedures and techniques of creating and manipulating images through electronic and digital means. Students will develop an understanding of image alteration. Topics may include color theory, displays, modeling, shading, and visual perception.

□ **AR 3000. THE ART OF ANIMATION.**

This course examines the fundamentals of computer generated 2D and 3D modeling and animation as they apply to creating believable characters and environments. Students will learn skeletal animation and traditional polygonal animation, giving weight and personality to characters through movement, environmental lighting, and changing mood and emotion. Students will be expected to master the tools of 3D modeling and skinning, and scripting of behaviors.

Introduction

- "Computer artist is modern-day alchemist"

(*Creating the Art of the Game*, by Matthew Omernick)

- Turn polygons and pixels into wondrous worlds
- Job of artist is to interpret world
- Quality toolset can empower, but doesn't make you an artist
 - Need passion, talent and practice
- Sources of inspiration

Introduction: Inspiration from Playing Games

- Duh, but many don't...
- Easy trap to fall into when busy
- But need to play games for comparison of competitive products, seeing other solutions to problems, etc.
- Plus, how can make fun game if not having fun yourself?

Introduction: Inspiration from Real World

- Tenet of Game Design:
- "The real world is always more interesting than anything we can make up"
 - Ex: even Dark Forces II: Jedi Knight, environment made real-world sense
 - Spaceport had entertainment area for pilots, cluttered maintenance bays, refueling pipes ...
 - And all was dirty
- (More examples later)

Introduction: Remember the Constraints

- Year 2098, Macrosoft will release FunStation 3000, 14 million terabytes of RAM, quantum-holographic drive with near infinite storage, processors at the speed of light
 - Game developers complain not fast enough
- Game artists must be creative *inside confines of technology*
 - All disciplines: engineering, design, sound
 - But often constraints biggest on artist

2D Animation

- Game Inception
- Foreword
- The Concept Artist
- Terminology
- 2D animation (next)
- 3D Art
 - Modeling, Texturing, Lighting

2D Animation

- Animation → produces the illusion of movement
- Display a series of frames with small differences between them
- Done in rapid succession, eye blends to get motion
- Unit is Frames Per Second (fps)
 - 24-30 fps: full-motion (Game Maker does 30)
 - 15 fps: full-motion approximation
 - 7 fps: choppy
 - 3 fps: very choppy
 - Less than 3 fps: slide show
- To do successfully, need to keenly observe, focus on differences in movement
 - Apply basic principles (next)

Key Frames

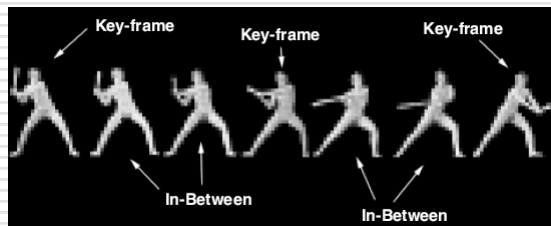
- Images at extremes in movement
 - Most noticeable to observer
 - Ex: for flight, wings up and wings down
 - Ex: for walking, right leg forward, legs together, left leg forward
- The more the better?
 - Smoother, yes
 - But more time to develop (tradeoffs)
 - And more prone to errors, "bugs" that interfere with the animation



FIGURE 9-3:
Key-frame
Example

In-Between Frames ("tweens")

- Generated to get smooth motion between key-frames
 - Can be tedious and time consuming to make
 - Most software allows duplication
 - Some does interpolation for you (Game Maker, Flash)



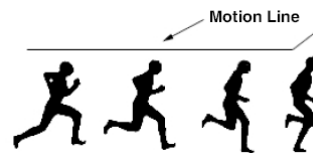
Frame Animation Guidelines

Object	Minimum # of Frames	Maximum #
4-legged animal running	4	16
Animal biting	2	5
Crawling	2	12
Explosions	5	16
Falling	3	5
Flying	2	12
Jumping	2	10
Kicking	2	6
Punching	2	6
Rotating/spinning	4	16
Running	2	12
Swinging (an object)	2	8
Throwing (an object)	2	6
Vehicle flying	2	4
Vehicle moving	2	8
Walking	2	12

(See GameMaker tutorial shooter for examples of Enemy Planes, Explosions)

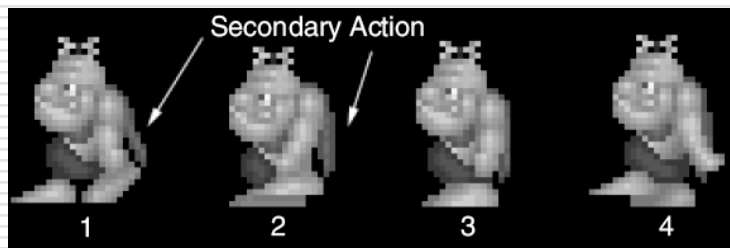
Motion Line

- Invisible line created by object as moves
 - Locate in center of gravity
- Straight if flying
 - Ex: bullet
- Up and down if bounces
 - Ex: rubber ball
- Depends upon speed and desire for exaggeration
 - Ex: Human sprinting versus walking
 - Ex: Tired soldier



Secondary Actions

- Animation part that does not lead movement, but follows it
 - Add extra dimensions of reality
 - Ex: Hair moving in wind
 - Ex: Cape billowing backward



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Based on Chapter 9, *Designing Arcade Computer Game Graphics*, by Ari Feldman

Steps in Creating Animation Sequences (1 of 3)

- Conceptualize – have vision (in mind or on paper) of what animation will look like
- Decide on object behavior
 1. Animated once (no looping)
 2. Animated continuously (using cycles)
 - 2nd choice means must make last key frame blend with first
- Choose a grid size – will contain and constrain object
 - Test and experiment briefly to have plenty of room
- Design key-frames - drawing the motion extremes
 - Start with simple shapes to represent main actions
 - Ex: stick figures or basic shapes (circles, squares)

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Steps in Creating Animation Sequences (2 of 3)



- Estimate the in-betweens – think of how many you will need to complete the sequence smoothly
 - Be conservative. Easier to add additional transition frames than remove them
- Create object motion lines - trace the motion line and motion angles for the sequence. Make sure properties are consistent with object, else adjust
 - Use your painting program's "line tool"
 - If not, make the appropriate adjustments to the sequence and repeat
- Apply secondary enhancements
 - Embellish to look convincing and enticing

Steps in Creating Animation Sequences (3 of 3)



- Test each movement
 - May have animation rendering (ex- Game Maker)
 - Can be done with 'copy' and 'undo' in tool
 - Look for flaws
 - movement, discolored pixels...
- Repeat
 - Do the same for all animations

General Animation Tips (1 of 3)

- Remember the relationship between frames and animation smoothness
 - More frames, more smoothness (but more time)
- Always account for color
 - Primary actions and secondary actions should be rendered in colors that make them easy to see.
 - Otherwise, the effectiveness of the animation can be compromised (ch 7 and ch 8)
- Use tempo wisely- Never too fast or too slow
 - Try to mimic nature. Observe yourself. Study the speed at which different types of objects move in different situations.

General Animation Tips (2 of 3)

- Try to individualize your objects
 - Unique and individualized touches make seem real. "Personality" that distinguishes it
 - Easiest may be to use exaggeration and embellishment (i.e., secondary actions)
- Keep it simple - Unnecessary complexity can ruin animation
 - Stick with primitives and minimal frames
 - Don't do any more work than you have to!

General Animation Tips (3 of 3)

- Use exaggerated elements - as an animation device, adds depth
 - Especially important for short animation sequences to make convincing
 - Learn from others - study how objects around you move, books on animation, observe your favorite games, look at sprites in Game Maker
 - Will give insights into animation techniques, make better animations yourself
- Make use of Primitives (next)

Animation Primitives

- Used in many games:
 - Cylindrical primitive
 - Rotational primitive
 - Disintegration primitive
 - Color flash primitive
 - Scissors primitive
 - Growing primitive
 - Shrinking primitive

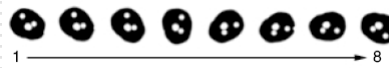
Cylindrical Primitive

- ❑ Spinning, rotating objects (hulls, wheels, logs...)
- ❑ Easy to master since doesn't require major changes
- ❑ Instead, uses *markers* that change
 - Show goes from one end to another
- ❑ Need at least 3 frames



Rotational Primitive

- ❑ Object moving in place (gun turret, asteroid...)
- ❑ Again, easy since rotate picture fixed degrees



Arcade Game Object	Degree Increments per Frame	Total Frames Required	Comments
Asteroids/meteors (coarse)	45°	8	Minimum required to produce convincing animation.
Asteroids/meteors (smooth)	225°	16	Sufficient to render convincing animation.
Gun turrets (coarse)	90°	4	Minimum required to produce convincing animation.
Gun turrets (smooth)	45°	8	Sufficient to render convincing animation.
Spinning objects (coarse)	90°	4	Minimum required to produce convincing animation.
Spinning objects (coarse)	45°	8	Sufficient to render convincing animation.
Vehicle/character facings (coarse)	90°	4	Minimum required to produce convincing animation.
Vehicle/character facings (smooth)	45°	8	Sufficient to render convincing animation.

Disintegration Primitive

- ❑ Remove object from screen (character dies, explosion...)
 - Melting – reduce vertical area
 - Dissolving – remove random pattern
 - Color fading – extreme color change
- ❑ Take fixed percentage out for smoothness

Selected Removal Method	Estimated Percent Removed per Frame	Total Frames
Melting (coarse)	25	4
Melting (smooth)	10	10
Dissolving (coarse)	25	4
Dissolving (smooth)	10	10
Color fade (coarse)	12.5*	8*
Color fade (smooth)	6.25*	16*



Color Flash Primitive

- ❑ Flickering behind object (flash of jewel, sparkle of torch, pulse behind rocket...)
 - Usually intense, contrast color
 - Usually short animation (but can be complex)



Scissors Primitive

- ❑ One of most popular (walking, biting)
- ❑ Few key frames, large changes in between



Growing/Shrinking Primitive

- ❑ For explosion, growth/reduction potion
- ❑ Pay attention to scale (ex: 2 works well)



Minor Primitives (1 of 3)

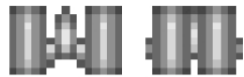


FIGURE 9-19: Squeeze Primitive Example

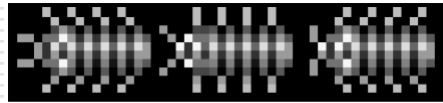


FIGURE 9-20: Swing Primitive Example



FIGURE 9-24: Stomp Primitive Example



FIGURE 9-21: Slide Primitive Example



FIGURE 9-22: Open/Close Primitive Example

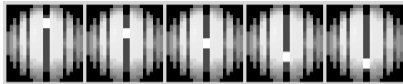


FIGURE 9-23: Bounce Primitive Example



FIGURE 9-18: Piston Primitive Example

Minor Primitives (2 of 3)



FIGURE 9-25: Slinking Example



FIGURE 9-26: Simplified Flying Sequence



FIGURE 9-28: Basic Walking Example #1



FIGURE 9-29: Basic Walking Example #2

Minor Primitives (3 of 3)

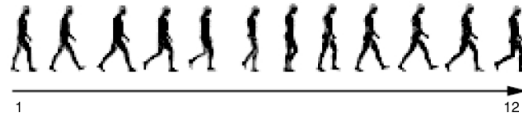


FIGURE 9-30: Complex Walking Example



FIGURE 9-33: Running Primitive Example (Humans)



FIGURE 9-38: Running Primitive Example (Animals)

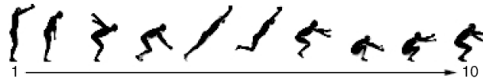


FIGURE 9-40: Complex Jumping Primitive Example



FIGURE 9-43: Crawling Primitive Example (Part 1)