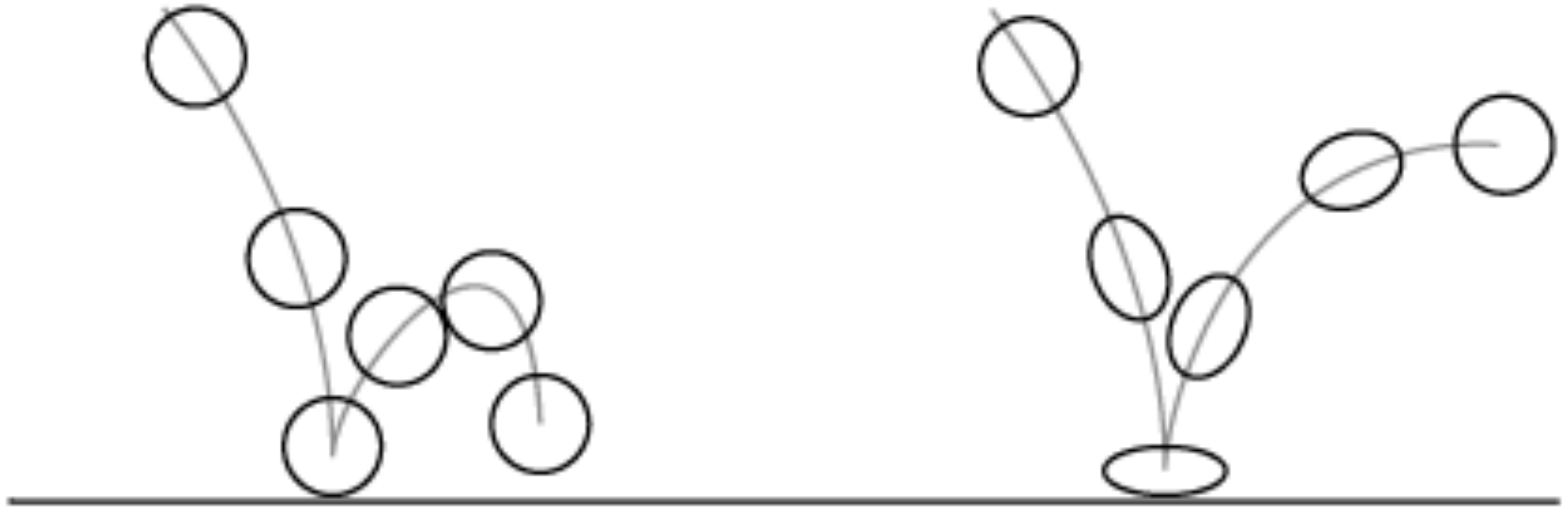
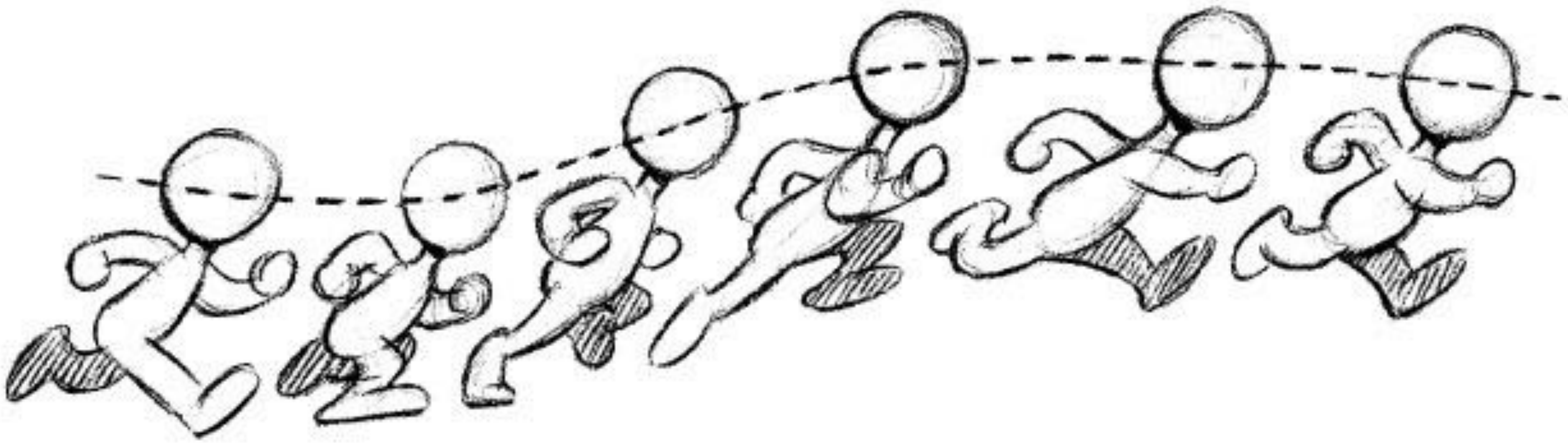
Effects and animation.

Part 1



Movement over time.



Mapping value ranges.

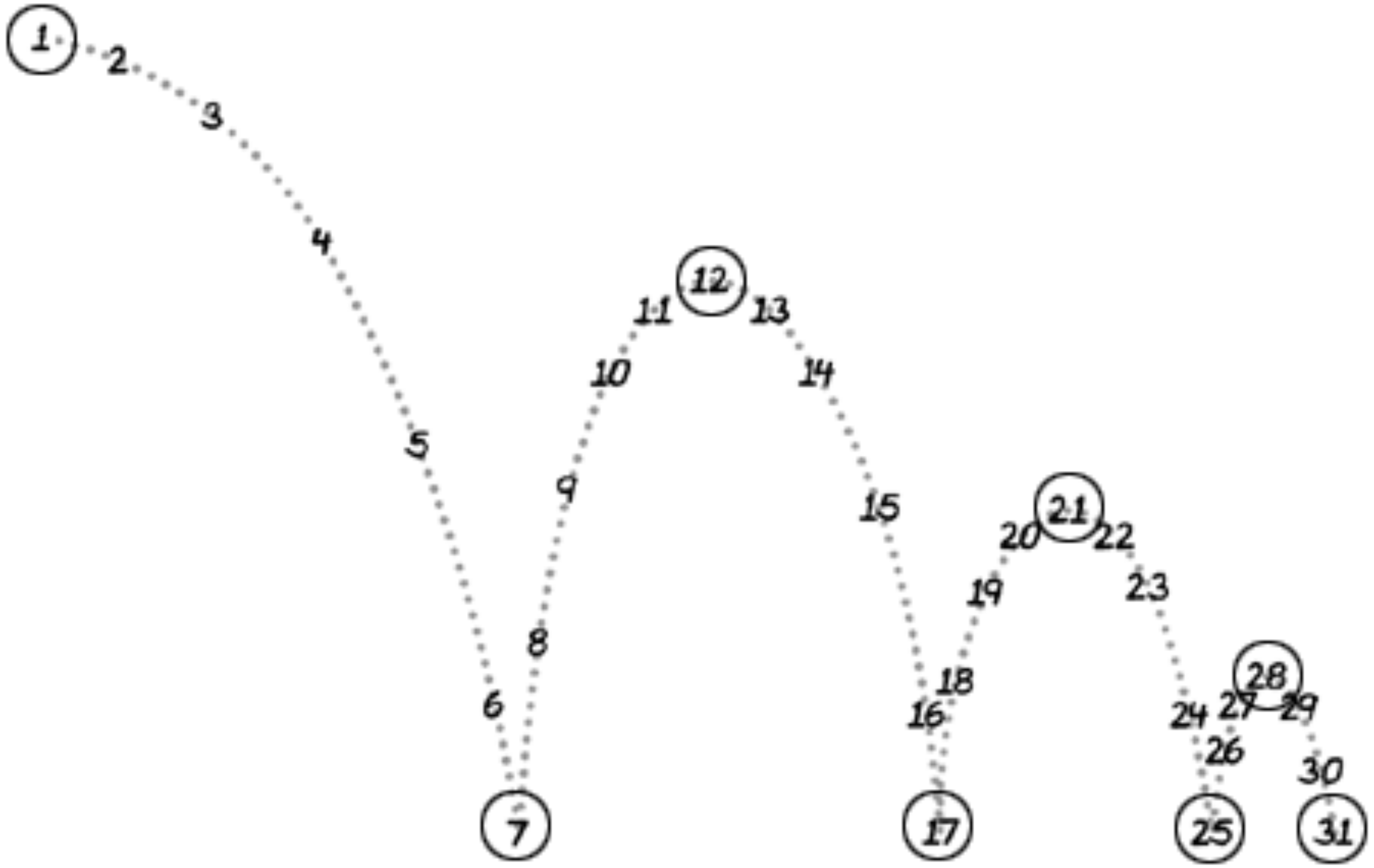
```
float mapValue(float value, float srcMin, float srcMax, float dstMin, float dstMax) {

    float retVal = dstMin + ((value – srcMin)/(srcMax–srcMin) ∗ (dstMax–dstMin));
    if(retVal < dstMin) {
        retVal = dstMin;
    }
    if(retVal > dstMax) {
        retVal = dstMax;
    }
    return retVal;

}
```

Tweening.

In-be-tweening.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
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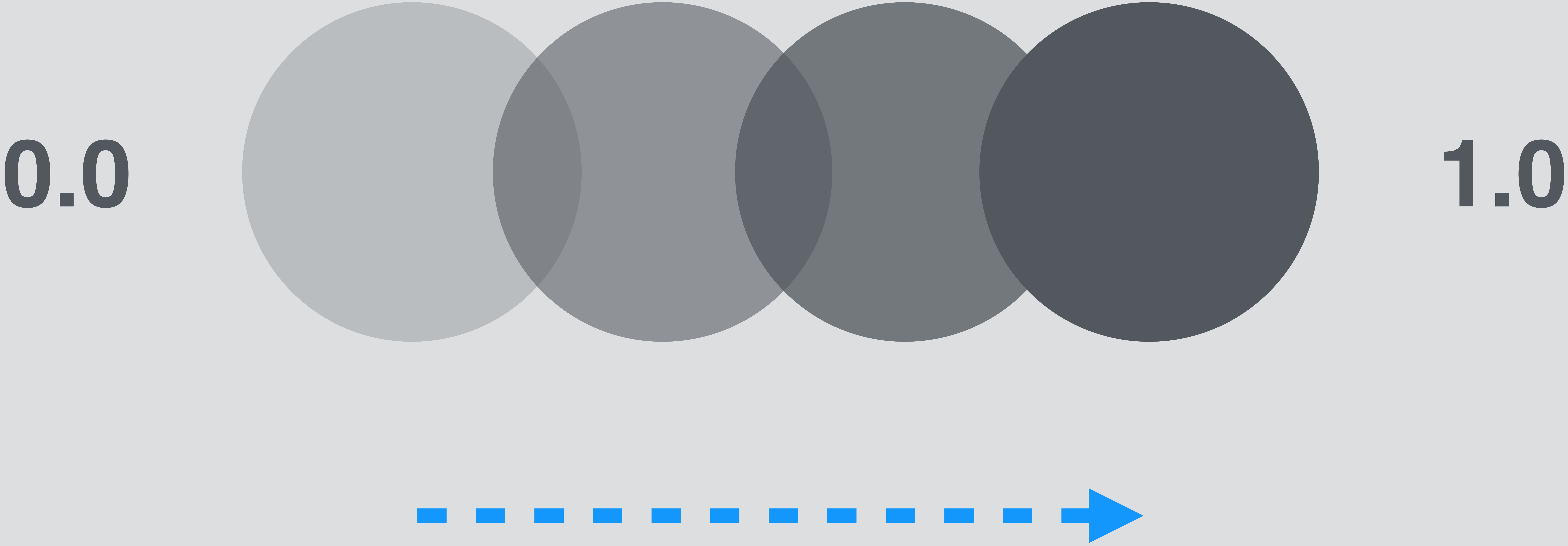
31

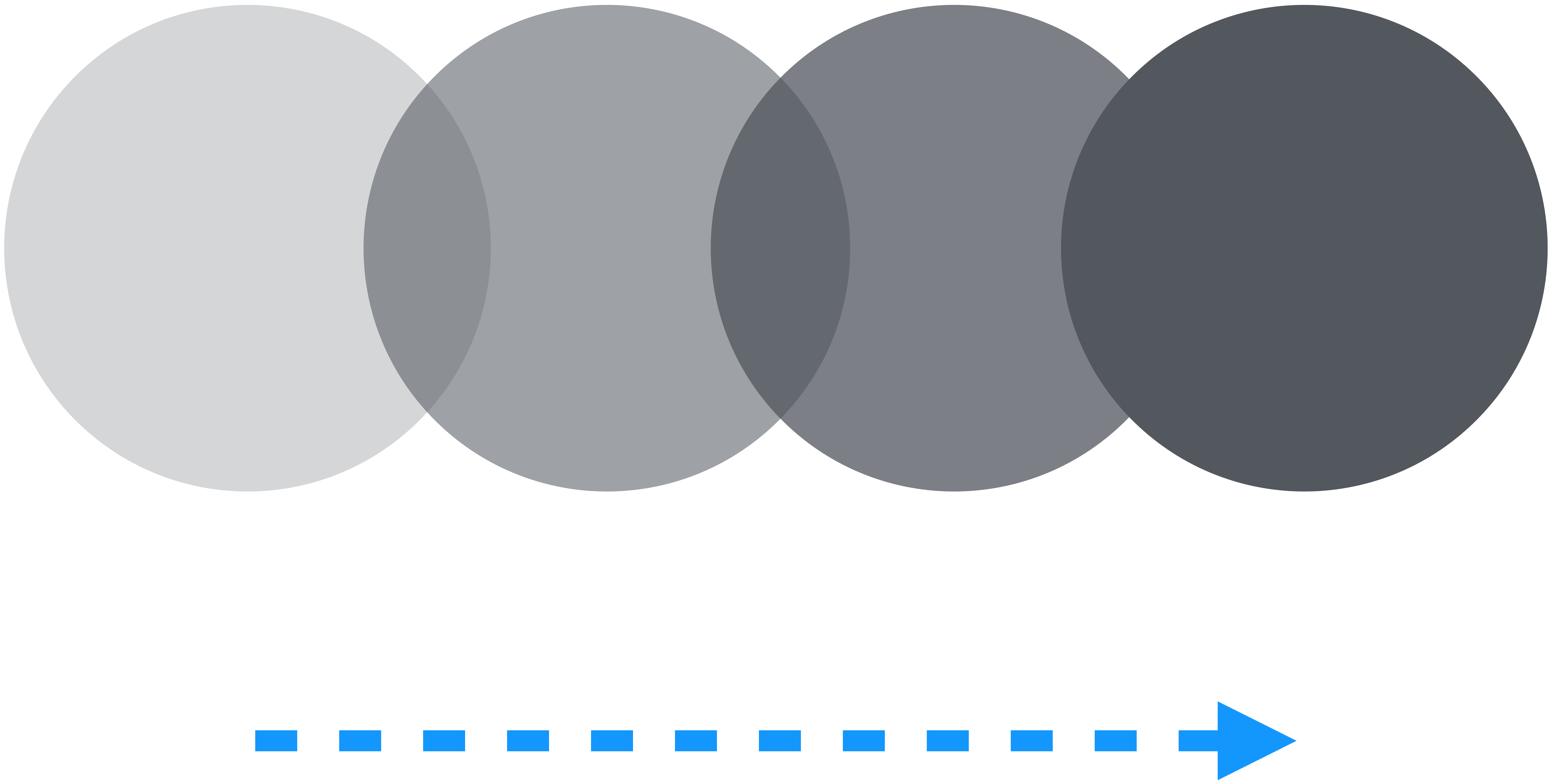


0.0

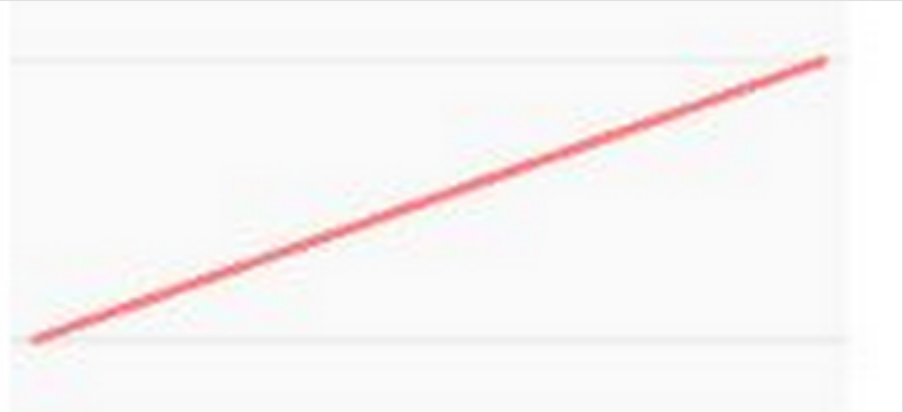
1.0

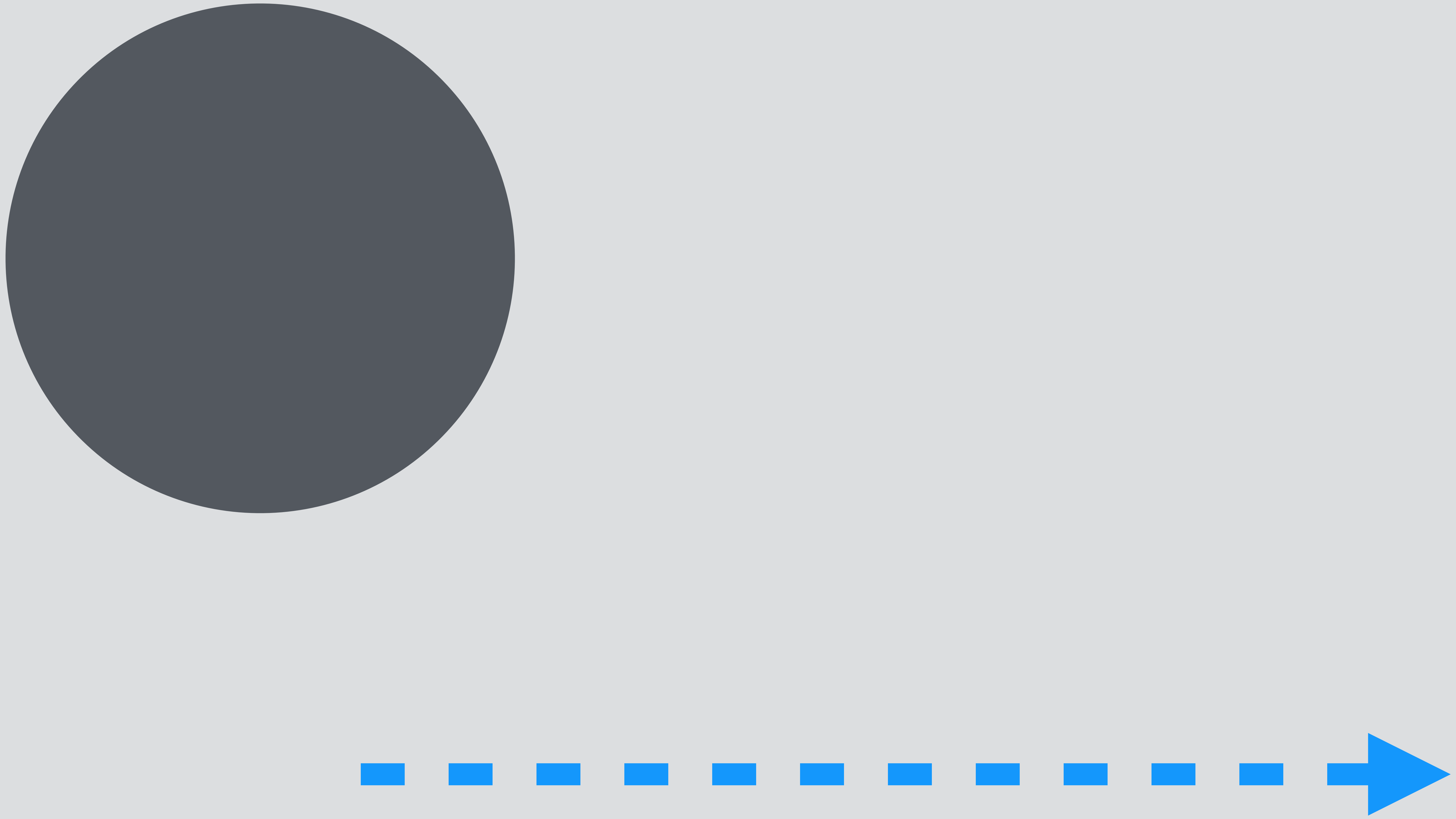
Linear interpolation.

```
float lerp(float from, float to, float time) {
    return (1.0-time)*from + time*to;
}
```



```
float lerp(float v0, float v1, float t) {
    return (1.0-t)*v0 + t*v1;
}

void Update(float elapsed) {

    animationTime = animationTime + elapsed;

    float animationValue = mapValue(animationTime, animationStart,
animationEnd, 0.0, 1.0);

    modelMatrix.identity();
    modelMatrix.Translate(lerp(0.0, 1.0, animationValue), 0.0, 0.0);
}
```



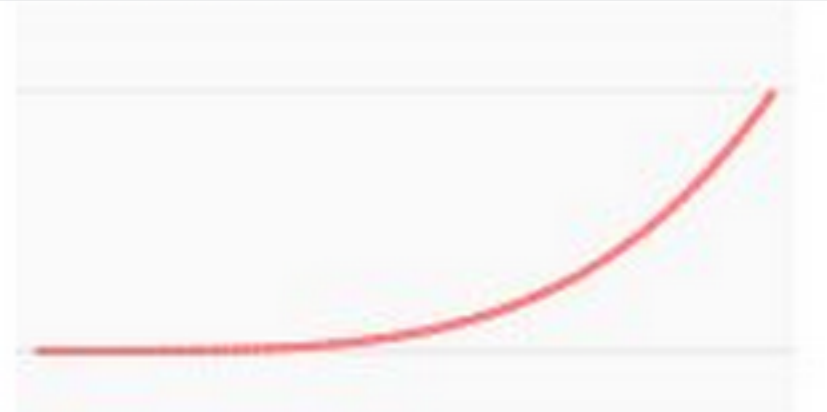


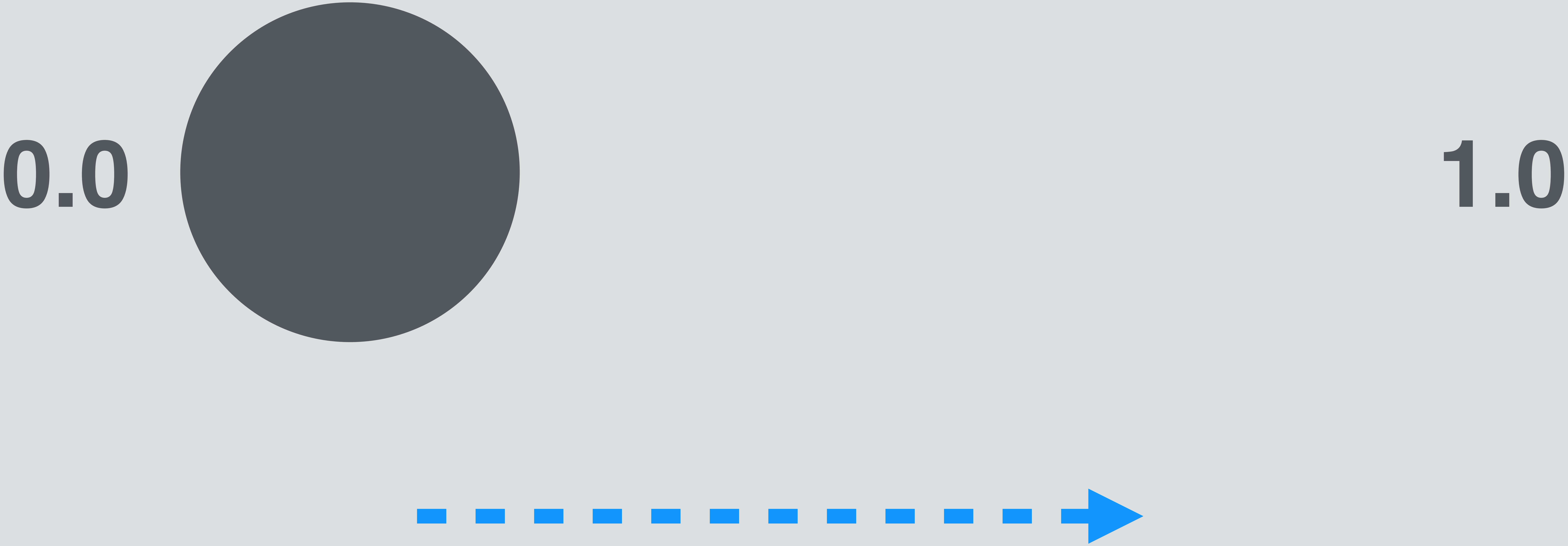
0.0

1.0

Easing in.

```
float easeIn(float from, float to, float time) {
    float tVal = time*time*time*time*time;
    return (1.0f-tVal)*from + tVal*to;
}
```



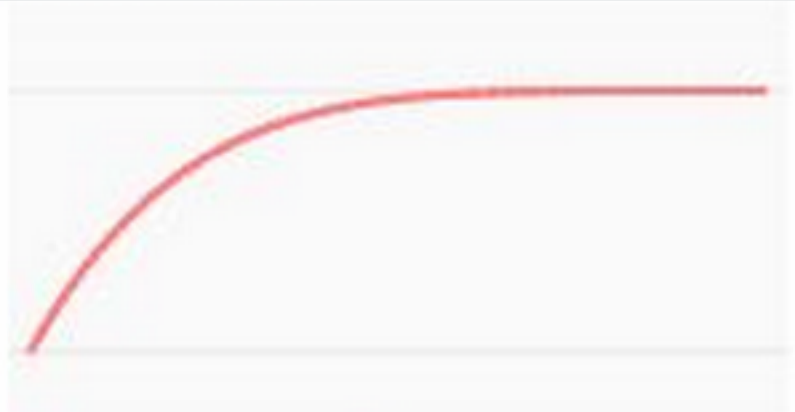


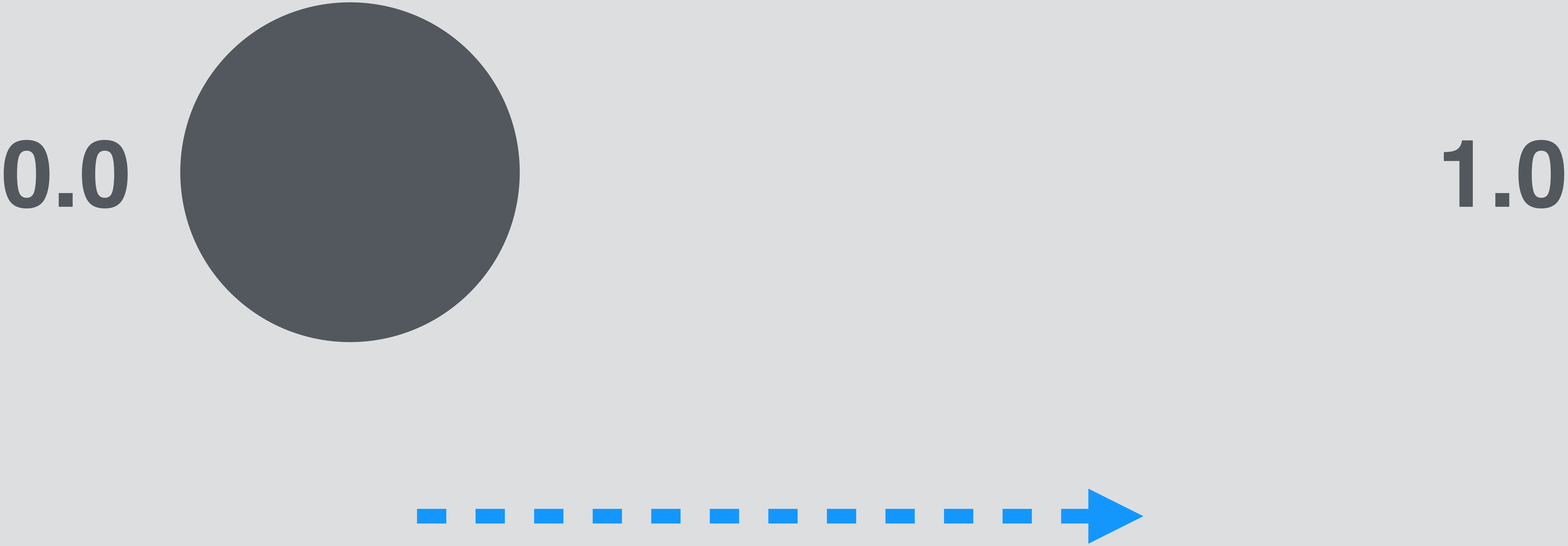
0.0

1.0

Easing out.

```
float easeOut(float from, float to, float time) {
    float oneMinusT = 1.0f-time;
    float tVal =  1.0f - (oneMinusT * oneMinusT * oneMinusT *
oneMinusT * oneMinusT);
    return (1.0f-tVal)*from + tVal*to;
}
```



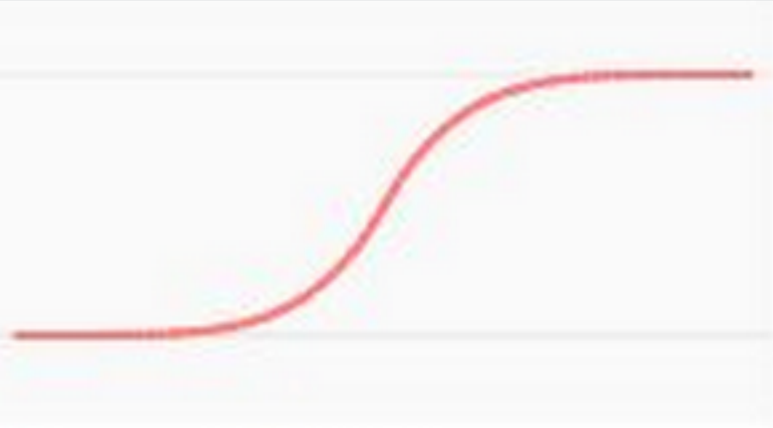


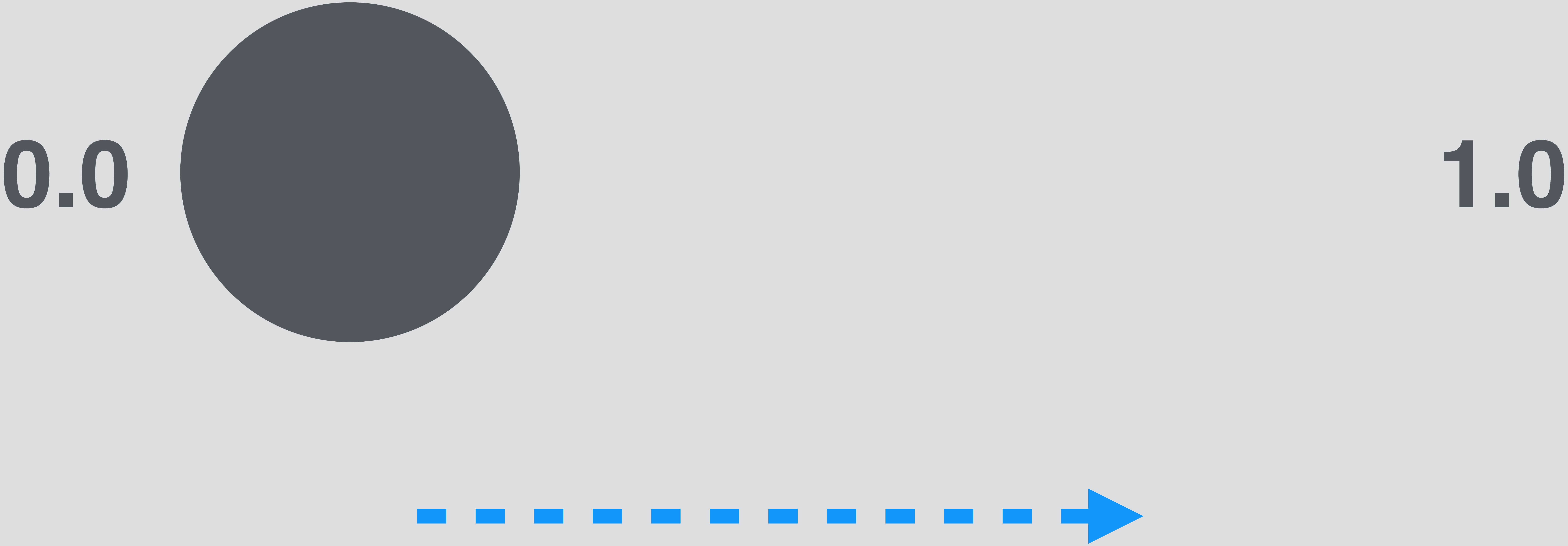
0.0

1.0

Easing in and out.

```
float easeInOut(float from, float to, float time) {
    float tVal;
    if(time > 0.5) {
        float oneMinusT = 1.0f-((0.5f-time)*-2.0f);
        tVal =  1.0f - ((oneMinusT * oneMinusT * oneMinusT * oneMinusT * 
oneMinusT) * 0.5f);
    } else {
        time *= 2.0;
        tVal = (time*time*time*time*time)/2.0;
    }
    return (1.0f-tVal)*from + tVal*to;
}
```

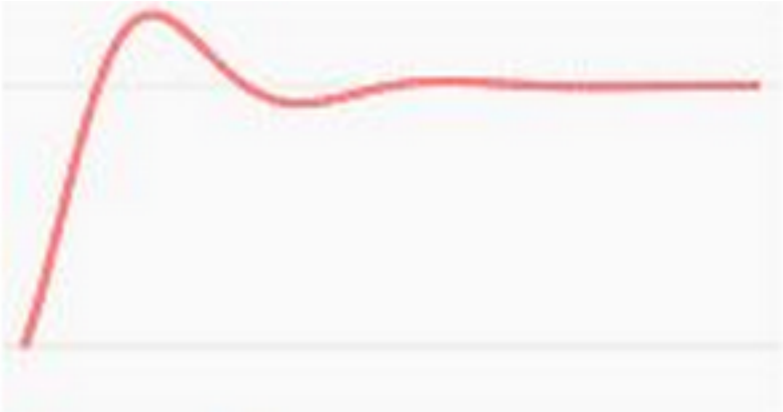




0.0

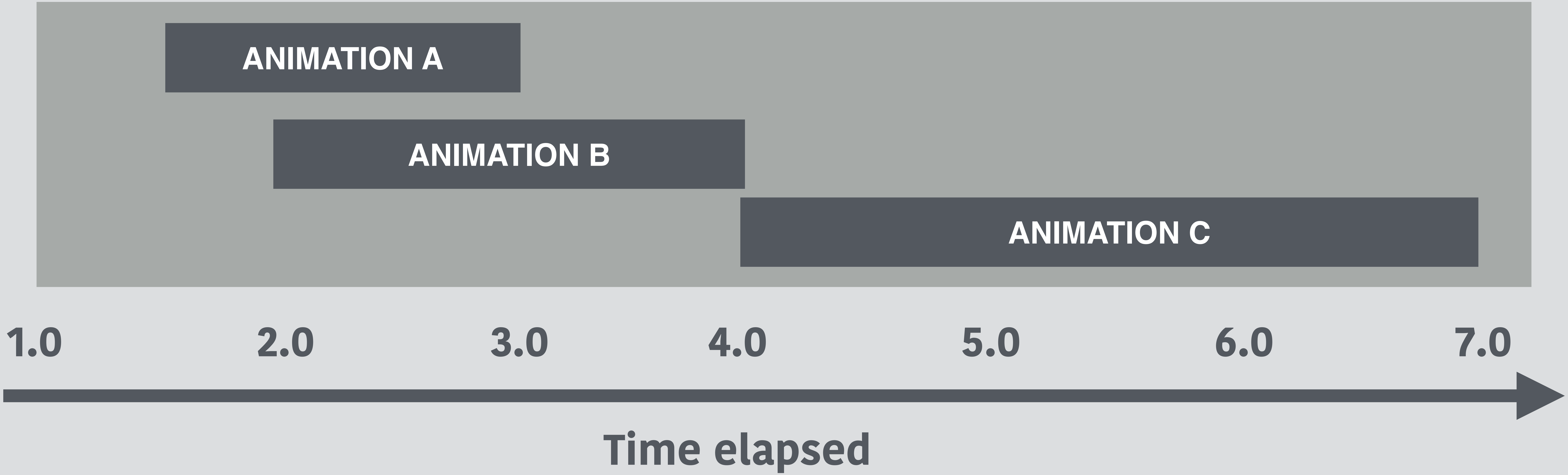
1.0

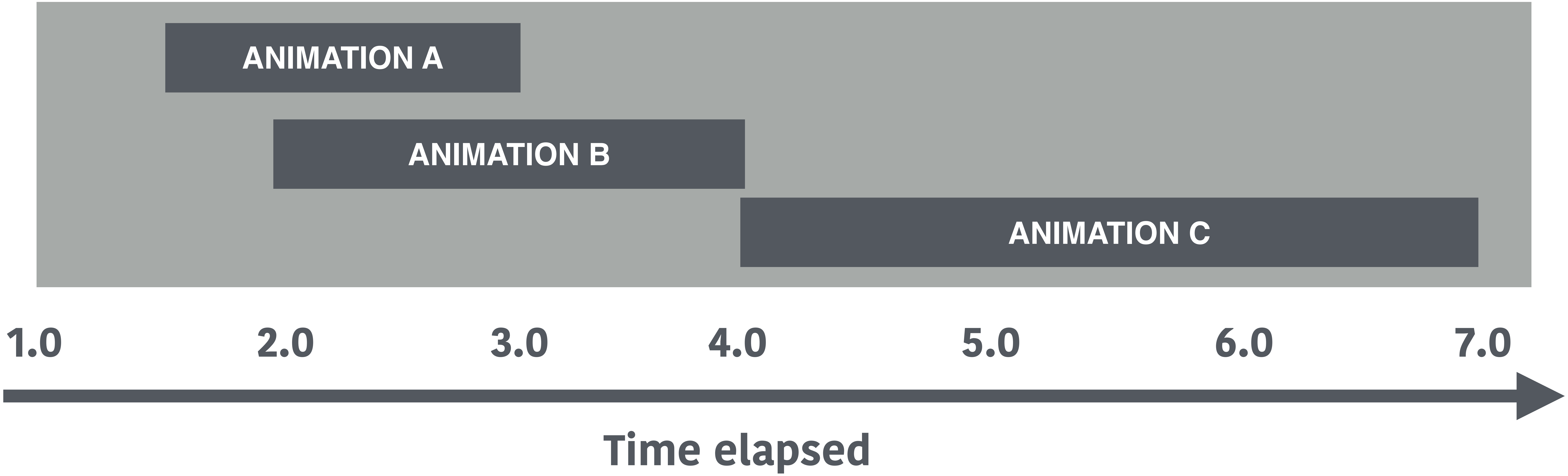
Overshooting our target.



```
float easeOutElastic(float from, float to, float time) {
    float p = 0.3f;
    float s = p/4.0f;
    float diff = (to - from);
    return from + diff + (diff*pow(2.0f,-10.0f*time) * sin((time-s)*(2*PI)/p));
}
```

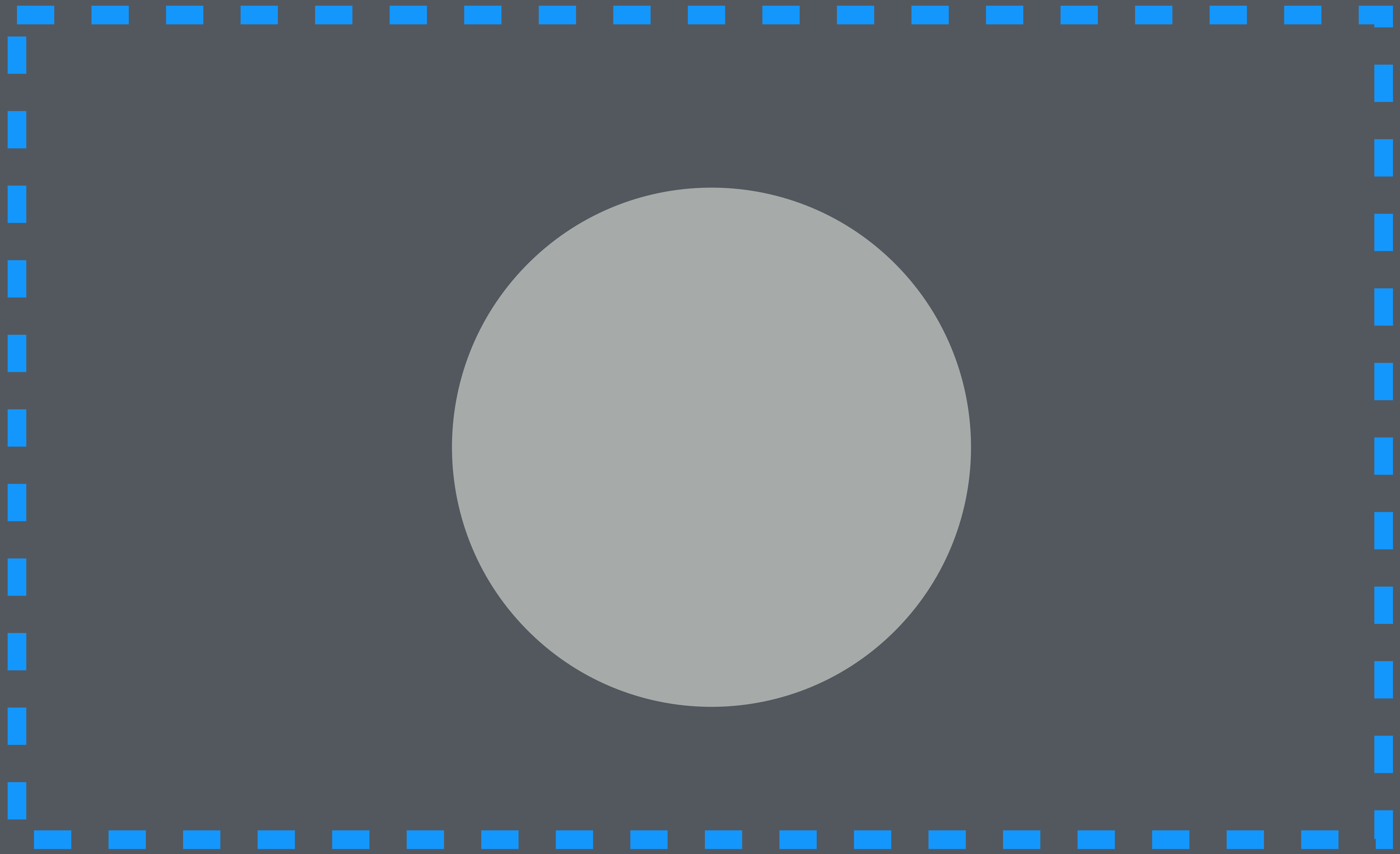
Mapping animations on a timeline.

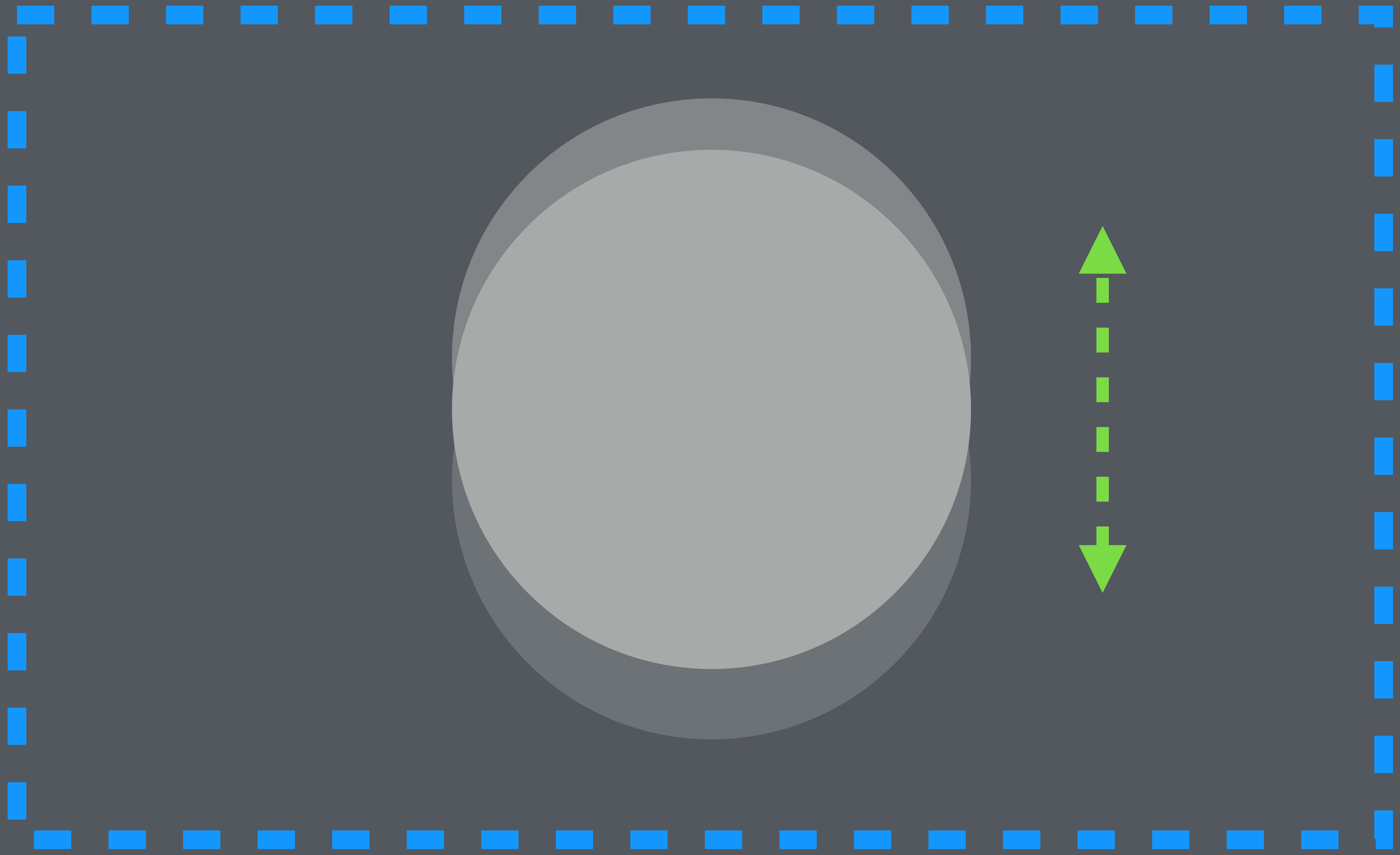

ANIMATION A
ANIMATION B
ANIMATION C
1.0
2.0
3.0
4.0
5.0
6.0
7.0
Time elapsed

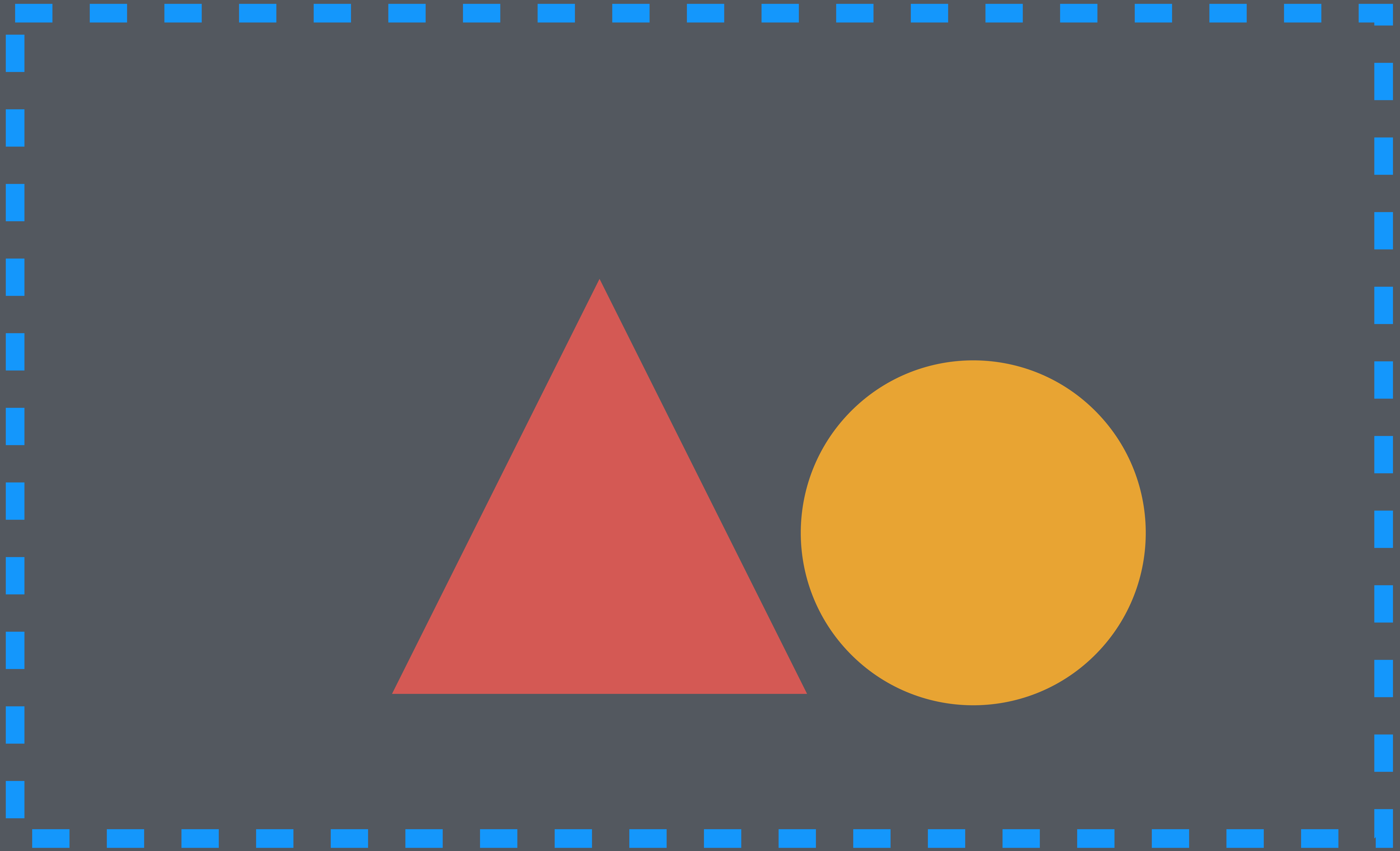


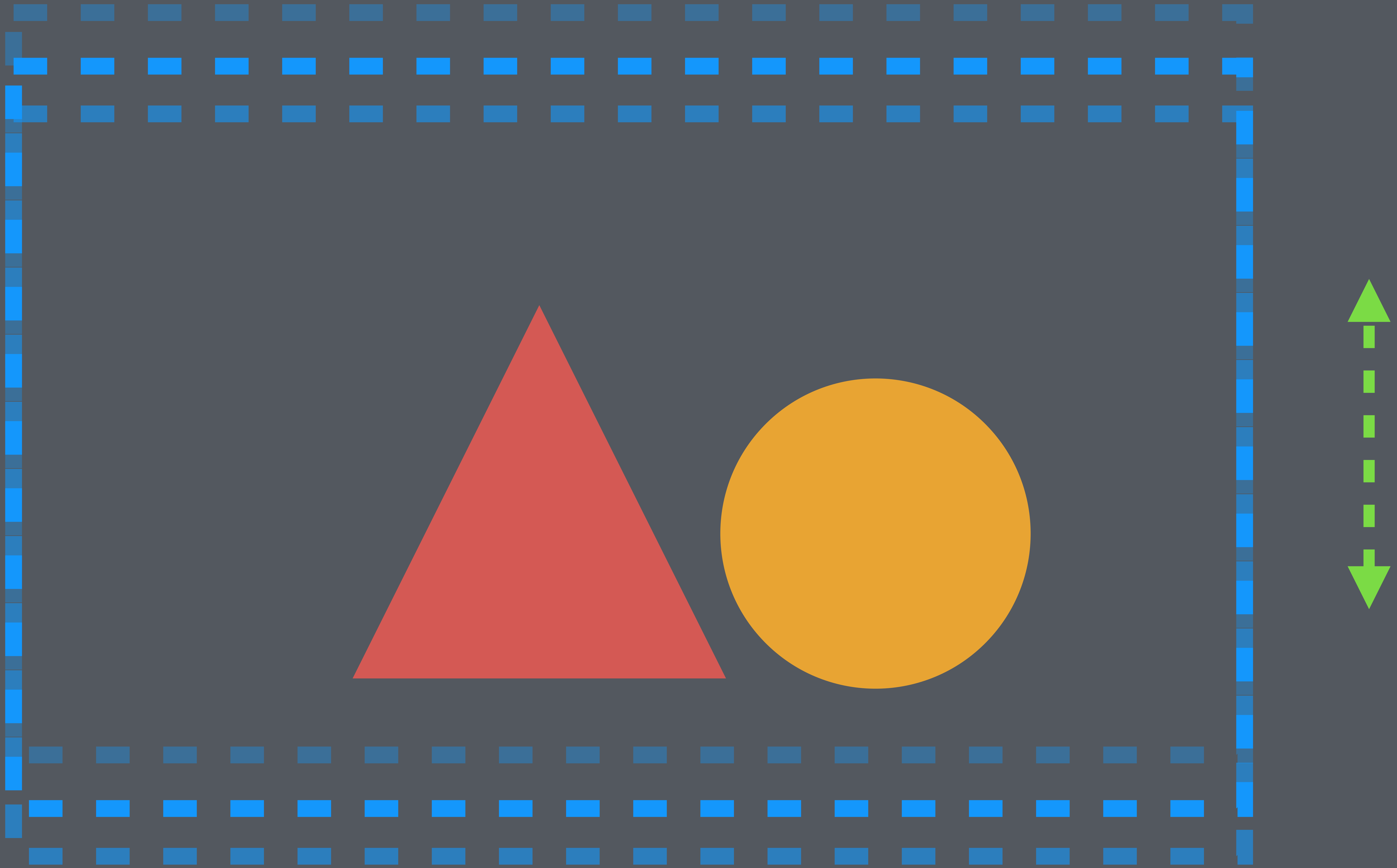
```
float animationAValue = mapValue(timeElapsed, 1.5f, 3.0f, 0.0f, 1.0f);
float animationBValue = mapValue(timeElapsed, 2.0f, 4.0f, 0.0f, 1.0f);
float animationCValue = mapValue(timeElapsed, 4.0f, 7.0f, 0.0f, 1.0f);
```

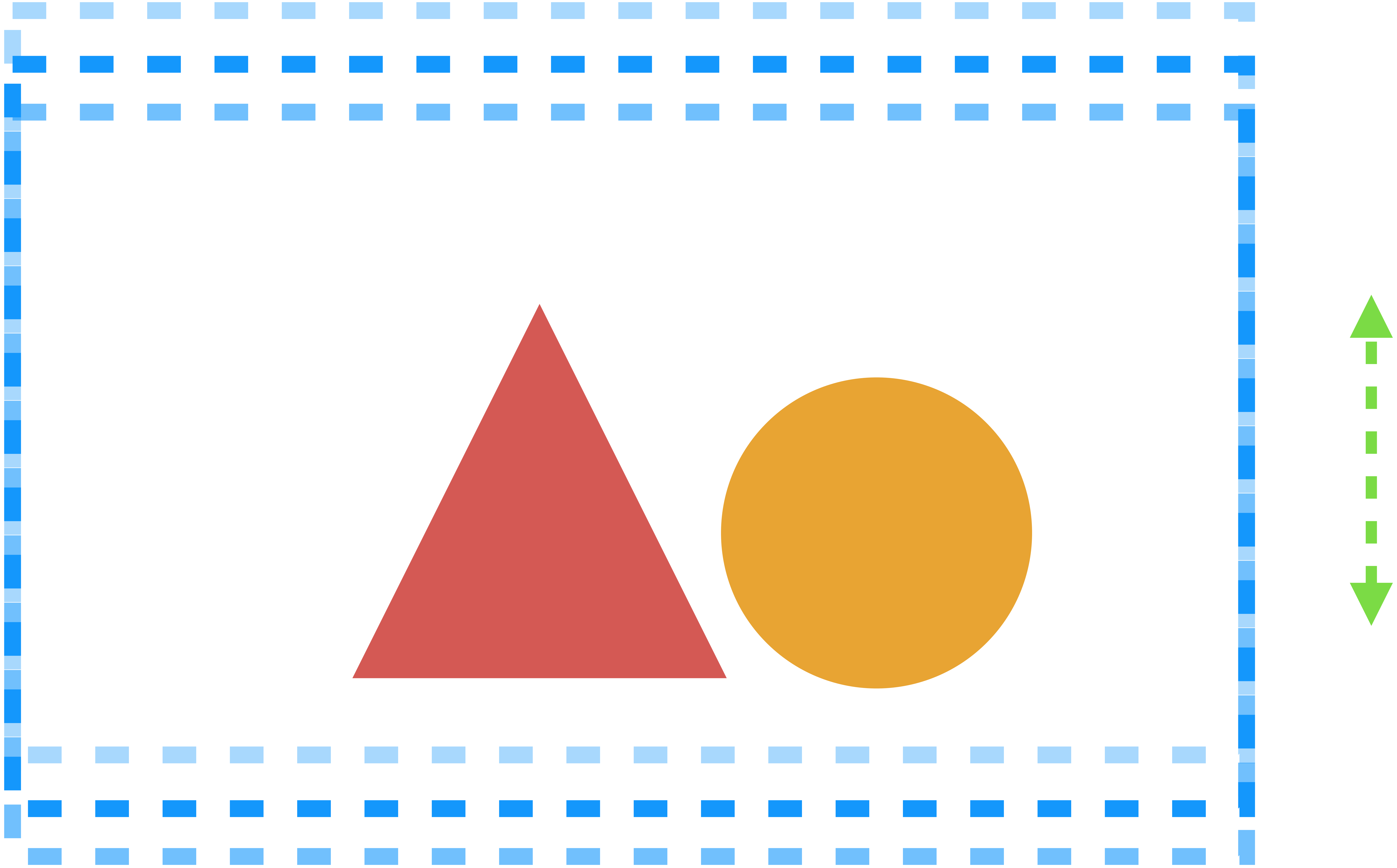
Screen Shake!









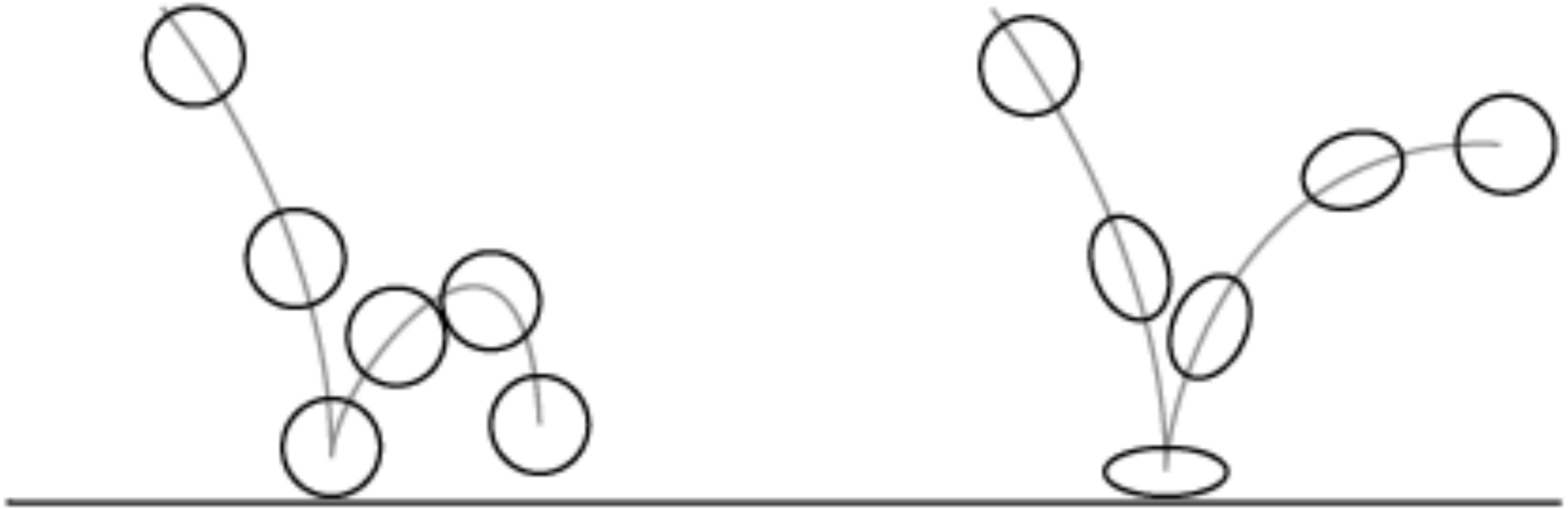


```
screenShakeValue += elapsed;

viewMatrix.Translate(0.0f, sin(screenShakeValue * screenShakeSpeed)* screenShakeIntensity,
0.0f);
```

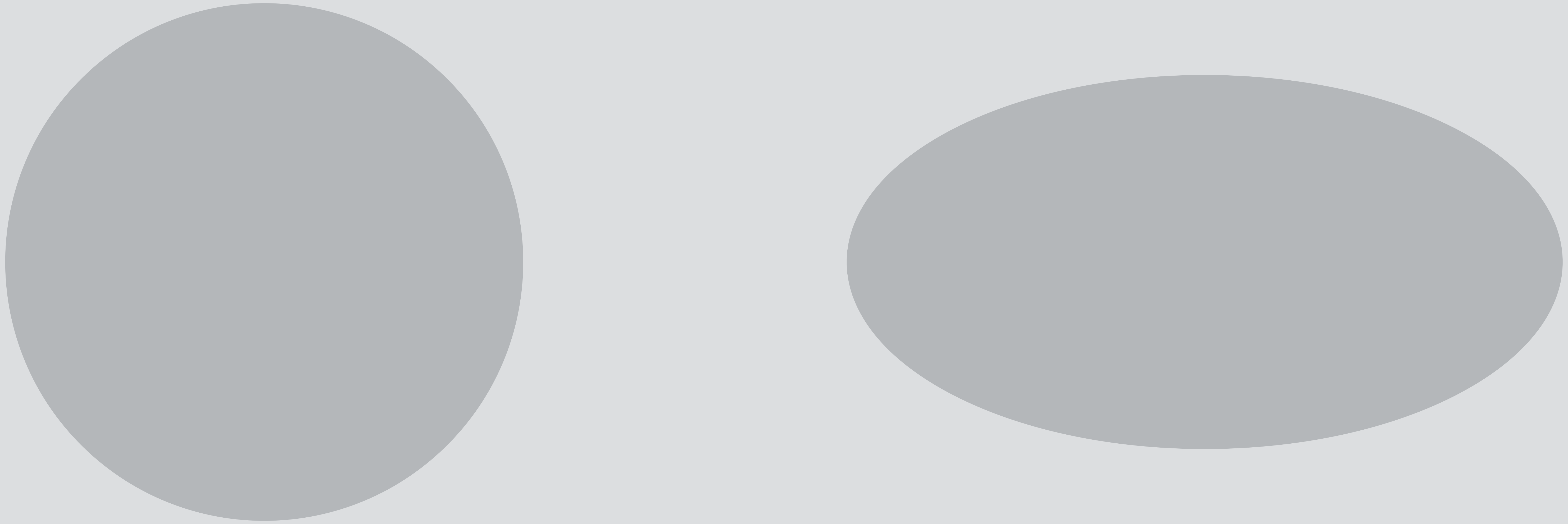
You can shake it sideways or both ways!

THERE IS NO WRONG WAY TO SHAKE THE SCREEN.

Squash and stretch.

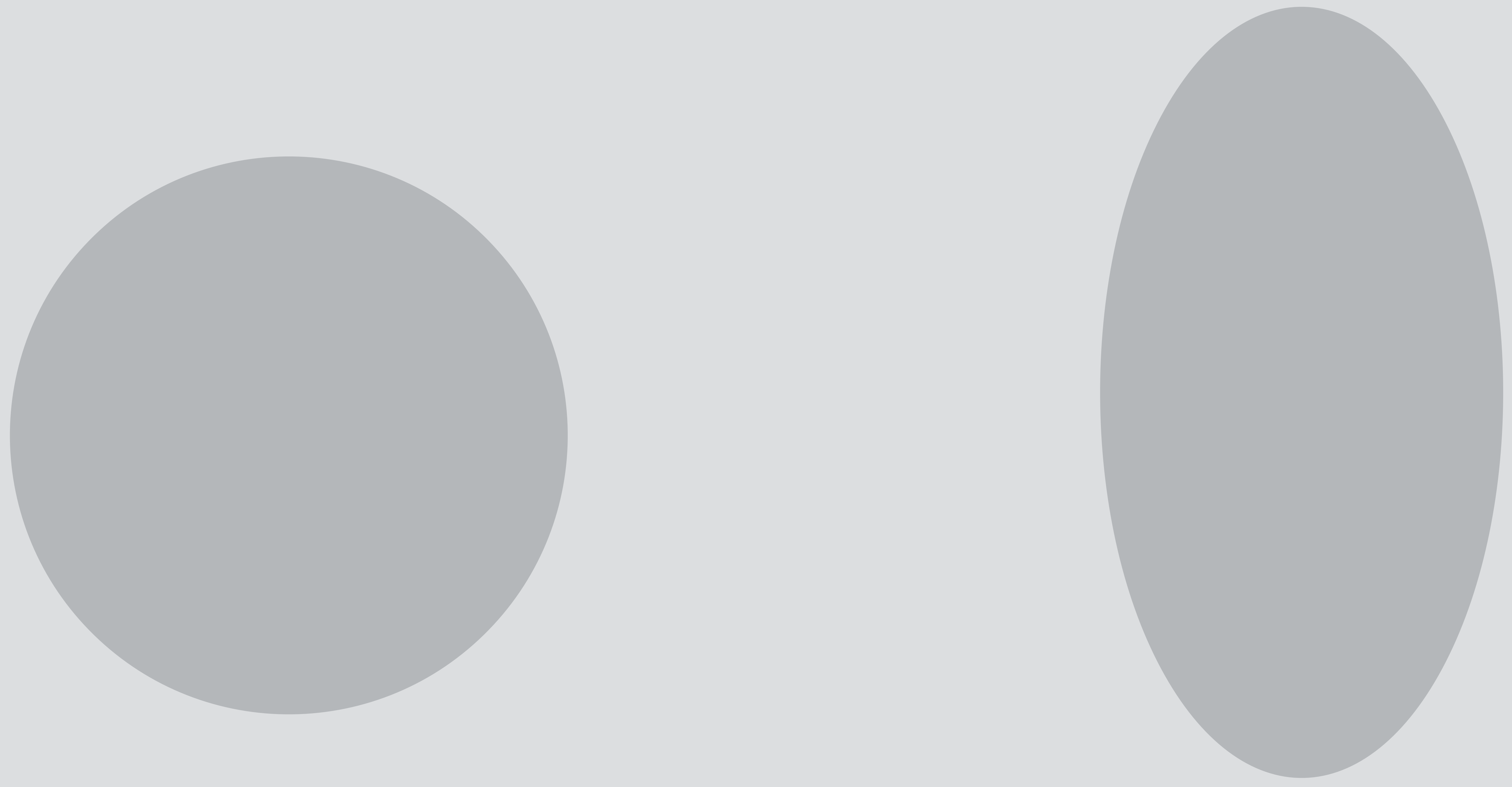


Squashing.



Fast movement on the X axis or impact on the Y axis..

Stretching.



Fast movement on the Y axis or impact on the X axis..

Map velocity on an axis to scale on that axis and map to the inverse of that scale on the other axis.

Map **velocity** on an **axis** to **scale on that axis** and **inverse of that scale** on **the other axis**.

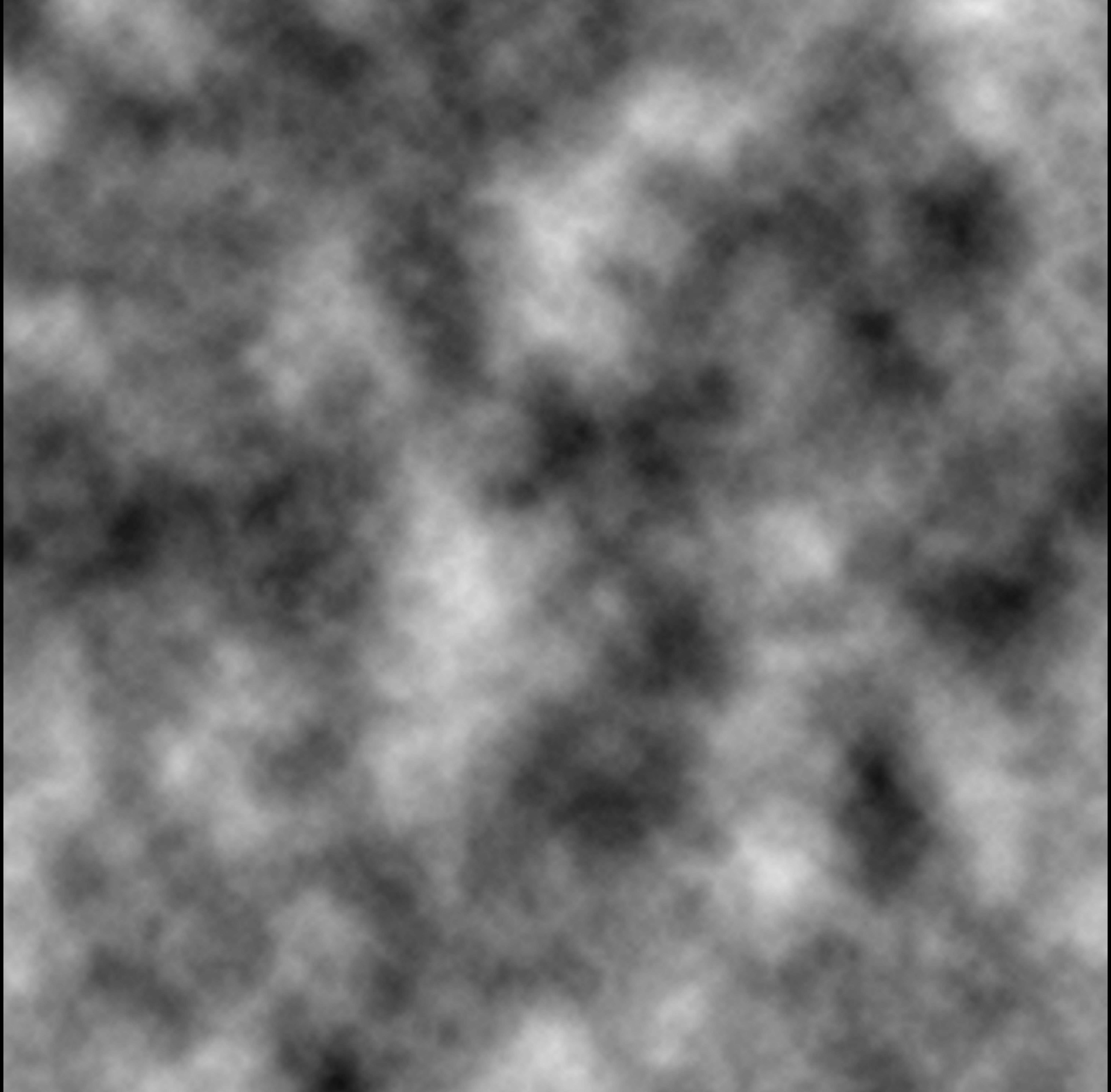
```
// map Y velocity 0.0 - 5.0 to 1.0 - 1.6 Y scale and 1.0 - 0.8 X scale

scale_y = mapValue(fabs(velocity_y), 0.0, 5.0, 1.0, 1.6);
scale_x = mapValue(fabs(velocity_y), 5.0, 0.0, 0.8, 1.0);
```

Thomas was Alone.

https://www.youtube.com/watch?v=22WW4_BxpR8#t=467

Perlin noise.

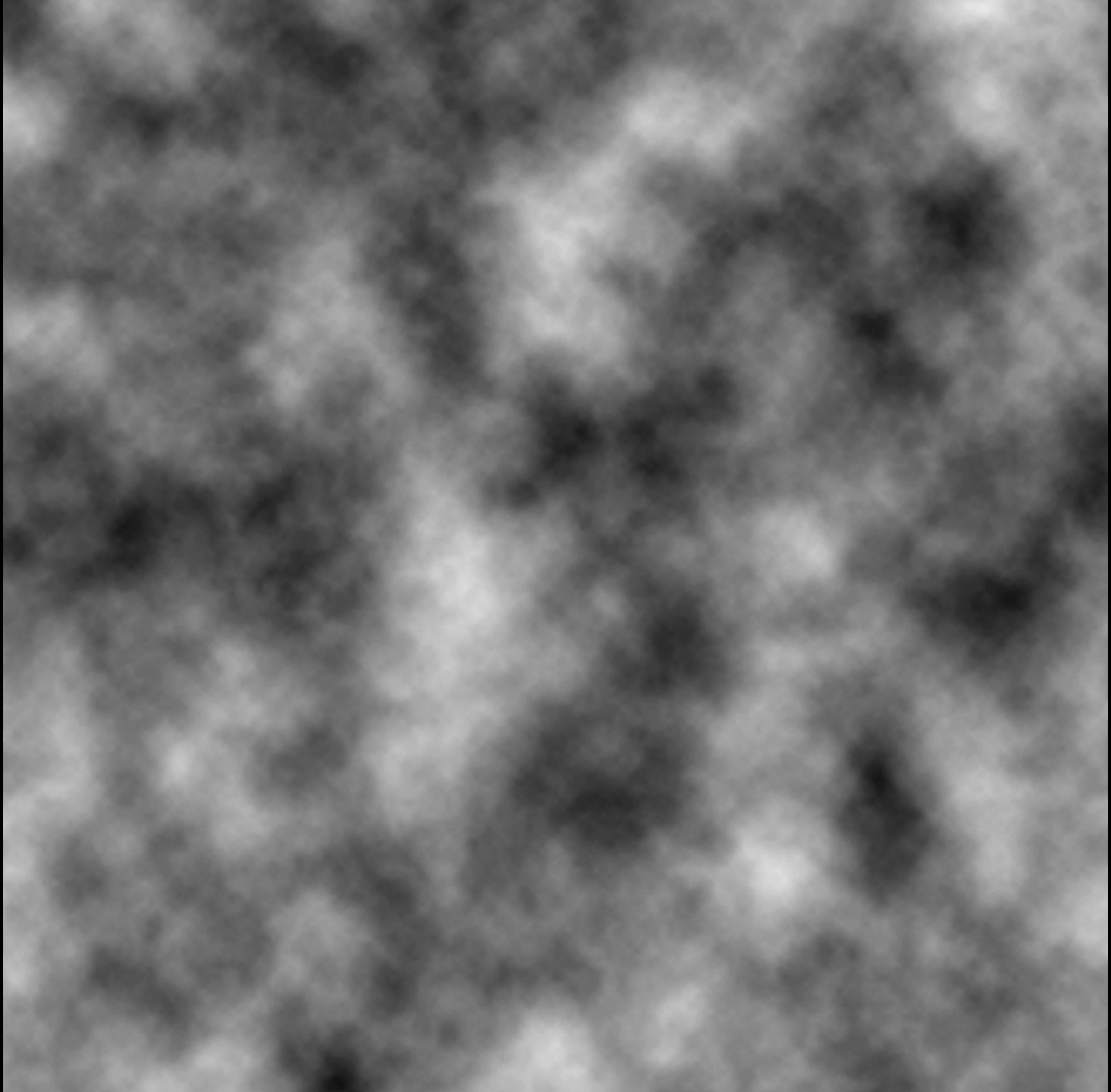
http://mrl.nyu.edu/~perlin/doc/oscar.html



Use **PerlinNoise.h** and **PerlinNoise.cpp** in class repository.

noise2 returns a -1.0 to 1.0 noise value for a **2D coordinate**.

```
float coord[2] = {0.05f, 0.0};
float val = noise2(coord);
```

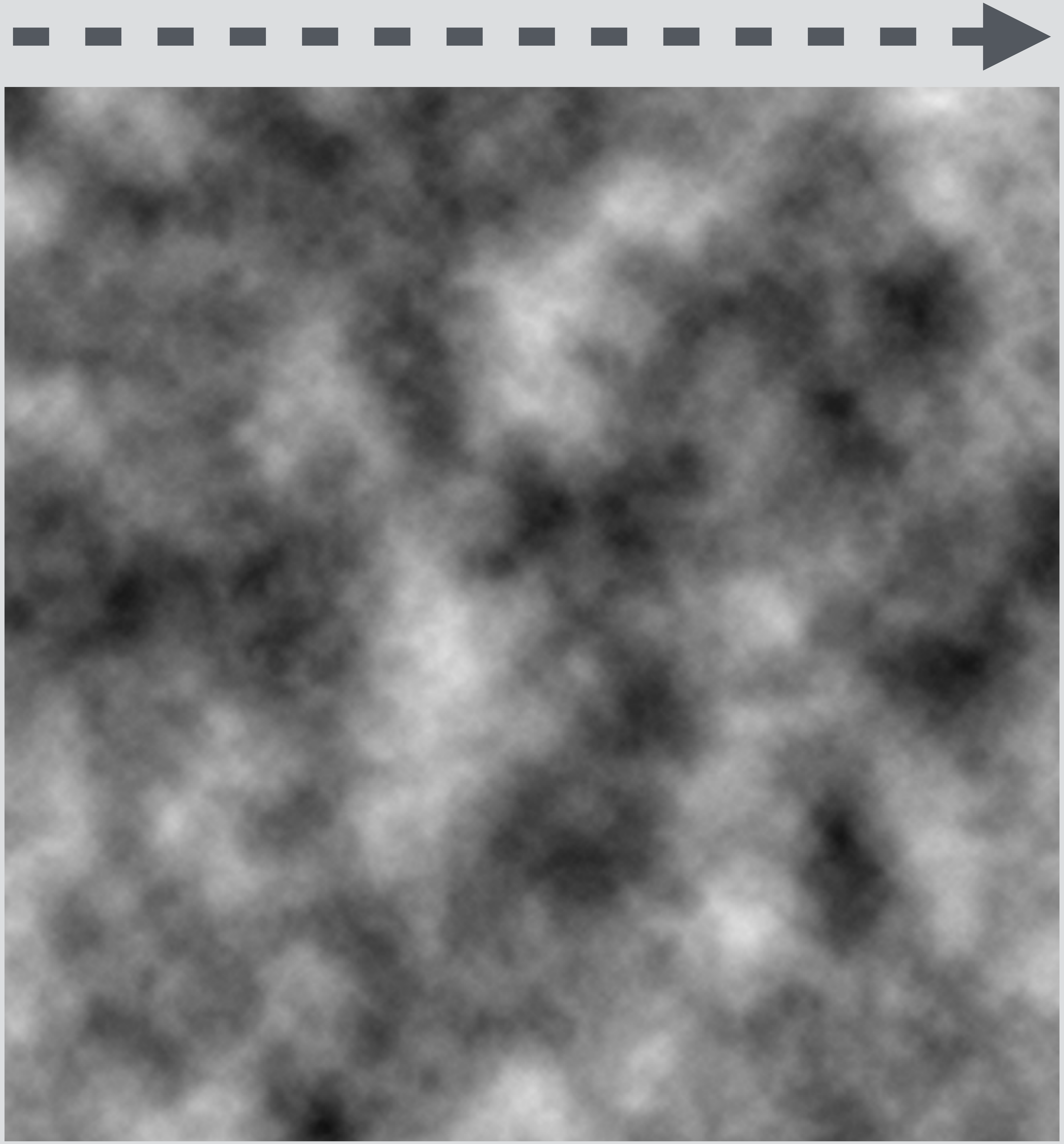


noise1 returns a -1.0 to 1.0 noise value for a **1D coordinate**.

```
float val = noise1(0.5f);
```

Using **perlin noise** for **natural movement**.

Time elapsed



Shaky cam example using 1**D noise**.

```
perlinValue += elapsed;

viewMatrix.Translate(noise1(perlinValue), noise1(perlinValue+ 10.0f), 0.0);
```

Shaky cam example using **2D noise**.

```
perlinValue += elapsed;

float coord[2] = {perlinValue, 0.0};
float val = noise2(coord);

coord[1] = 0.5f;
float val2 = noise2(coord);
viewMarix.Translate(val, val2, 0.0);
```

You can use Perlin noise for good looking screen shake too!

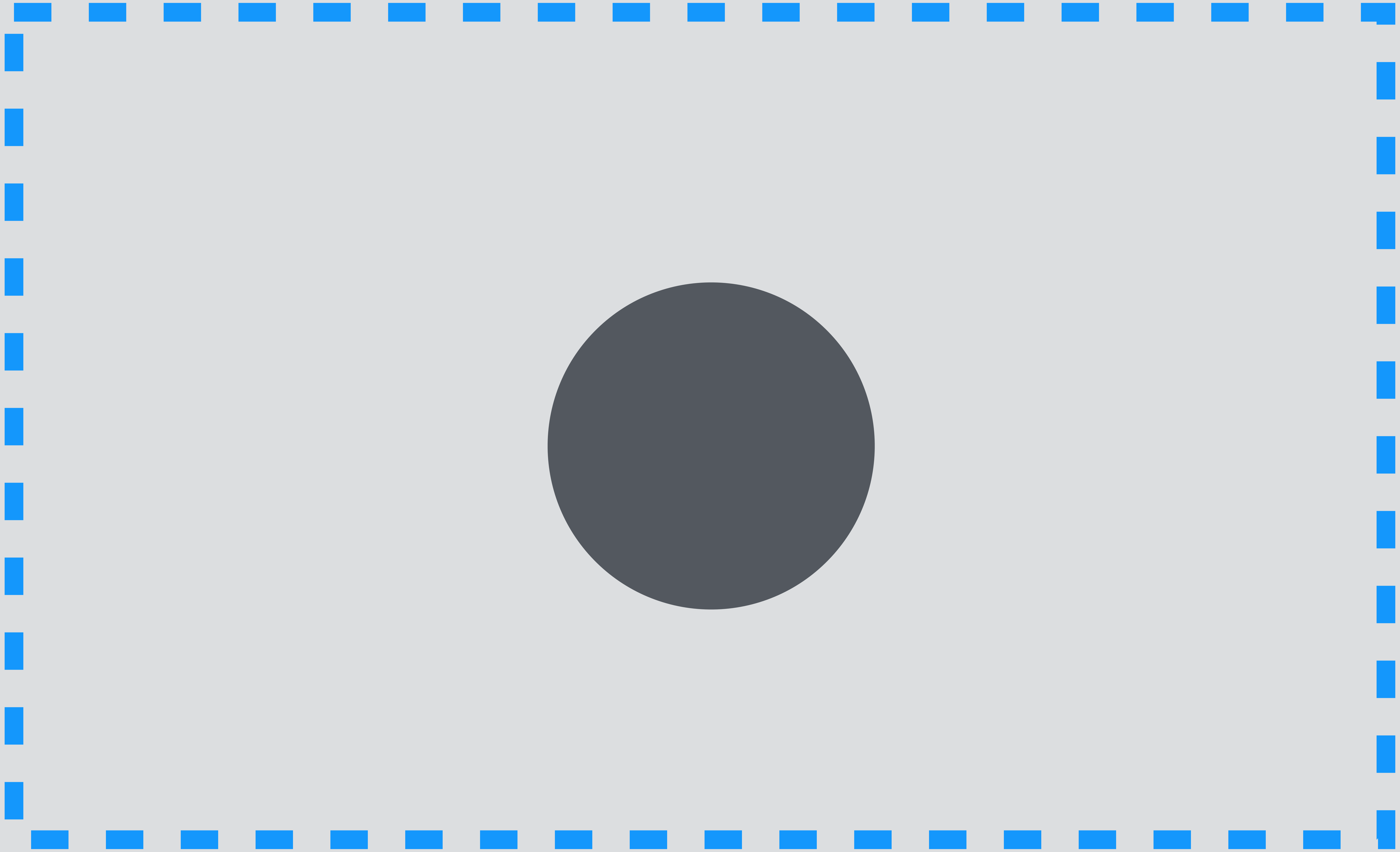
Or to make things **hover** realistically.

Fading in and **out**.

To fade the screen, you can draw a fullscreen **rectangle** after your **scene** using a **basic untextured shader** and **animate its alpha value** via a **uniform**.

```
uniform float alphaValue;

void main()
{
    gl_FragColor = vec4(0.0, 0.0, 0.0, alphaValue);
}
```

Don’t forget to enable **blending** and set an **identity view matrix**!



Final project requirements.

- Must have a title screen and proper states for game over, etc.
- Must have a way to quit the game.
- Must have music and sound effects.
- Must have at least 3 different levels or be procedurally generated.
- Must be either local multiplayer or have AI (or both!).
- Must have at least some animation or particle effects.

Bonus points for (one of) the following:

- Getting it running on your phone.
- Having 3D elements.
- Having shader effects.

(we haven’t covered any of this yet!)