

CS559 Spring 2019

Module: Transforms 2: Scale

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Transforms or Transformations?

Translate - move everything

```
translate(10,10);  
translate(10,10);  
translate(10,10);
```

could be:

```
translate(30,30);
```

Translate is one kind of transform

Two others that are really useful:

- Scale
- Rotate

And many more over the course of the semester

Scale Transformations

```
context.fillRect(20,20, 20,20);
```

multiply all coordinates by 2

```
context.scale(2,2);  
context.fillRect(10,10, 10,10);
```

rect is weird since `width,height` is relative

Non-Uniform Scale

```
context.scale(2,1);
```

Flip Y

```
context.scale(1,-1);  
context.fillRect(10,-10, 10,10);
```

Beware! (with rectangles)

- measurements (not points) may not be handled as you expect
- points correctly measured upwards

Multiple Scales

```
context.scale(2,1);  
context.scale(1,2);  
context.scale(3,3);
```

Scale causes things to move

```
context.scale(2,2);  
context.fillRect(10,10, 10,10);  
context.scale(2,2);  
context.fillRect(10,10, 10,10);  
context.scale(2,2);  
context.fillRect(10,10, 10,10);
```

zero does not move!

Translate then scale

Scale then translate

Transformations compose

Composition does not **commute**
(order matters)

Scale about center

(world coordinates)

```
translate(cx, cy)  
scale(sx, sy)  
translate(-cx, -cy)
```

(object coordinates)

inside out... or outside in...

Read the code...

Backwards (from the object)

Forwards (from the coordinate systems)

order matters!

Mirror Reflections

```
scale(-1,1)  
translate(tx,0)
```

Flip about bottom...

```
scale(1,-1)  
translate(0,-height)
```