

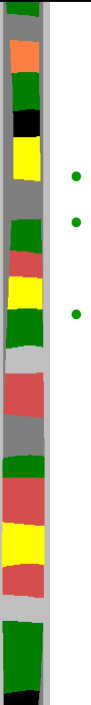


# Interactive Media and Game Development

## 2-D Tiles and Sprites




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# Outline

- Tiles
- Sprites
- More material:
  - Ari Feldman. *Designing Arcade Computer Game Graphics*, Online at:  
<http://www.gamemaker.nl/feldman/full.zip>
  - Tsugumo. *So You Want to Be a Pixel Artist?*, Online at:  
<http://web.cs.wpi.edu/~claypool/courses/frontiers-06/samples/pixel-artist/default.html>



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## Tiles

- Needed for commonly backgrounds
  - Too hard to make every pixel different!
- RPGs make heavy use
  - Grass, trees, water, sand
- Start with a grass tile to warm up



## Grass is Green

- Use a basic green square
- But looks unnatural
  - Like flat, shiny metal
- No illusion of movement

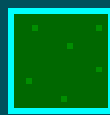


SIMPLY A GREEN  
BOX WITH LIGHTER  
GREEN DOTS.



## Grass has Variation

- Can do a lot with simple enhancement of color shades

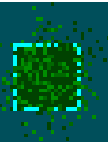


SIMPLY A GREEN  
BOX WITH LIGHTER  
GREEN DOTS.



## Make Random

- Use the "spray" tool



3 GREEN SHADES RANDOMLY  
"SPRAYED" AND A 16X16  
CHUNK TAKEN FROM IT.



## Make Look Random with Control

- Draw by hand for more control
  - 4 pixel line strokes



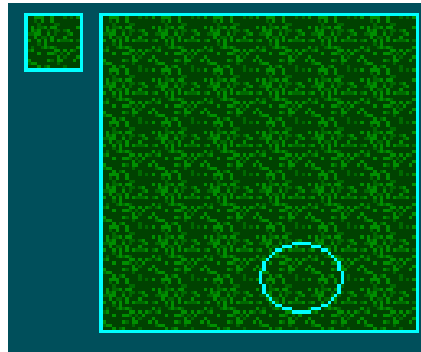
## Don't Try This at Home

- Don't use same texture for all, else not much better than just colors



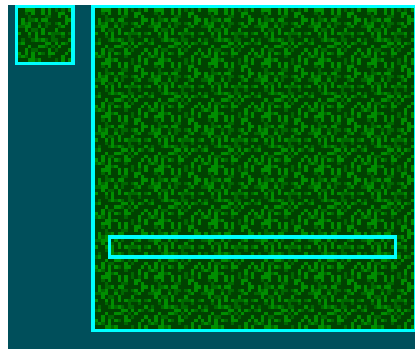
## The "Grid" (1 of 4)


- Looks too much like tiles
- "Large" blank is problem, so remove



## The "Grid" (2 of 4)



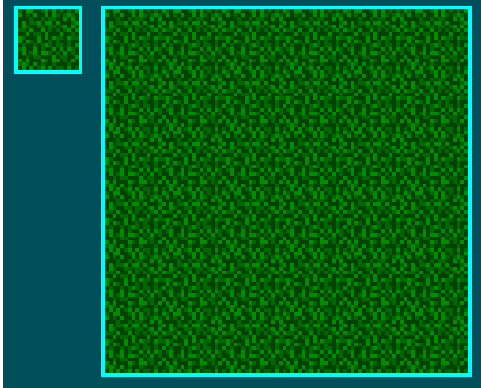
- Still, some "lines" are visible when repeated
- Break up with more color






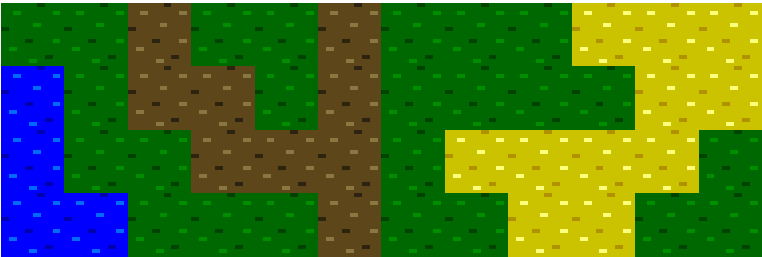
### The "Grid" (3 of 4)

- Much better!



### The "Grid" (4 of 4)

- When rubber hits the road?



## Outline

- Tiles
- Sprites (next)



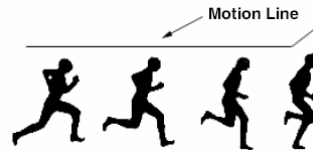
## Animation

- 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). For video:
  - 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



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



## 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, leg together
- 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

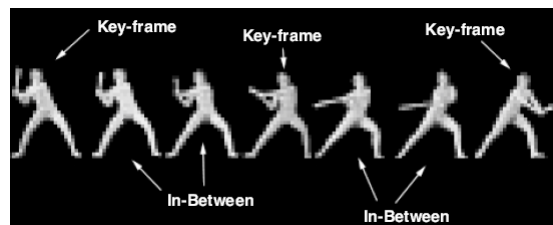
Based on Chapter 9, *Designing Arcade Computer Game Graphics*, by Ari Feldman





## In-Between Frames

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



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## 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

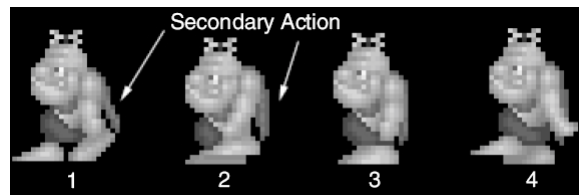
(See GameMaker tutorial shooter for examples of Enemy Planes, Explosions)

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## 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



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## 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)
    - 2<sup>nd</sup> choice means must make last key frame blend with first
- Choose an image 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)

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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

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## 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

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## 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
- 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.

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## 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!

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## 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

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## 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)

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## 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

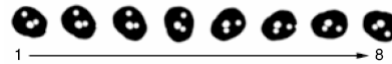


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## Rotational Primitive

- 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.

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## 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

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*



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## 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)



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## Scissors Primitive

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



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## Growing/Shrinking Primitive

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



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## Minor Primitives (1 of 3)

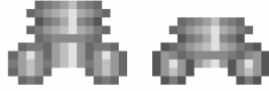


FIGURE 9-18: Piston Primitive Example

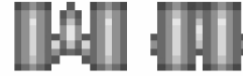


FIGURE 9-19: Squeeze Primitive Example

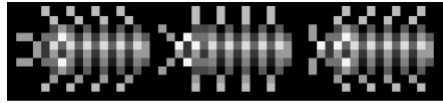


FIGURE 9-20: Swing Primitive Example



FIGURE 9-21: Slide Primitive Example



FIGURE 9-22: Open/Close Primitive Example



FIGURE 9-24: Stomp Primitive Example

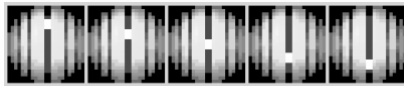


FIGURE 9-23: Bounce Primitive Example

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## Minor Primitives (2 of 3)



FIGURE 9-25: Slinking Example



FIGURE 9-26: Simplified Flying Sequence

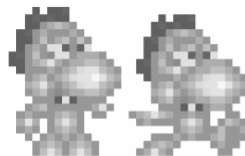


FIGURE 9-28: Basic Walking Example #1



FIGURE 9-29: Basic Walking Example #2

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## Minor Primitives (3 of 3)

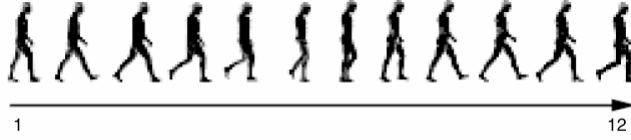


FIGURE 9-30: Complex Walking Example



FIGURE 9-33: Running Primitive Example (Humans)



FIGURE 9-38: Running Primitive Example (Animals)



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



FIGURE 9-40: Complex Jumping Primitive Example

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