

# Development of Games

Lecture 3  
Creativity and Design



# Outline

- Sources of idea of game
- Nurturing the Creative Process
- 3D Art
  - Modeling, Texturing, Lighting
- Animation (mostly 2D)

# Sources of idea of game

- Book
  - Ex. Duna, Garry Potter
- Movie
  - Ex. Starwars
- Legends
- Fantasy or dream
  - Ex. Warcraft, starcraft
- Existing board or Intelligent game
  - Ex. Play cards, chess, go
- Knowledge (wish to simulate and try what will be if ...)
  - Ex. Civilization, Colonization, Sudden Strike
- Wish to get unusual or unavailable feeling
  - Ex. Flight simulators
- Wish to make new intelligent game
  - Ex. tetris

# Nurturing the Creative Process

- Creativity is not intellectual anarchy
- Thoughts are associative – generate new ideas by combining others (picture of lattice of association)
  - Trick is to notice patterns in association
  - Say, similarity between *post office delivery* and *network traffic routing*
- Facilitate creative process
  - Stuff head with concepts and associations
    - Can't notice association between Post Office and Network Routing if don't know anything about either
  - How? *Read* (All great game designers?)

# Nurturing the Creative Process - Read

- Make reading a lifelong process
- Broaden your reading
  - More than SciFi and Fantasy books
  - History, Religion, Politics, Culture
  - Game Design books
- Wonder as you read (“Why is the sky blue? Why do some coins have serrations on their edges?...”)
  - Tightens up Web of associations
- Find answers to “wonders”
  - Once you find why sky is blue, will tell you why sunset is red (tightens associations further)
- Help build overall *creative foundation*

# Nurturing the Creative Process – Play Games

- More than computer games – *board games*
  - Columbia Games, Avalon Hill, RPGs
  - Example: LOTR Confrontation, Reiner Knizia
- Even computer games, *broaden*
  - Pick titles you would not otherwise play
  - Like FPS games? Fine. But try different genres
  - Become a “student” of games. Learn from them.
  - Bargain bin, even, maybe not great games but maybe great ideas

# Nurturing the Creative Process – Sources of Inspiration

- Perhaps games not as broad as film
  - Shoot ‘em ups like “Alien”
  - RPG’s like “D&D”
  - Safe: “It’s like Medal of Honor but in Desert Storm” ... how creative is that?
- Draw upon wide range of sources for inspiration
  - Opera, Movies with subtitles, Random lectures, scuba diving ... anything to remove *stale thinking*
- Originality in gameplay, story, setting, interface ...
  - Freshness to one, great game
  - Freshness to all, new genre!
- Stephen King – originality when put familiar together in unexpected ways
  - Ex: vampire in pirate setting (turns to shark)

# Nurturing the Creative Process - Brainstorm

- Brainstorming has been much studied, and there have been found some common elements
- Intense emotional involvement
  - *Care* about problem
- Creator struggles, mightily, but fails
- Quiescent period, creator is distracted
- Finally, brainstorm itself and solution leaps to forefront
  - It may even seem obvious at that time



# Having the Idea

- “How many industries can claim to deal in daydreams?”
  - Dreams are where every game begins
- With an idea, don’t implement or tie down to technology
- “Genius is 1% inspiration, 99% perspiration” – Edison
  - Enjoy the 1% because everything else is hard work
- Think of many raw ideas to throw into game
  - May come up with hybrid
  - Look at what can contribute to others so get emergent game

# Nurturing the Creative Process – Growing the Idea

- Most ideas shouldn't grow further
  - Just because it is a creative idea, does not mean it is a good one
- Be aggressive at this point in your own mind in ripping into your own idea
  - Others soon will, so you should first
- Then, when pushing the idea (to, say, a publisher) through to a concept, make sure can “protect”, perhaps with partner politically skilled

# The Creative Process – The Beginning

- Once you have an idea
  - Is it really good?
  - Worth spending time and money on?
  - Even if “rehash” should bring improvement to original and new challenges
  - Discuss with someone that can appreciate the idea

# The Creative Process – Define the Product

- Consider target audience
- Gather feedback from colleagues
- Think about core objectives
- List the challenges
  - Will help determine genre
- Determine how player will interface
- Define unique features, essential to gameplay
  - Has features been done before? If not, is there a reason why not?
- Consider theme (not graphical theme)
- Solidify in two- to three-page document

# The Creative Process – Involving Others

- Never design by committee
  - “The only useful document ever designed by a committee is the constitution”
  - But blend of “like-minded” people can be very effective
- Meet with team with one-pager
- Keep early meetings focused on design and not on technical
- Write all ideas down, may come in handy later
- Incorporate changes into 2-3 page document
- Move on to *Concept Document*

# Steal 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

# Preparing to Create

- Using *reference* essential
  - Difference between mediocre and exceptional game
  - Gives you goals, direction, clues, motivation
- Ex: portrait of friend
  - Could: sit down, imagine friend, draw
  - Or, could: use photo and draw
  - Latter will include details didn't think of
  - Same holds for buildings, cars, etc.
- Reference is not “cheating”
  - Yeah, many want to create directly in minds, but using the *right* reference a skill in itself!

# How and Where to Collect Reference

- Search 'net – Google image search (show demo)
  - Ex: Couch, lazy-boy, lounge chair
  - 2 minutes can provide a lot of details
- Books
  - Ex: on submarines for U-boat
- Movies
  - Ex: U-571
- Physical location
  - Ex: visit U-boat tour, tour country/climate of game. Even fantasy world has trees, etc.



# Setting the Quality Bar

- Need to continually improve own work
- Video games, especially
  - Competition to outdo
  - Driven by hardware improvements
  - Every new release raises expectations
- Look at other games, movies artwork for inspiration
  - Look in past for right, and wrong, and improvement

# Blocking Out Your Scene (1 of 3)

- Mantra: “Broad strokes, then add detail”
  - Ex: painting mountain scene.
    - Start with blue sky, define brown mountains, lake. Finer brush for trees, clouds. Finer for rocks, birds in sky ...
    - Start in corner. Paint all details and move over. You’d go crazy! Would be skewed.
  - Ex: animating a character.
    - Set two keyframes, point A and point B. Get speed right, basic idea. Add frames for up and down. Then legs and arms swing ...
    - When done, smooth walk

# Blocking Out Your Scene (2 of 3)

- For scene, use simple primitives to define scale and layout
- Ex: create village.
  - Working with designer, create plane (crudely drawn map) of layout
    - Scan and import into 3D tool (say, *Maya*)
  - Import 5'11" character (just shape)
    - Use to decide how tall building or how wide door
  - Add objects in right scale
  - Quickly → basic, functional scene of right size and scale.  
Broad stroke number 1!

Tip: get artists & designers to agree upon measurement units & heights of characters

# Blocking Out Your Scene (3 of 3)

- If game engine working, can export into game and run around
  - Often designer will do this, anyway, but artist should have input
- Can throw in some lighting (later) and colors (later)
- Add a few textures (not final ones, but canned that show right feel)
  - Can even add text saying “brick”

# Introduction to Modeling

- Understand core philosophy of polygonal modeling for games
- Want to do it fast and efficiently
  - Allow “broad strokes” in model early
  - More time (and polygon resources) for refinement later
- If quick, but sloppy, end up with stray vertices, overlapping faces ...
  - Wasted resources
  - Plus bugs! For collision detection

# Modeling

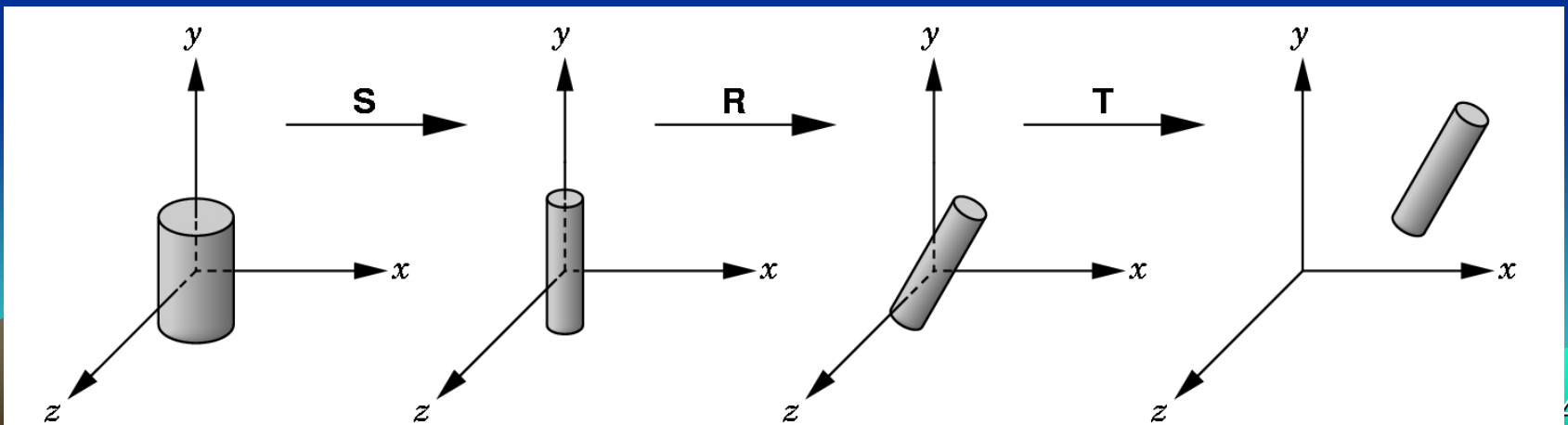
- The modeling problem
- Modeling primitives
  - Polygon
  - Sphere, ellipsoid, torus, superquadric
  - NURBS, surfaces of revolutions, smoothed polygons
  - Particles
  - Skin & bones
- Approaches to modeling complex shapes
  - Tools such as extrude, revolve, loft, split, stitch, blend
  - Constructive solid geometry (CSG)
  - Hierarchy; kinematic joints
  - Inverse kinematics
  - Keyframes

# Primitives

- *Primitives* are basic shapes
- Most 3d packages have same primitives:
  - Sphere, Cube, Cylinder, Plane
  - Use for “broad strokes”
- Concentrate on primitives within object
  - Ex: human body (ovals for shoulders, cylinders for legs, sphere for head...)
- *Components* are parts that make up primitive
  - Ex: vertices, edges, triangles, faces, elements
  - Similar across all packages but terminology can vary
- *Transformation* allows moving, rotating, scaling object or component

# Representing objects

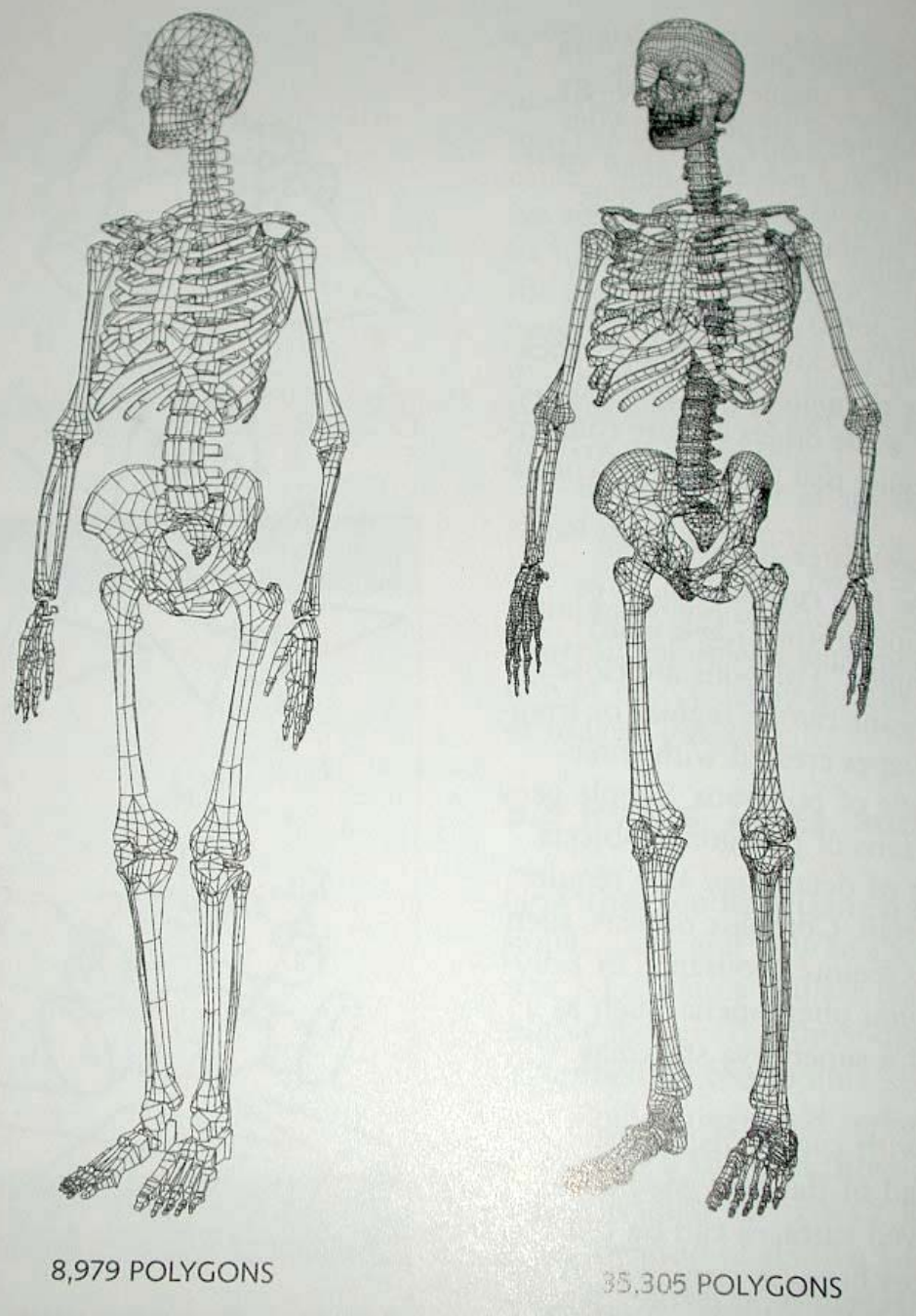
- Objects represented as symbols
- Defined in model coordinates; transformed into world coordinates ( $M = TRS$ )
  - `glMatrixMode(GL_MODELVIEW);`
  - `glLoadIdentity(); glTranslatef(...);`
  - `glRotatef(...); glScalef(...);`
  - `glutSolidCylinder(...);`





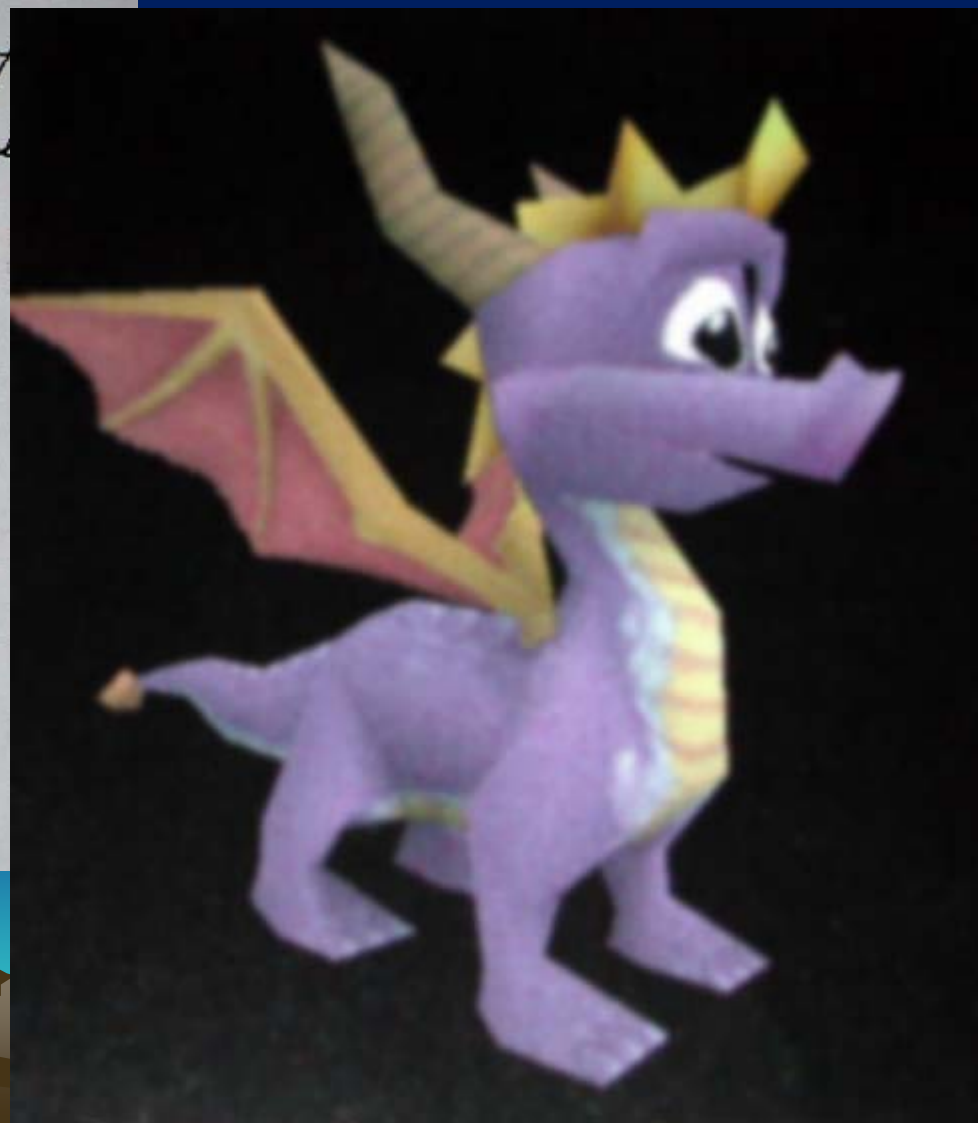
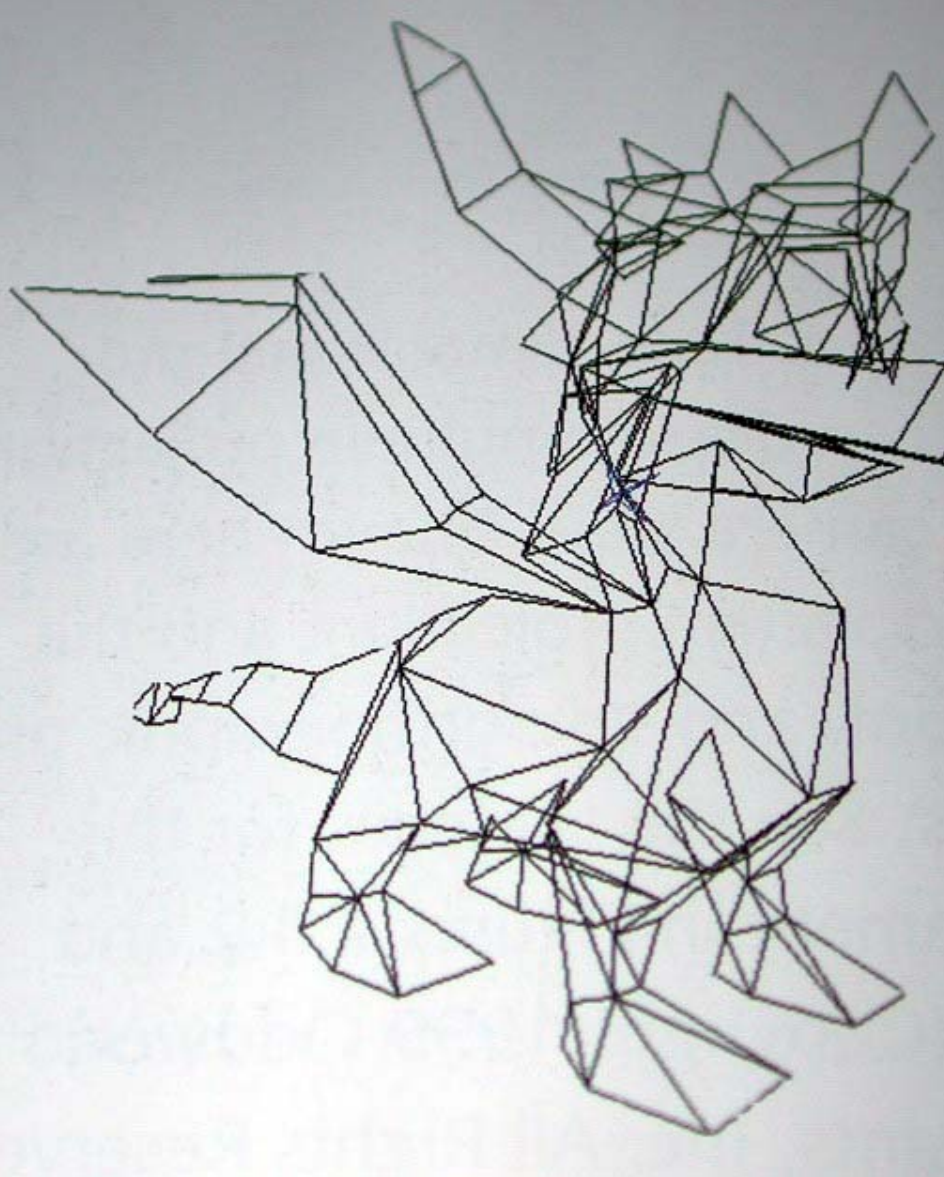
# Primitives

- The basic sort of primitive is the polygon
- Number of polygons: tradeoff between render time and model accuracy



# Polygons

- Polygons preferred since made up of triangles
  - Note, NURBS (Nonuniform Rational B-Splines) uses curves, but more complex to model (not broad!) and render
- Face may have triangles that share vertices (Ex: square down middle)
  - Software may hide shared edge for cleaner look



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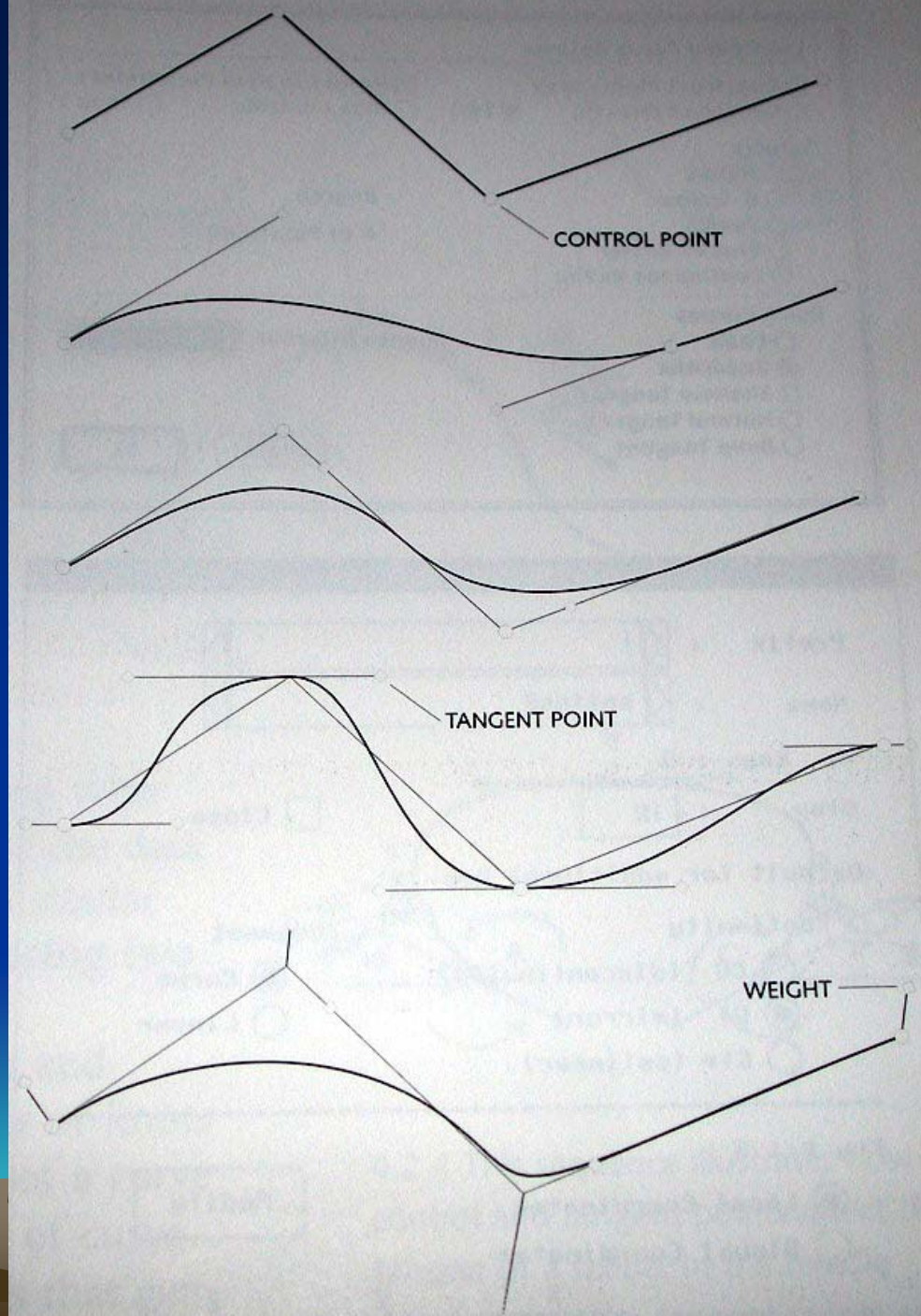






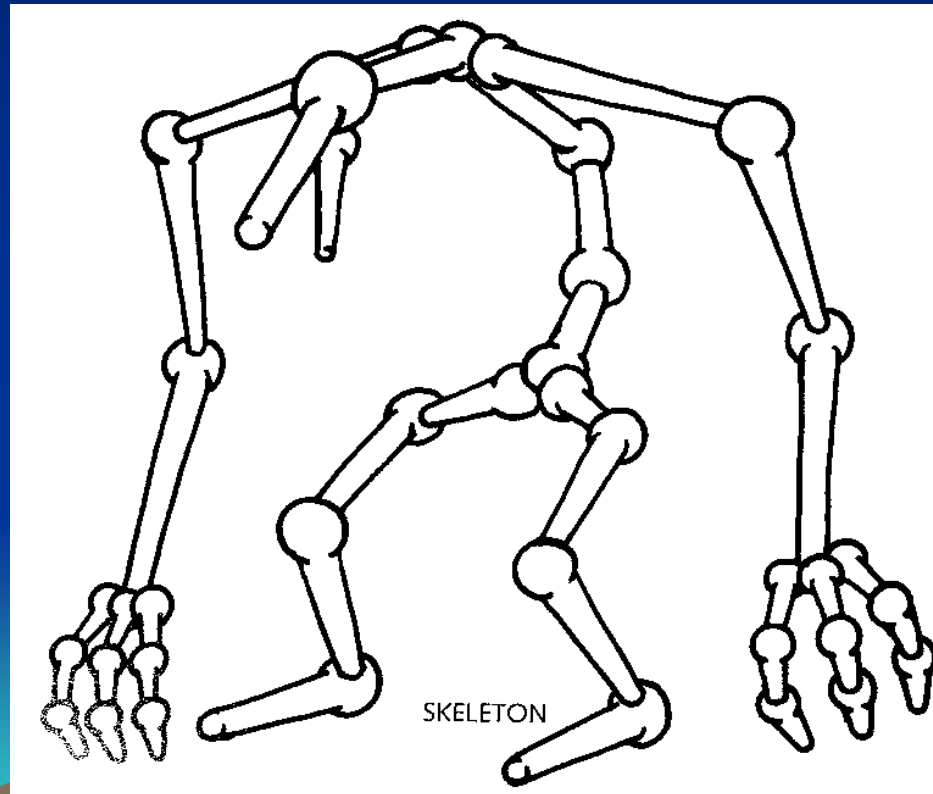
# Spline Curves

- Linear spline
- Cardinal spline
- B-spline
- Bezier curve
- NURBS (non-uniform rational b-spline)

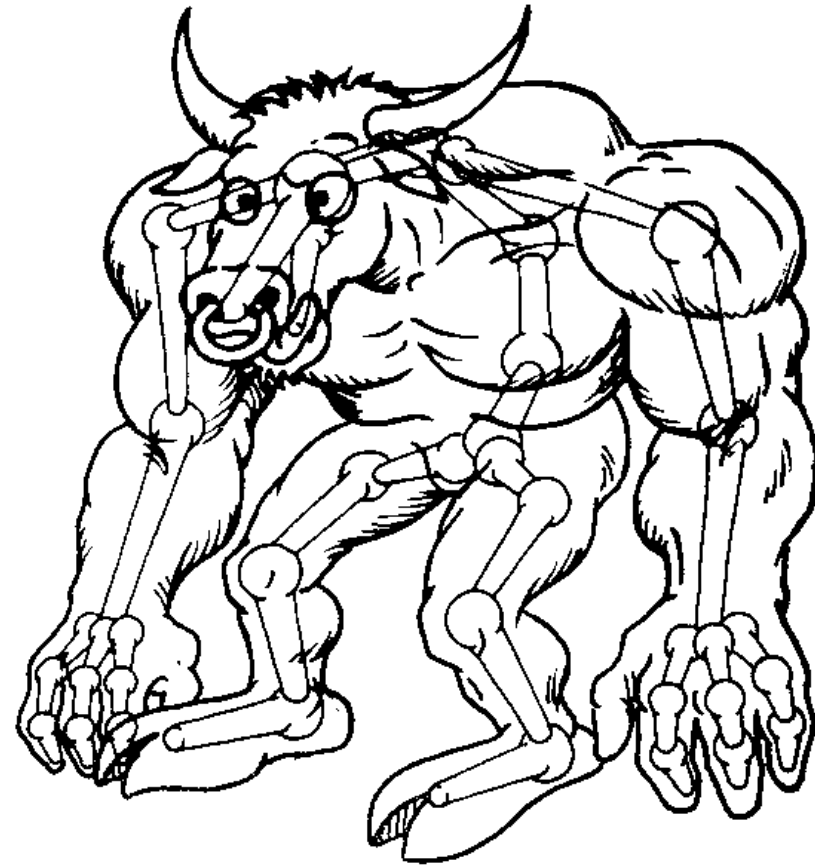
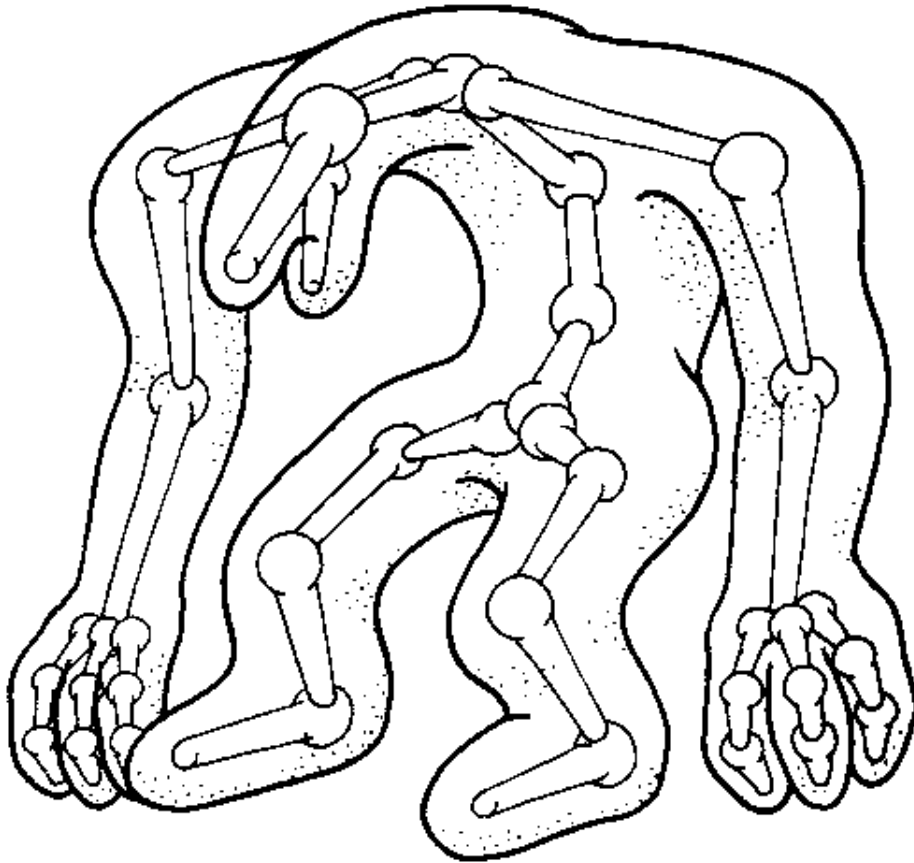


# Skin and Bones

- Skeleton with joined “bones”
- Can add “skin” on top of bones
- Automatic or hand-tuned skinning

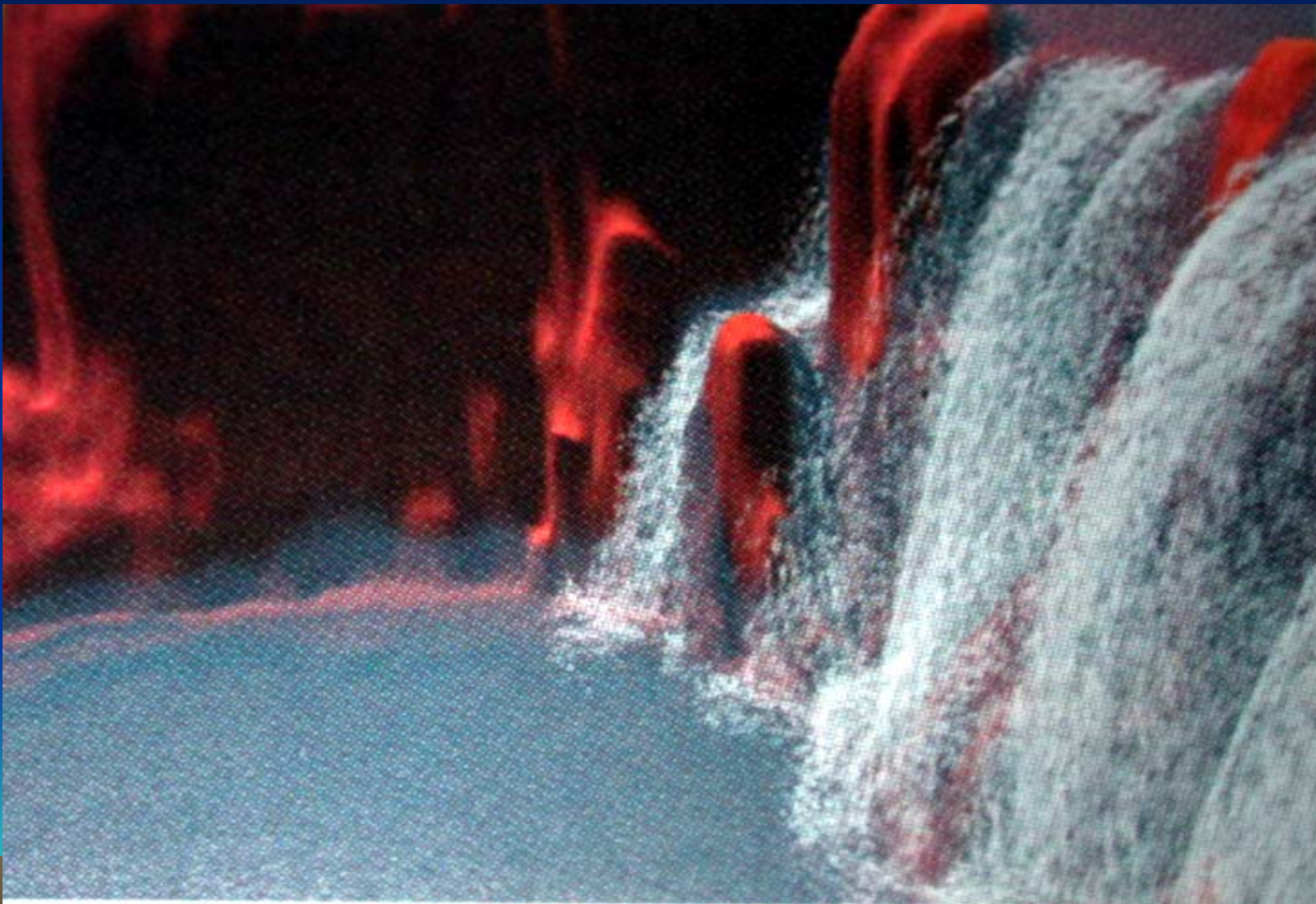


# Skin and Bones (cont.)



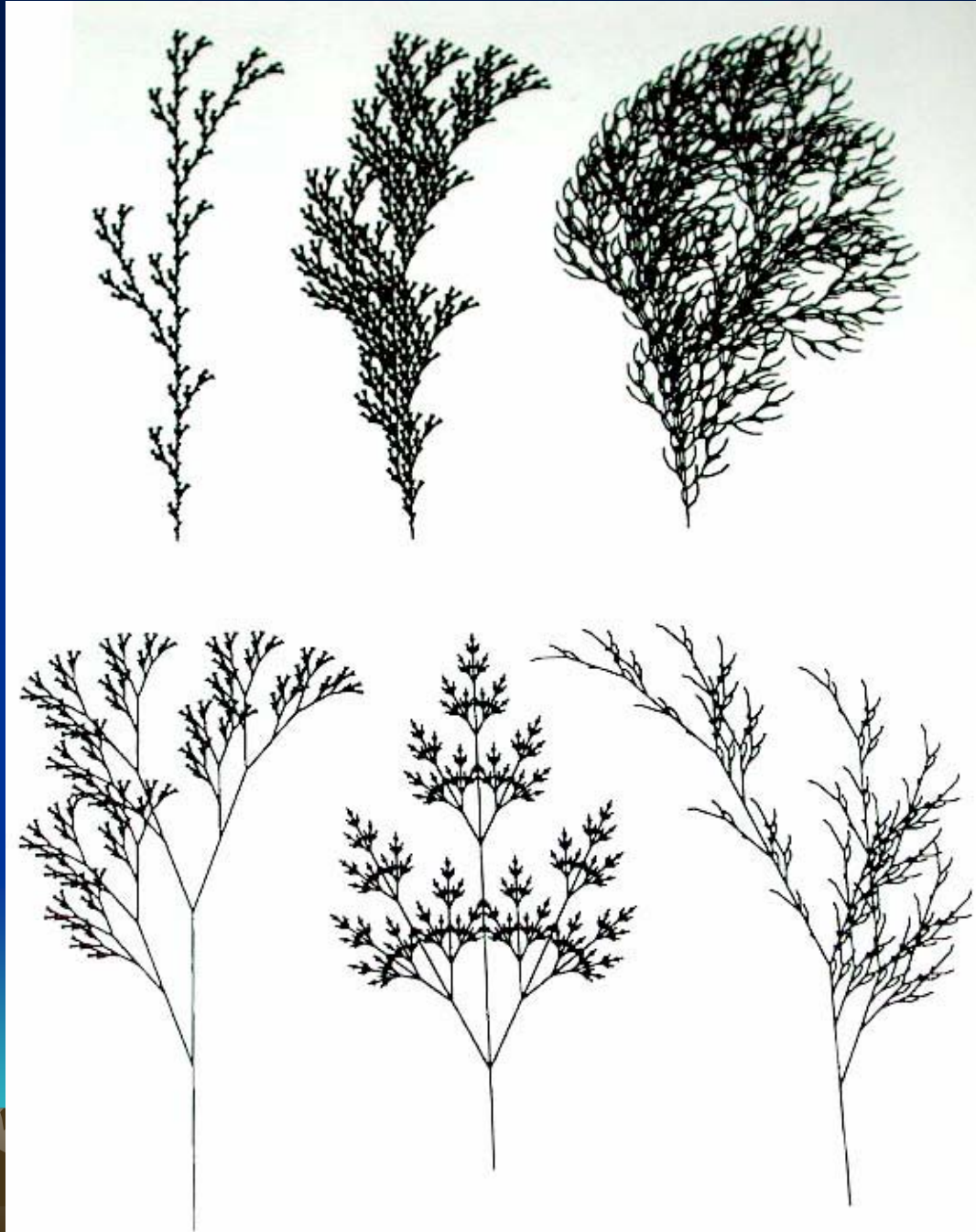


# Particles



# Algorithmic Primitives

Algorithms for  
trees, mountains,  
grass, fur,  
lightning, fire, ...

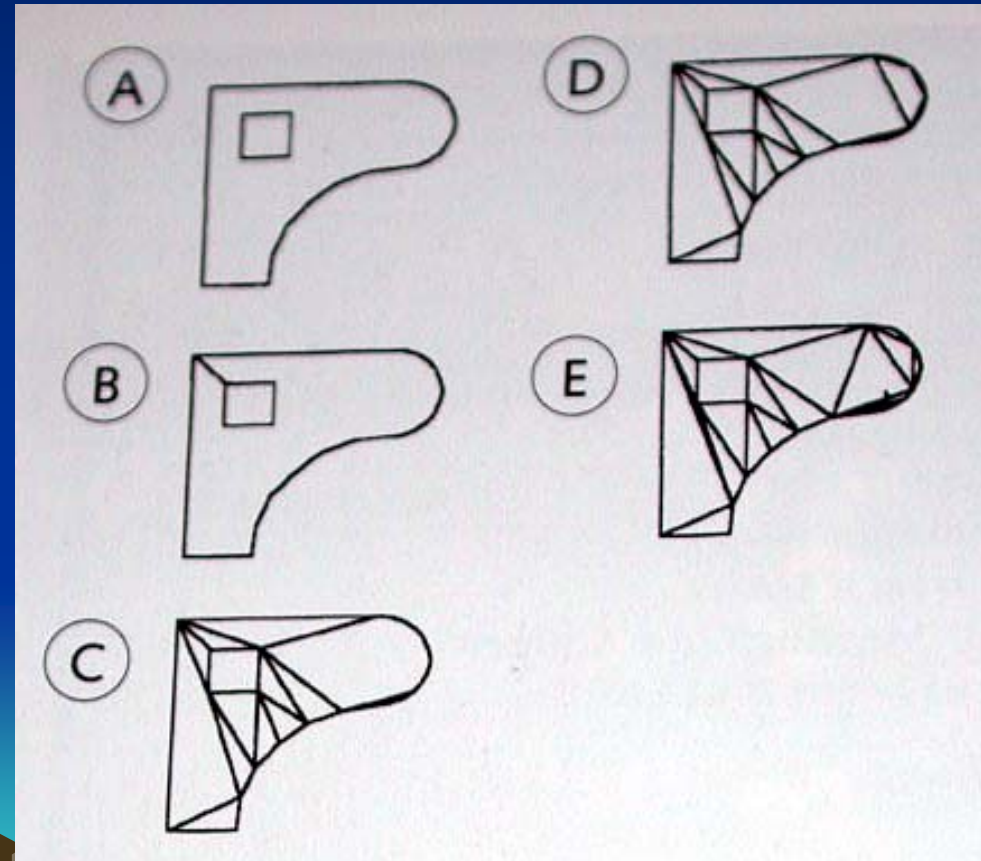






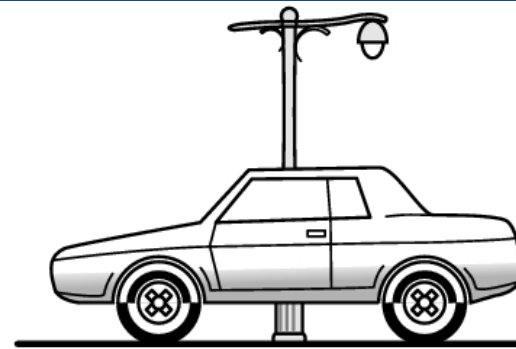
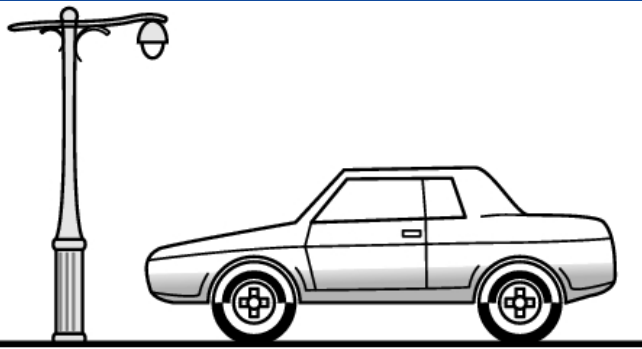
# Geometric model file formats

- .obj: Alias Wavefront
- .dxf: Autocad
- .vrml: Inventor
- *Dozens more*
- Can convert between formats
- Converting to a common format may lose info...



# Hierarchical models

- When animation is desired, objects may have parts that move with respect to each other
  - Object represented as hierarchy
  - Often there are joints with motion constraints
  - E.g. represent wheels of car as sub-objects with rotational motion (car moves  $2\pi r$  per rotation)

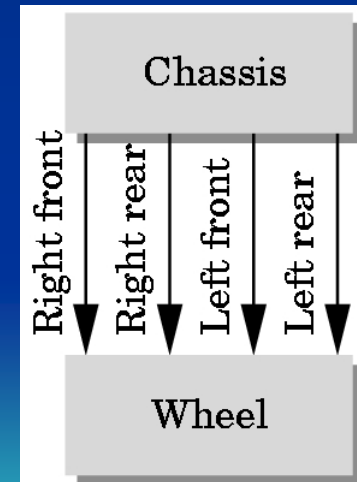
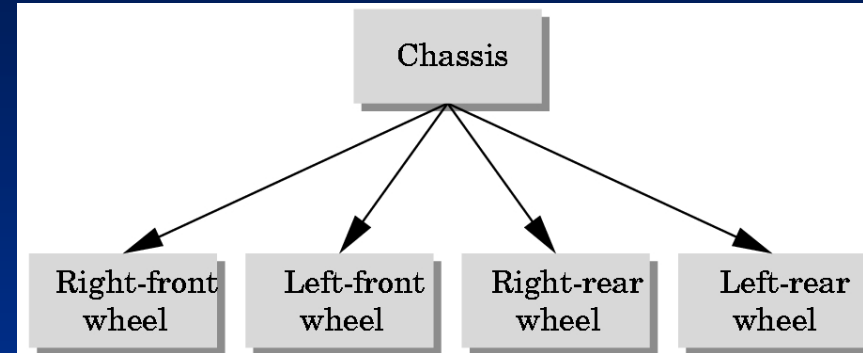






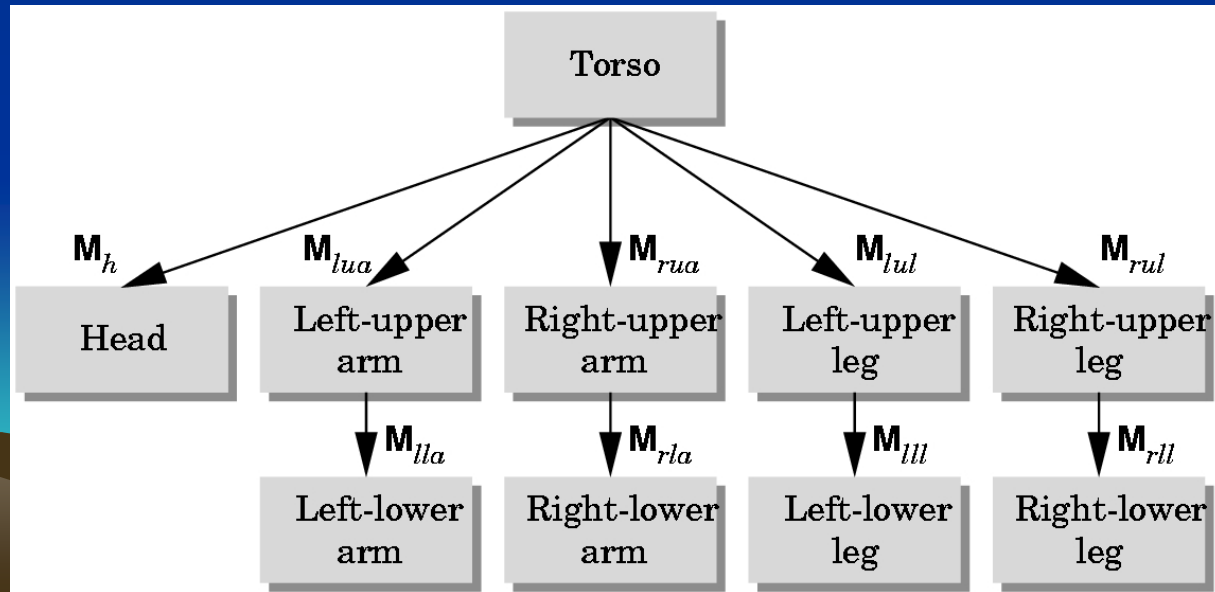
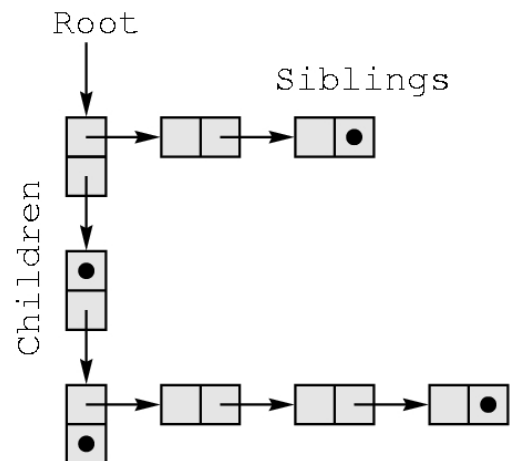
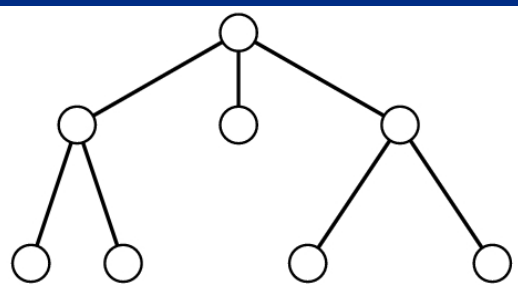
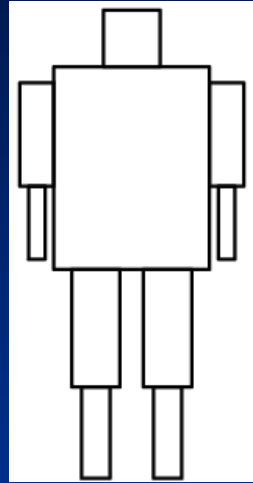
# DAG models

- Could use tree to represent object
- Actually, a DAG (directed acyclic graph) is better: can re-use objects
- Note that each arrow needs a separate modeling transform
- In object-oriented graphics, also need motion constraints with each arrow



# Example: Robot

- Traverse DAG using DFS (or BFS)
- Push and pop matrices along the way (e.g. left-child right-sibling) (joint position parameters?)





# Texturing

- Motivation
  - Games rely heavily for realism
  - Important to compensate for low geometry
  - Challenging, yet rewarding
- Distinction between texture and shader
  - *Shader* – define surface property of object
    - how shiny, bumpy, how light effects
  - *Texture* – bitmap plugged into shader that defines image we want to appear on object

# Detail in Texture

- Add depth, lines, etc. without polygons.
- Box is 12 polygons, bricks would take many more



(Taken from <http://www.mostert.org/3d/3dpdzscenem.html>)

# Make Interesting Textures

- Consider story behind object
- Consider door (contoured, so could do geometry, but cheaper to put picture up)
- Could just take one on Internet and put up
- But can make more believable
  - How old? Who uses it?
  - Repainted? How long ago?
- Add grunge around knob, show nicks at bottom, flecks of color where repainted ...



# Textures are Their Own Artwork

- Rarely ready to go ... spend time in Photoshop massaging, customizing
- Think of each texture as custom artwork
- Before and after page 49
  - Wood → with coffee mug stain, nicks and scratches
  - Window → depth in reflections, uneven opacity
  - Concrete → cracks, discoloration
- Need to be aware if tiled and reused
  - Interesting textures harder to re-use since noticeable

# Resolution

- Analogy:
  - Smiley face with 15 rocks
    - Hard to make out
  - Smiley face with 30 rocks
    - Looks Better
  - Smiley face with sand
    - Looks great
- So, always use high resolution for textures? Not necessarily. Takes more video memory.

# Where To Use Pixels?

- Think about
  - Physical size – actual size of object relative to character
  - Distance – how far away and how close can character get to it
- Example p.55
  - Room with box, window, clock
    - Each has a different resolution texture applied to it
  - Box not much (on floor and can't crawl) 128x128
  - Wall more since big (but still uninteresting) 512x512
  - Clock small and high, but numbers so 64x64
  - Window has picture of lighthouse but far so 32x32

# Color Depth

- How many bits to use to color each pixel
  - Ex: 16 colors (4-bit) lot less memory than 65,536 colors (16-bit)
  - Recommendation, try low and see if holds
- Sometimes low-bit gives “washed out” look that can be desired
- In fact, T.V. and real-world have lower color depth than most computer monitors
  - Try for yourself
  - Vibrant on computer may not be realistic
  - Worse, if port to T.V. reds bleed together





# A Brief Word on Alpha Channels

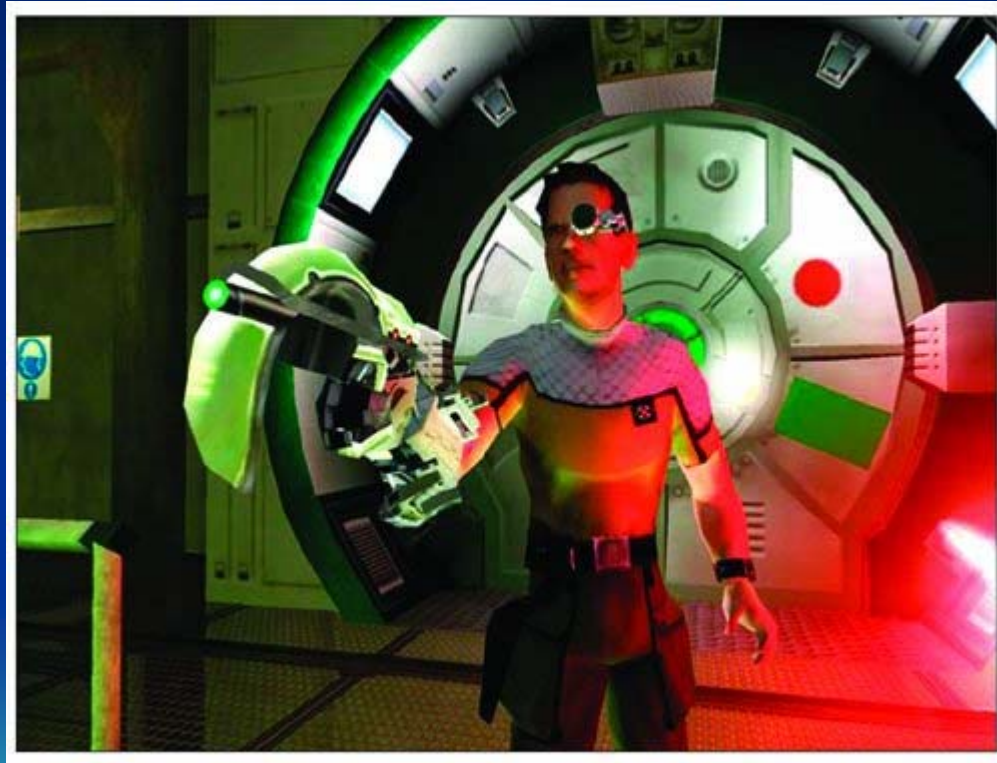


- Greyscale image embedded in extra 8 bits of 32-bit image (24 bits gives true color)
- Use for:
  - *Transparency* – parts that are black are transparent, white parts are not (can use gray for semi-transparency)
  - *Bump maps* – use to create illusion of varying heights
    - light areas out, dark areas in - tweak each pixel based on grayscale
  - *Secularity* – define what areas reflect light most – human face shiny where oil, water secular for ripples

# Lighting

- Can conjure feelings, emotions, even change what you are seeing
  - Reveal (or hide) depth
  - (Many books on traditional lighting)
  - AR/ID 3150. LIGHT, VISION AND UNDERSTANDING
- Remember, when see things is really reflection of light
- Sub-outline
  - Color
  - Mood
  - Setup
  - 3-D lights

# Color Indicates Danger



RTX Red Rock

# Color

- Powerful in setting mood
- Move beyond cliché
  - Green is ok, Red is danger
- Powerful associations
  - Ex: *The Matrix*
    - Green is in Matrix
    - Blue is in real-world
- Culture specific
  - Red danger, but in China red happy
  - White purity, but in China white death
- Balance –
  - too many and chaotic, over-stimulation
  - too little and drab and boring
  - color theory classes can help

# Pleasing Colors

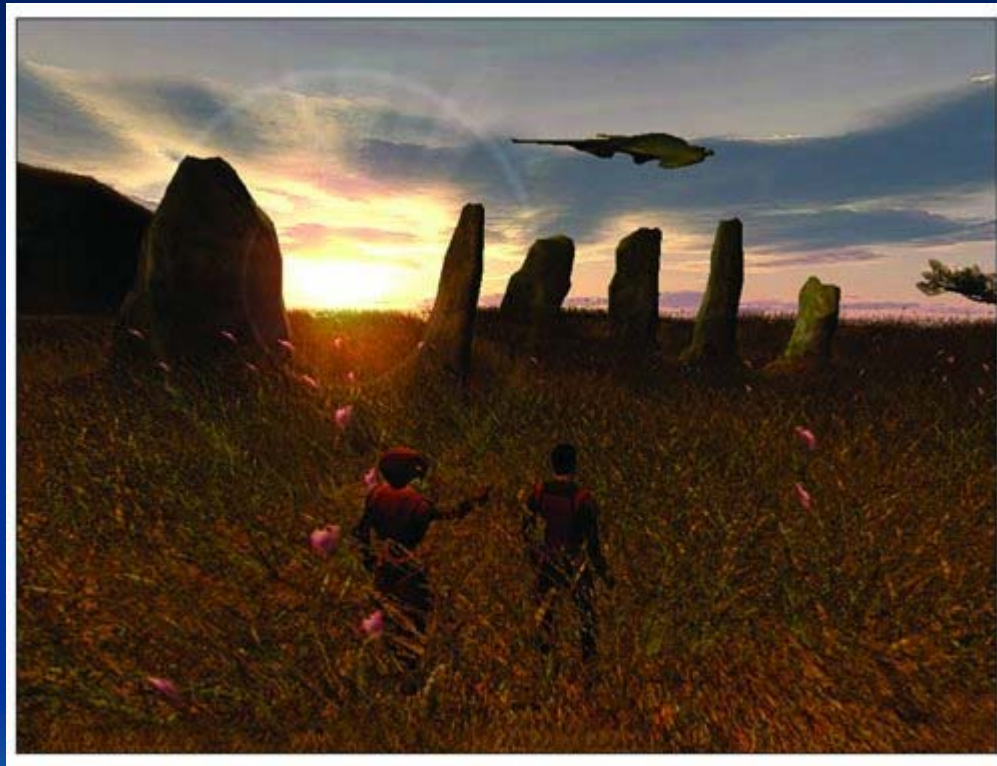


Star Wars: Knights of the Old Republic

# Mood

- Intensity, direction, angle, number of lights, and shadows all affect mood
- Even humidity, dust, air quality

# Mood by Lighting Example (1 of 3)



A calming outdoor scene using simple, yet effective, lighting



# Mood by Lighting Example (2 of 3)



Long shadows not only add to the atmosphere, but also help break up repetition

# Mood by Lighting Example (3 of 3)

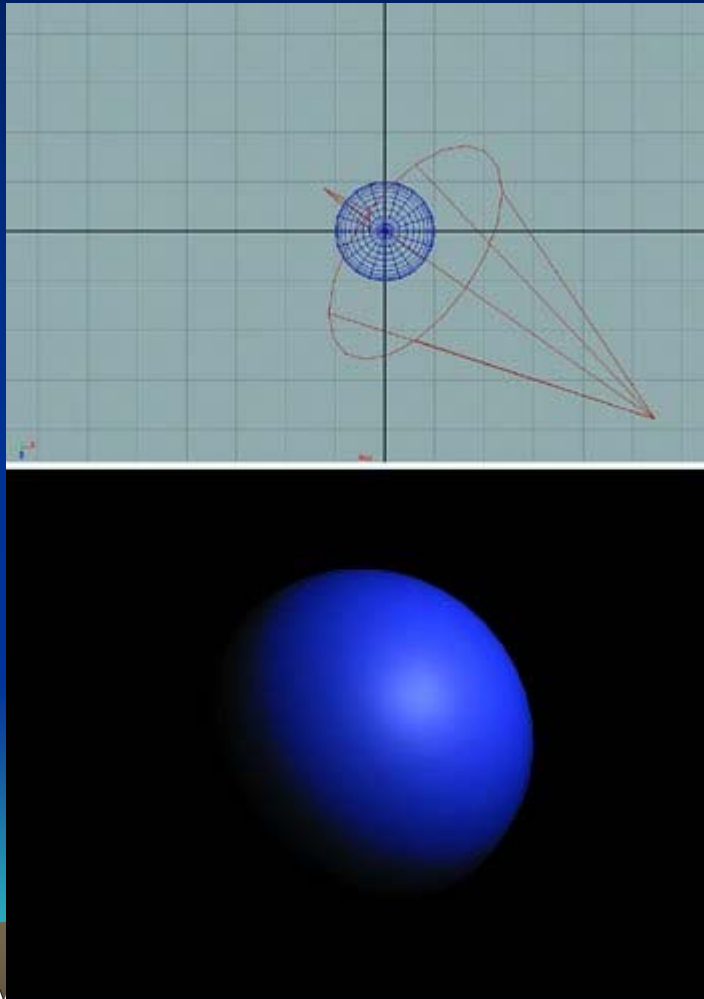


Light beams and rays give clues as to the humidity, dust, and air quality in a scene

# Lighting Setup (1 of 3)

- Traditional lighting
  - Key light, Fill light, Back light
- 3-D lighting different than traditional lighting
  - Start with traditional and modify until you get desired affect (broad strokes)
- *Key light* – main light source. Most intense and majority. Put at angle to define 3-D forms.

# Lighting Setup Example (1 of 3)

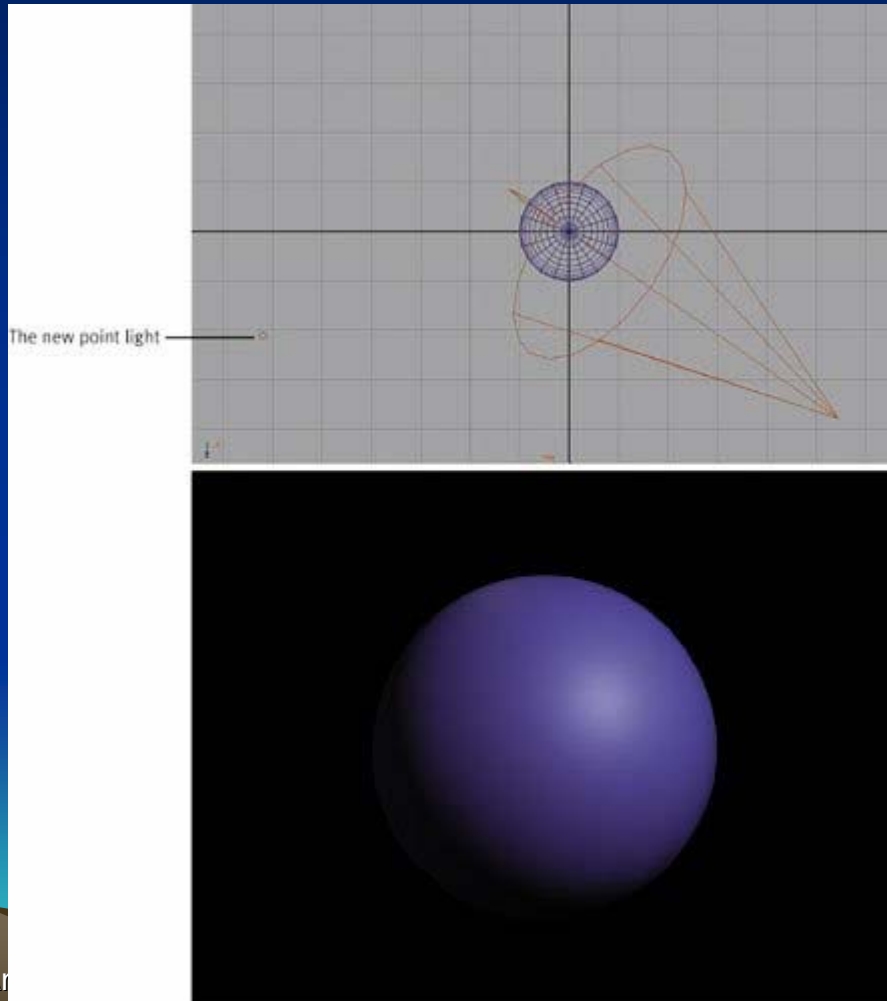


A sphere lit only by a key light positioned at an angle. The detail and form of the sphere are not as clear as if we added another light source.

# Lighting Setup (2 of 3)

- *Fill light* – Brings out some details out of shadow. Works well at angle.

# Lighting Setup Example (2 of 3)



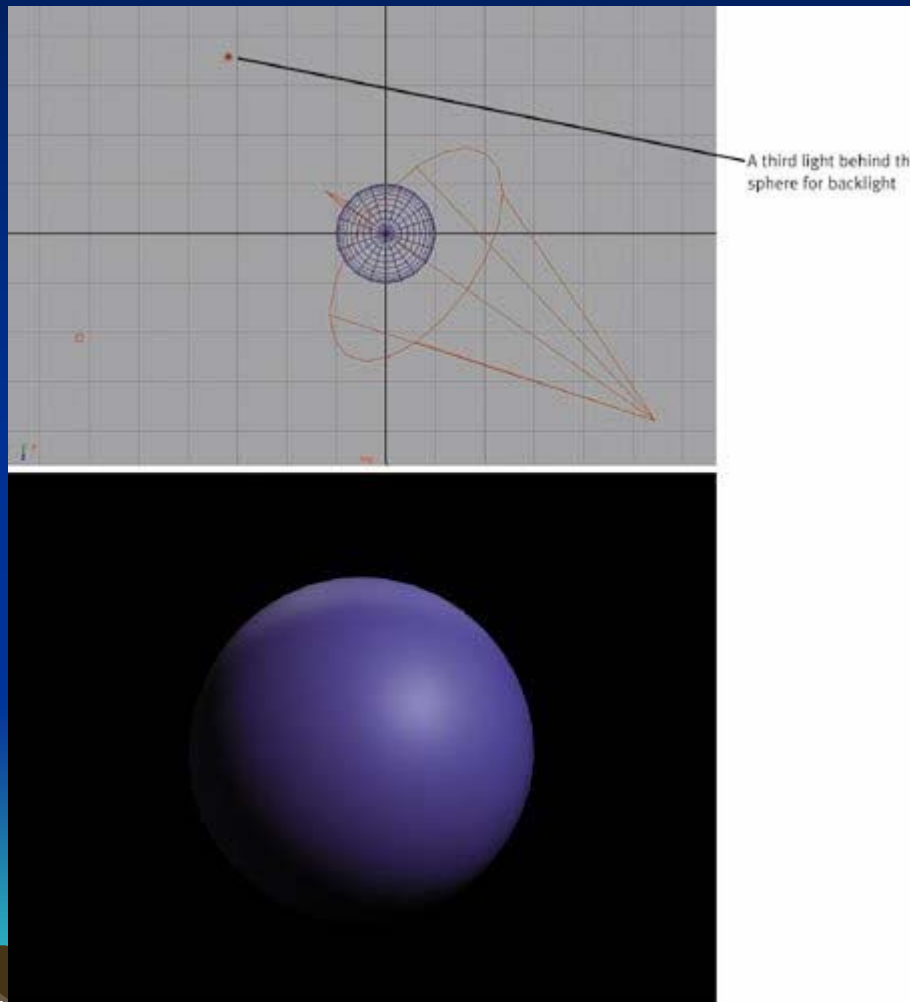
A fill light brings out more form. Notice the point light has been added to the left of the sphere.



# Lighting Setup (3 of 3)

- *Backlight* – Placed behind and slightly above or below object to help define shape. Highlights edges, pulls away from background.

# Lighting Setup Example (3 of 3)



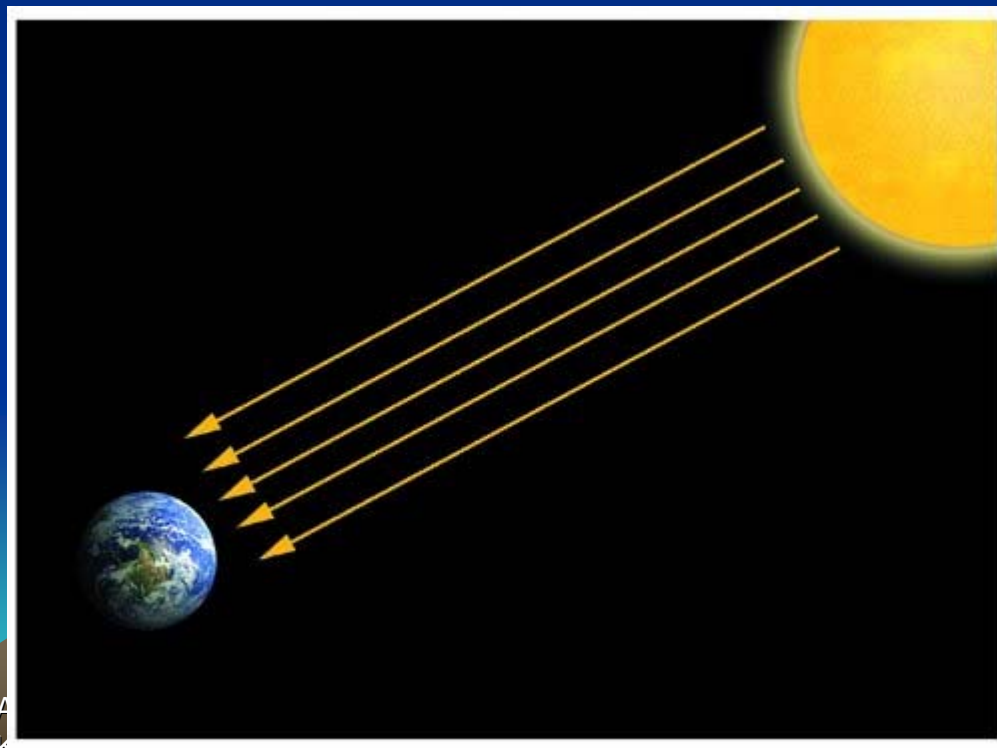
The addition of the third light highlights the edge, helping give the sphere more dimension.

# Working with 3D lights (1 of 4)

- 3-D lighting different than traditional lighting
  - Start with traditional and modify until you get desired affect (broad strokes)
- Tools give different kinds of lights
  - (next)
- A few effective practices
  - (after)

# Working with 3D lights (2 of 4)

- *Directional Lights* – used for sunlight or moonlight. Often as key light. Predictable.



By the time the sun's rays reach the earth, they are nearly parallel to one another.

# Working with 3D lights (3 of 4)

- *Ambient Lights* – spread everywhere, equally. Uniform diffuse lights.
- *Spot Lights* – focus beam on single location. Great control.
- *Point Lights* – single point in all directions. Light bulbs, candles, etc.

# Working with 3D lights (4 of 4)

- *Global Illumination* - attempt to mimic real-world lighting by calculating bouncing, etc.
  - Can be expensive to compute
  - May be limiting



A room lit without radiosity. Bottom The same room with a radiosity solution.



# Effective Lighting Practices (1 of 3)

Pools of light  
- Don't always  
try to light evenly.  
- Gives sense of  
mystery



Pools of light in Indiana Jones:  
The Emperor's Tomb

# Effective Lighting Practices (2 of 3)



Using light to guide the player. Helps highlight areas that are accessible and important to the objectives.

# Effective Lighting Practices (3 of 3)

- Be Creative
  - Try not to stick to the standard solutions
  - Tell a story with your lights
  - Talk to level designer about scenes, even
  - Ex: Maybe your level harder than last, convey that tension
- Experiment
  - Start simple, add detail.
  - Experiment at early stages.
  - Try crazy combinations of color, reverse the intensities, or reposition lights in unorthodox places.

# Lighting Summary

- Study real-world light carefully to understand 3D light
  - 3D is at best only an approximation
- Study different conditions – rain, sunny, indoor, outdoor....
- Study lights from photos
- The key to developing skills as lighting artist → observe and re-create what you

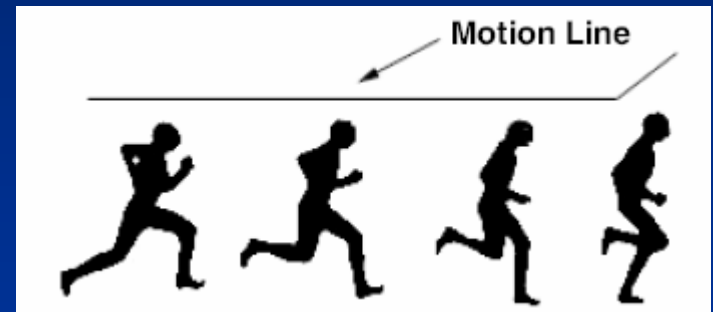
see

# 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)

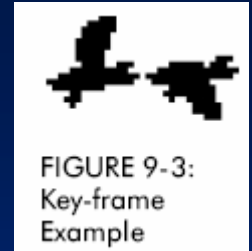
# Motion Line

- 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: Warcraft III





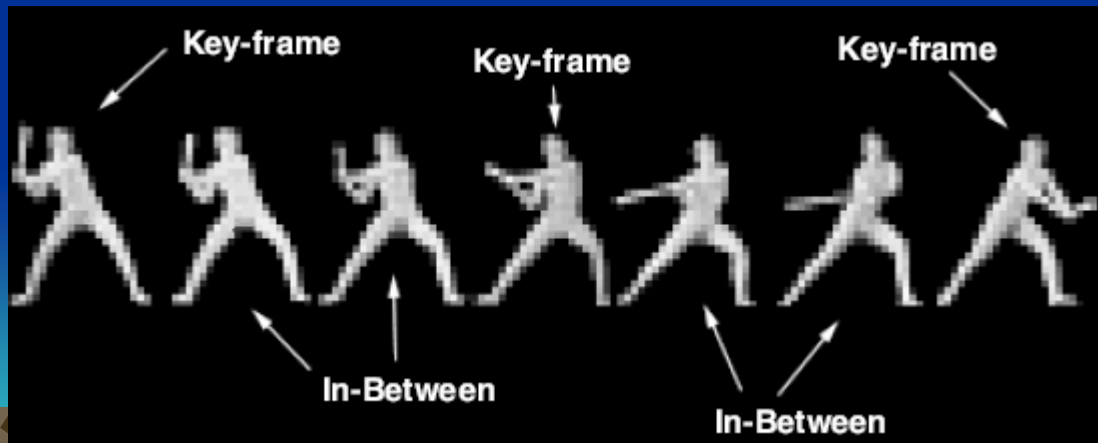
# Key Frames



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

# In-Between Frames

- Generated to get smooth motion between key-frames
  - Can be tedious and time consuming to make
  - Most software allows duplication



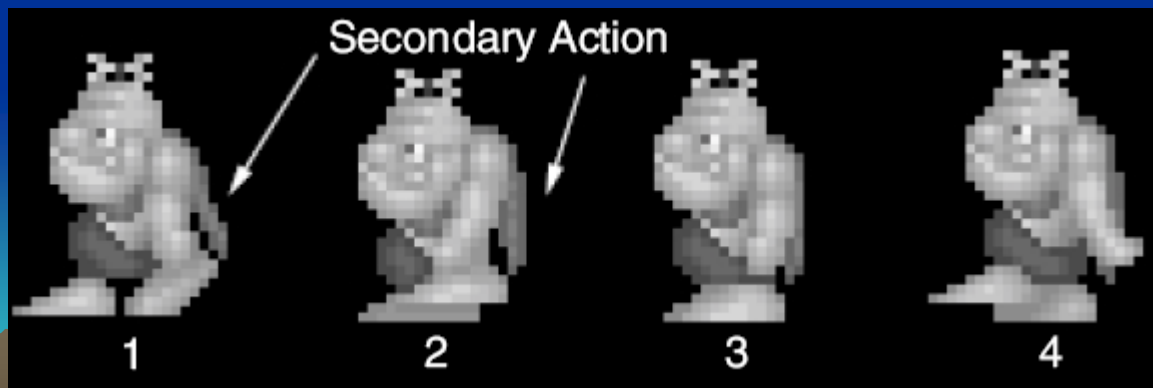
# Frame Animation Guidelines

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  
Enemy Planes, Explosions)

# Secondary Actions

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

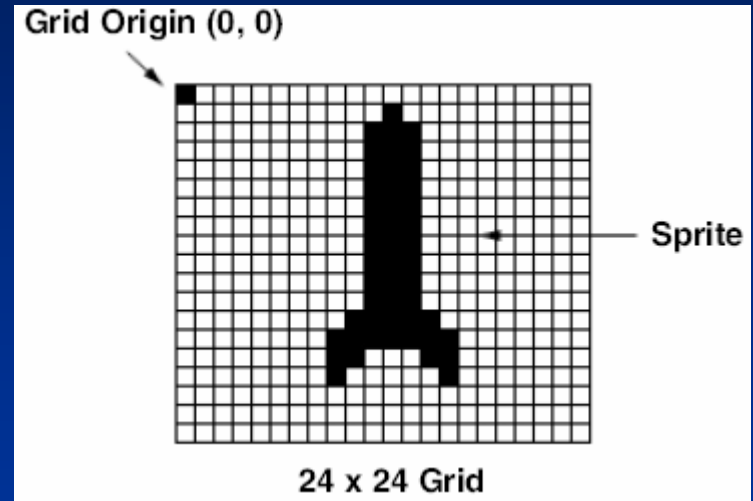


# Sprites

- Graphic objects that can move separately from background
- Often animated
- Topics:
  - Grid Squares
  - Primitives

# Grid Squares

- “Mini-Screen” to depict
  - Individual pixel modifications
- Help observe animation progression
- (Show Game Maker image editor example)
- Strips for tools





# Primitives

- Used in many games. If identify, can apply primitive rules and use:
  - Cylindrical primitive
  - Rotational primitive
  - Disintegration primitive
  - Color flash primitive
  - Scissors primitive
  - Growing primitive
  - Shrinking primitive
  - Minor primitives (used less often)

# Cylindrical Primitive

- Spinning, rotating objects (hulls, wheels, logs...)
- Easy to master since doesn't require major changes
- Instead, uses *markers* that change
  - Show go 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 smooth

<i>Selected Removal Method</i>	<i>Estimated Percent Removed per Frame</i>	<i>Total Frames</i>
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*

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Kyung Hee University



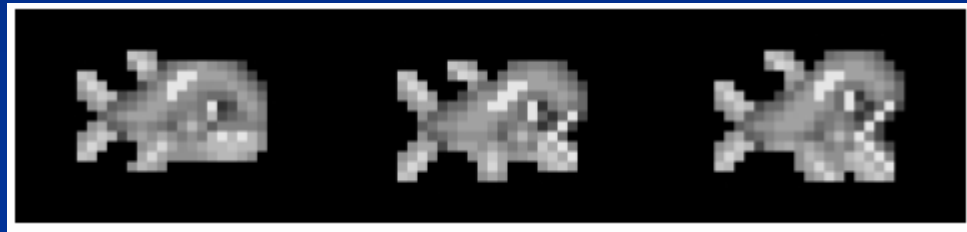
# Color Flash Primitive

- 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



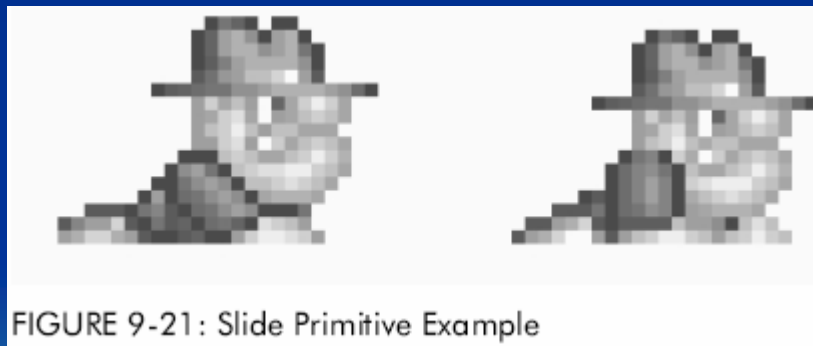
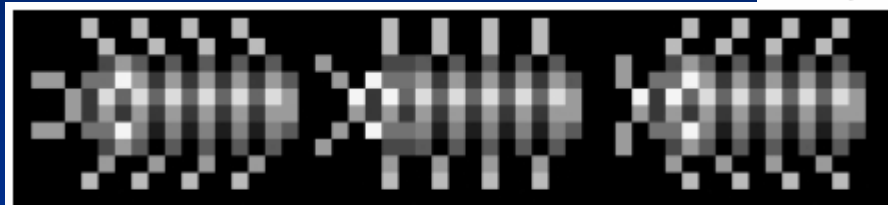
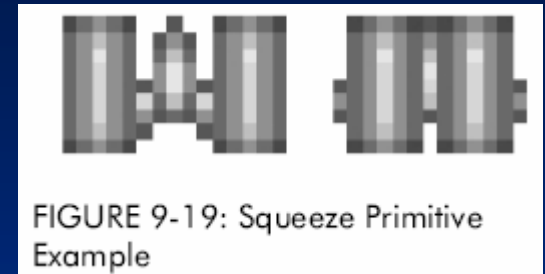
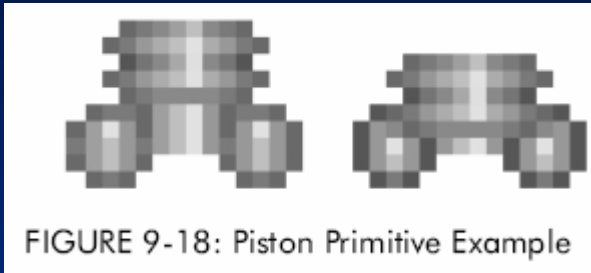


# Growing/Shrinking Primitive

- For explosion, growth/reduction potion
- Pay attention to scale



# Minor Primitives (1 of 3)



# Minor Primitives (2 of 3)



FIGURE 9-25: Slinking Example

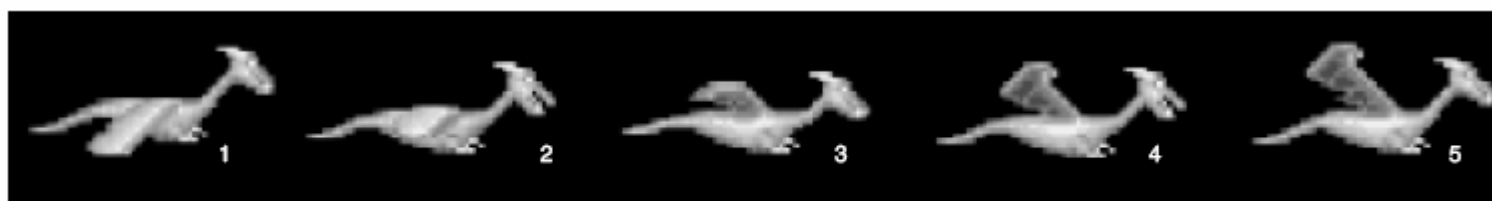


FIGURE 9-26: Simplified Flying Sequence

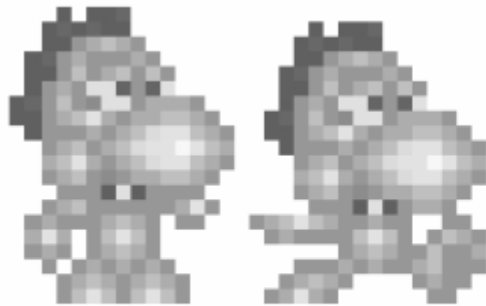
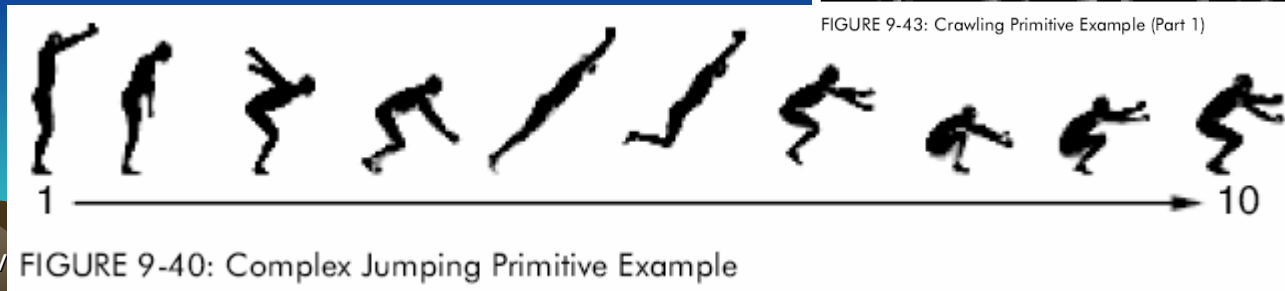
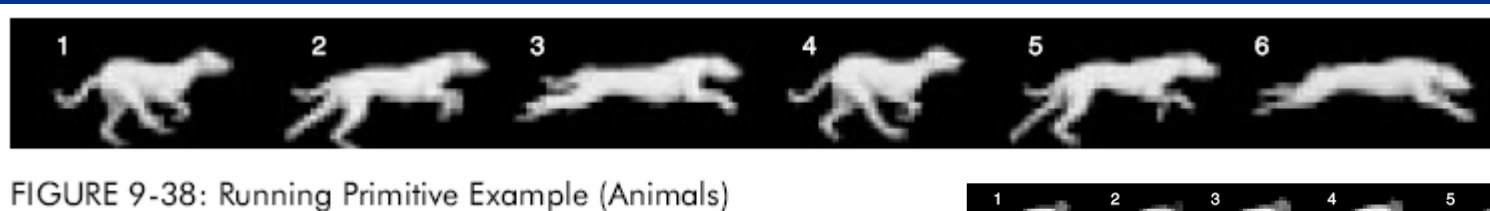
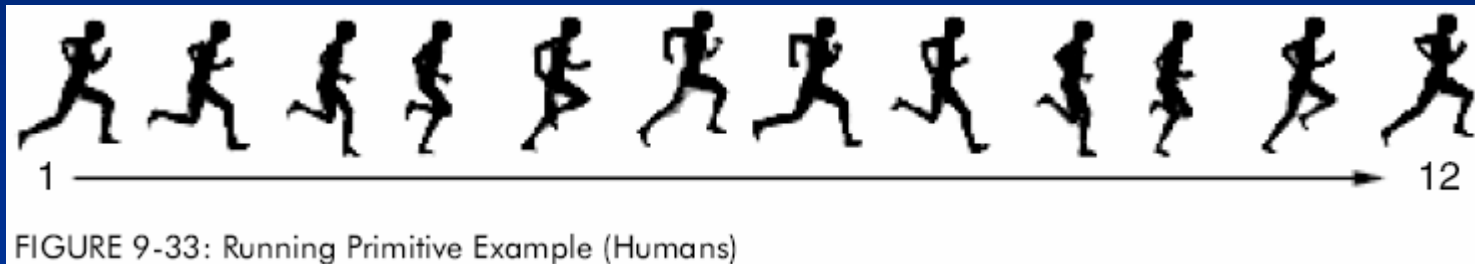
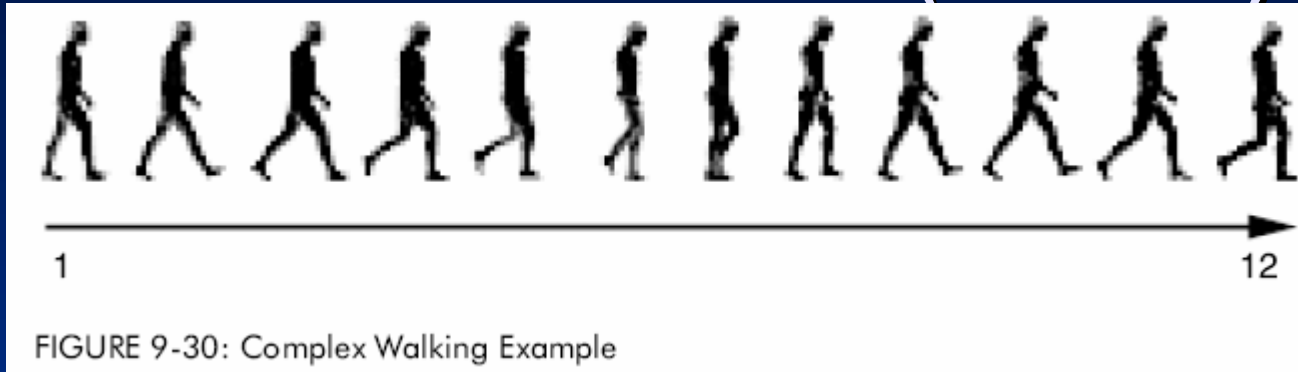


FIGURE 9-28: Basic Walking Example #1



FIGURE 9-29: Basic Walking Example #2

# Minor Primitives (3 of 3)



# 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
  - animated continuously (using cycles) or
  - animated once (no looping)
- 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
  - Use simple shapes to represent main actions
    - Ex: stick figures or basic shapes (circles, squares)

# 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
  - Can be done with 'copy' and 'undo' in tool
  - Others have animation rendering (ex- Game Maker)
  - Look for flaws (movement, discolored pixels ...)
- Repeat - Repeat 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, 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
- Constantly observe - study of the objects around you. Study how different things move. Study books on animation. Observe your favorite games
  - Will give insights into animation techniques, make better animations yourself