

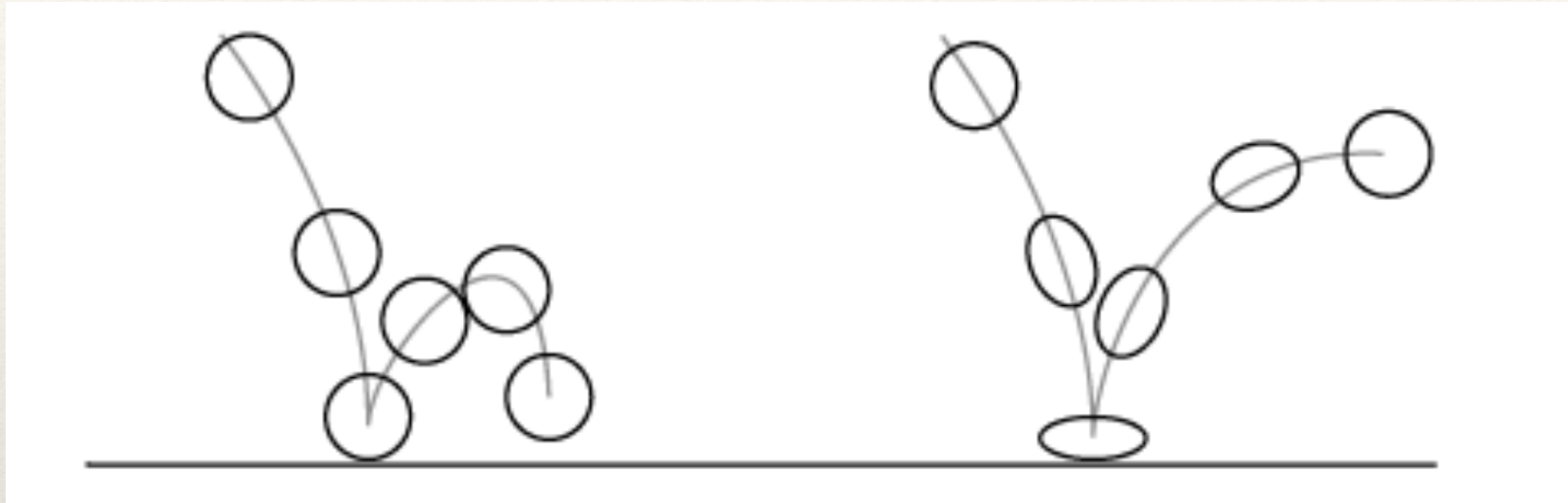
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Animation

Elements of Graphics
CS324e

Animations



- ❖ Series of images presented in succession
- ❖ Gives the impression of continuous motion
- ❖ Images can be tuned by an artist to add impact

Sequence of Images

- ❖ Animations can be pre-rendered as **sprites**
- ❖ Sprites are two-dimensional images that depict a character or object
 - ❖ Hand-drawn frames
 - ❖ Animation-specific programs (e.g. After Effects or Flash)
- ❖ Sprites can be animated separate from the surrounding scene

Loading Animations in MonoGame

- ❖ Same principle as loading and displaying a single image
 - ❖ Load all sprites as `Texture2Ds`
 - ❖ Load next sprite in sequence
- ❖ Can use a **frame buffer** to hold a sequence of `Texture2Ds`
 - ❖ Store images in animation order inside array
 - ❖ Dynamically name loaded images to avoid hard-coding
 - ❖ `ToString` formats numbers into Strings and provide necessary padding

Integer Padding

- ❖ `ToString()` takes an argument containing the **format** (D or X) and **minimum length** (n) of the string
 - ❖ D is for decimal representation
 - ❖ X is for Hexadecimal representation
 - ❖ n is places requested
- ❖ Example:

```
int x = 20;
```

```
string s = x.ToString("D3");
```

```
Console.WriteLine(s); //prints 020
```



```
int numFrames = 11;

Texture2D[] x_sprite = new Texture2D[numFrames];

void LoadContent()
{
    for (int i = 0; i < x_sprite.Length; i++)
    {
        int place = i+1;

        String imageName = "x_running-" +
            place.ToString("D2");

        x_sprite[i] = Content.Load<Texture2D>(imageName);
    }
}
```

Drawing Animations in Processing

- ❖ Array index provides access to next sprite in sequence
- ❖ Modulo operator allows for infinite looping
 - ❖ Remainder of one number divided by another
- ❖ Can associate update to sprite with the frame number itself **or** the time elapsed

Sprite Example

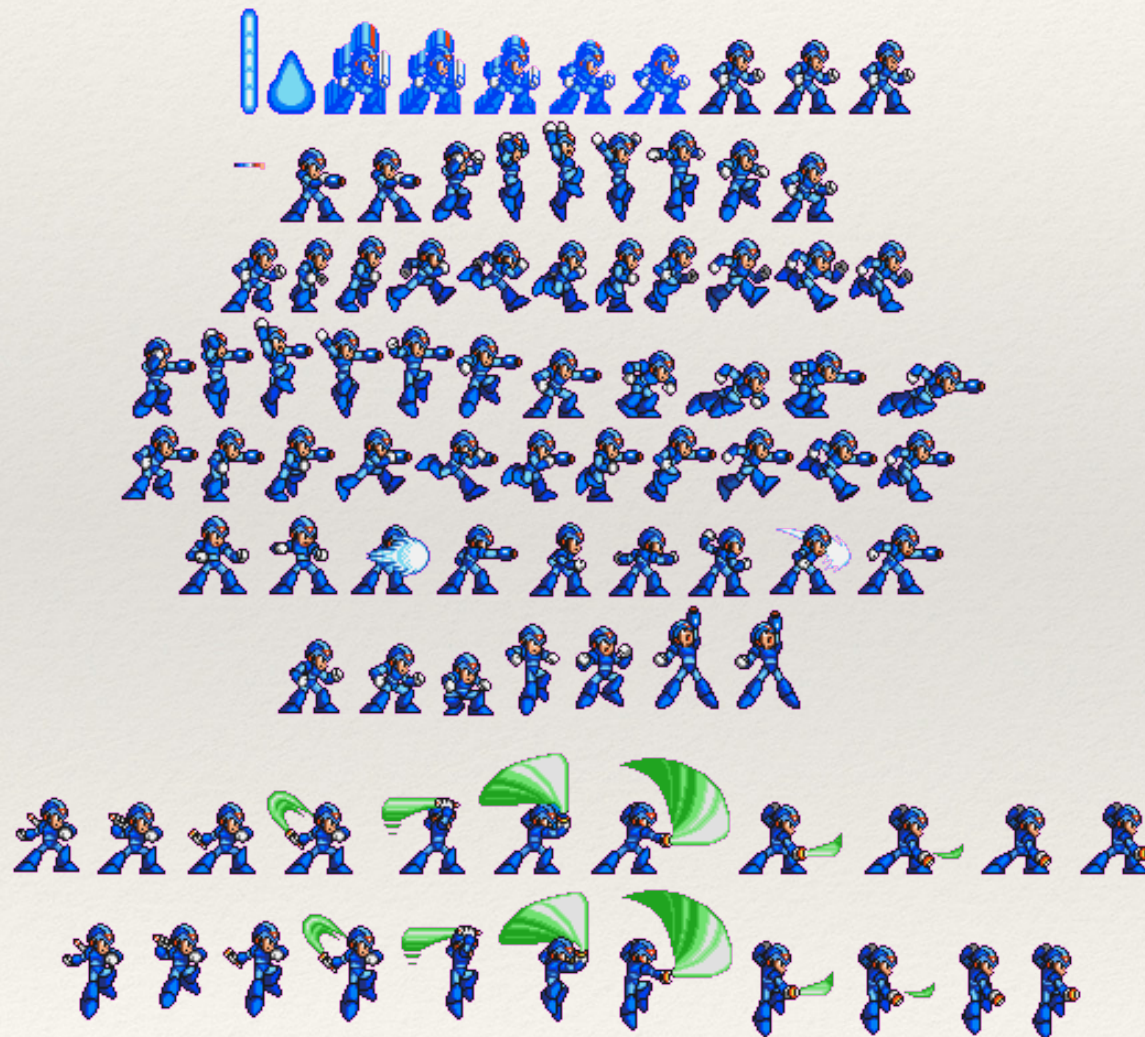
Instapoll Question: Sprites

- ❖ What image will be displayed when the sprite example is on frame 20?
- ❖ Access Code: 3165

Texture Swapping

- ❖ Different texture parameters for different `SpriteBatch.Draw()` calls requires a **texture swap**
- ❖ Texture is unbound on GPU before binding new texture
 - ❖ Expensive and can incur large performance penalties
- ❖ Ideally should avoid texture swapping by **sampling** from the same texture as much as possible
- ❖ Texture atlases (or sprite sheets) facilitate that process

Sprite Sheet Example



Accessing a Texture Atlas

- ❖ What additional information do we need to know to correctly pull out the individual sprite we want to display on a given frame?

Rectangle Struct

- ❖ Has `(x, y)` `location` parameter specifying the upper left corner of the rectangle
- ❖ Has `(width, height)` `size` parameter specifying the width and height of the rectangle
- ❖ `SpriteBatch.Draw` can take a `destination` and `source` `Rectangle`
 - ❖ `Destination` is drawing bounds on the screen
 - ❖ `Source` is the region of the texture to render

Specifying Texture Atlas Values

- ❖ Texture atlases often have **metadata** associated with them to automatically specify the rectangles needed for each sprite
- ❖ We will discuss these in more detail after we cover json and xml data!

Hands-on: Sprite Animations

❖ Today's activities:

1. Collect or create a sequence of images to use as a sprite
2. Load these sprites into an array using the `ToString()` function
3. Display the images in sequence to create the illusion of animation
4. Bonus: Try using a `Rectangle` with a sprite sheet to see how to display these images in a sequence