

# Motion Design with CSS

*Master the Principles with*  
**@RachelNabors & Tuna P. Katz**



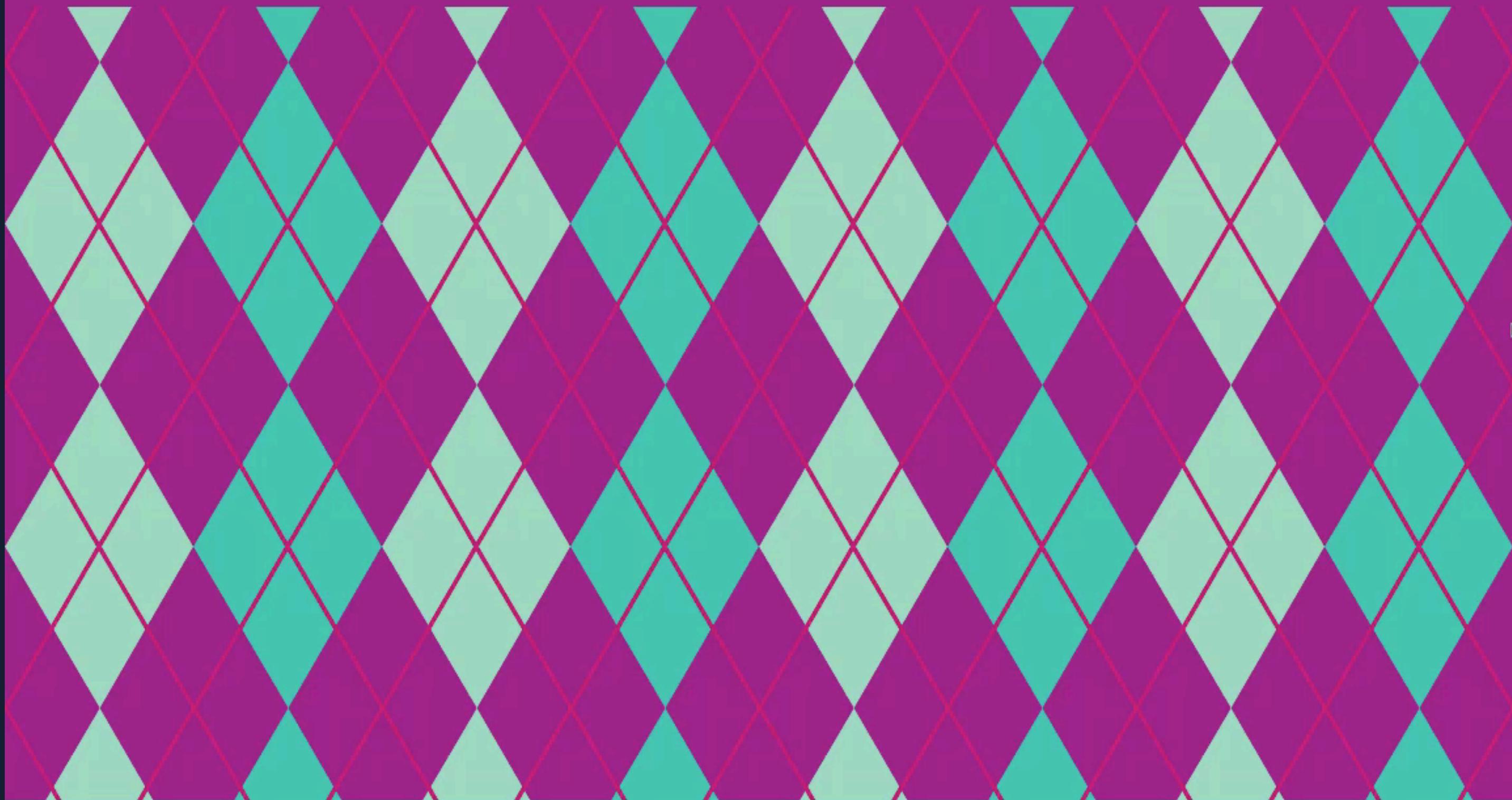
Get started with “FRONTENDMASTER” at [goo.gl/b8HicV](http://goo.gl/b8HicV)

@RachelNabors RachelNabors.com



*[devtoolschallenger.com](https://devtoolschallenger.com)*

# Alice in Videoland



A retelling of Lewis Carroll's classic in pixels and HTML by [Rachel Nabors](#)

[rachelnabors.com/alice-in-videoland/book](http://rachelnabors.com/alice-in-videoland/book)



Getting Started

Design

Overview

Color

Data Entry

Displaying Data

Layout

Loading

Messaging

Motion

Navigation

Typography

Components

Voice and Tone

Native

Resources

FAQ



Design

# Motion

## Key Principles



### TIMING

A “grid of time” creates consistent rhythm. Animation is defined as multiples of a base grid.



### ELEVATION

Utilizing the Z-axis to support spatial organization aids in creating a visual hierarchy we refer to as “atmosphere”.



### EFFECTS

Attributes are animated over time to create a vocabulary of effects.

Types of Animation

[lightningdesignsystem.com/design/motion](http://lightningdesignsystem.com/design/motion)



***WebAnimationWeekly.com***  
*(It's the best.)*

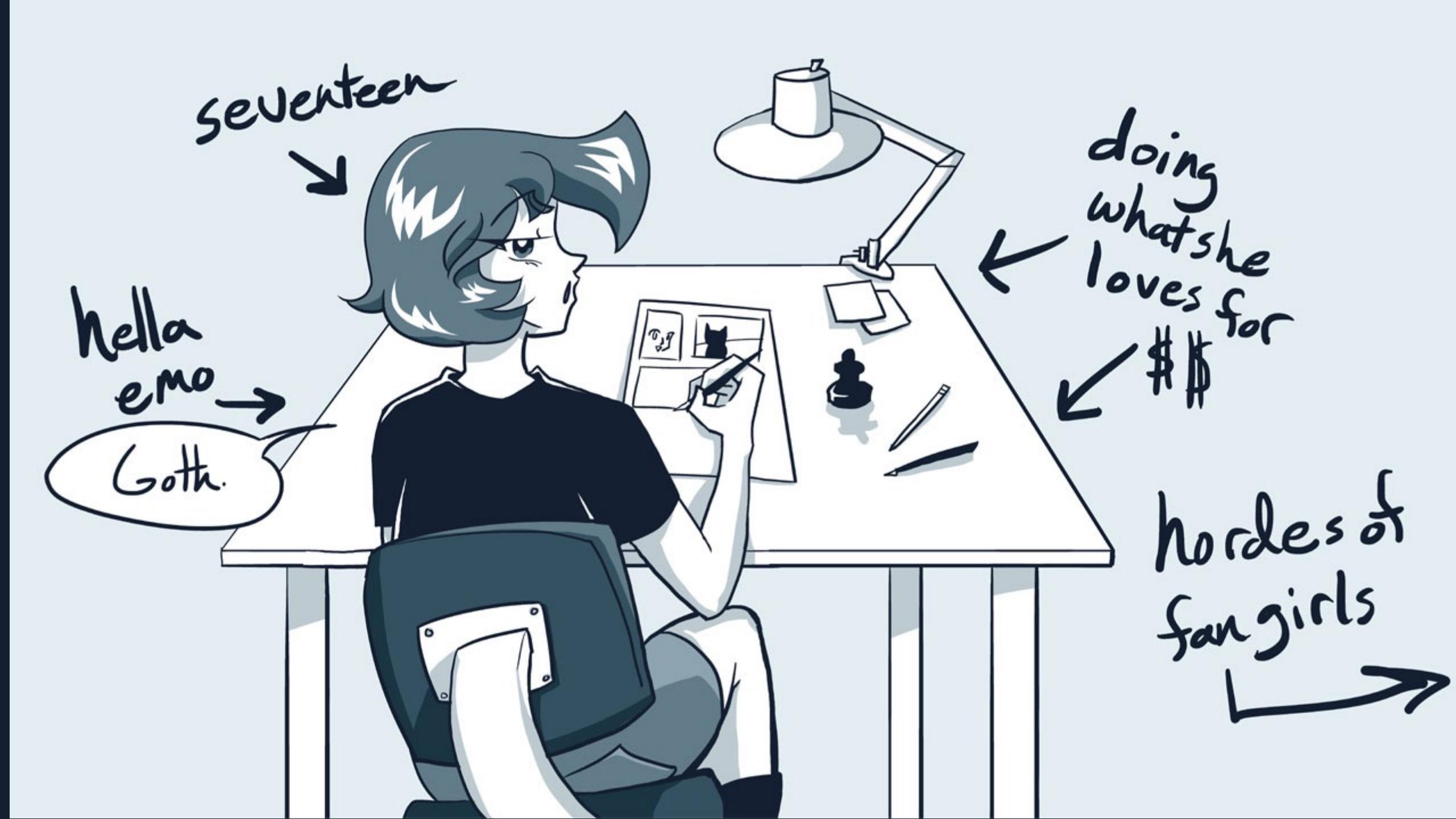
# You will learn...

- CSS Transitions & Animations
- How to use animation in product design
- How to create stateful animations with JavaScript
- How to use developer tools to manipulate animations
- How to design performant animations

# For your convenience...

All of the exercises use:

- jQuery
- -prefix-free
- CodePen

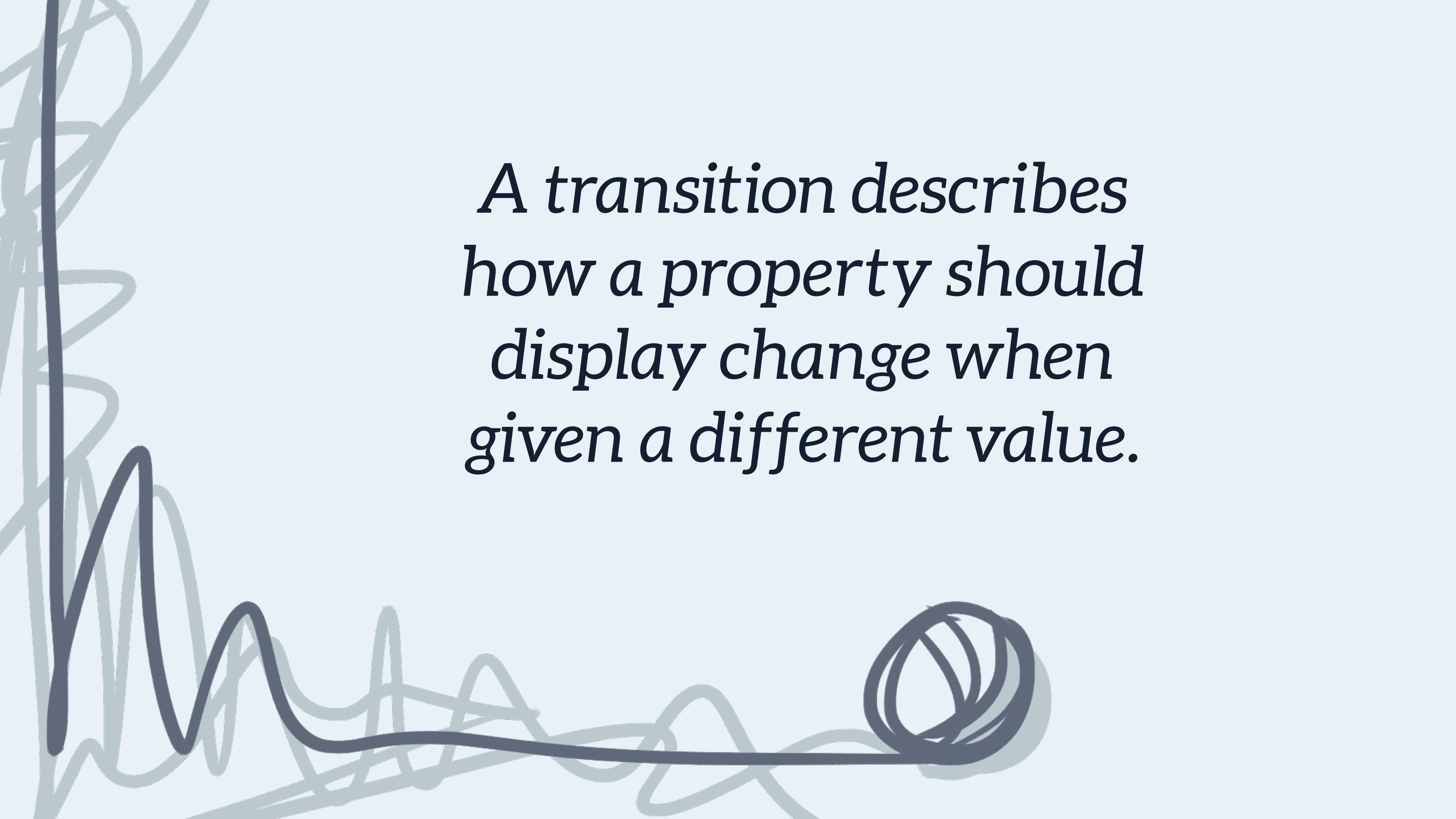


# Our Teacher's Assistant Today



# CSS Transitions





*A transition describes  
how a property should  
display change when  
given a different value.*

**transition: color 2s;**

Demo time: [cdpn.io/oXgqWy](https://cdpn.io/oXgqWy)

**transition-property: color;**

**transition-duration: 2s;**

# Anatomy of a transition

- **transition-property** the property you want to transition.  
*(Only some properties are transitional, see [goo.gl/Ttk1S2](http://goo.gl/Ttk1S2))*
- **transition-duration** in seconds or milliseconds: 4s or 4000ms
- **transition-timing-function** “cushioning” for the transition, **optional**: defaults to ease
- **transition-delay** the number of milli/seconds to delay the transition before firing it, **optional**

so this must  
be the delay



**transition: color 2s 100ms;**

duration   
always  
comes first

*exercise*

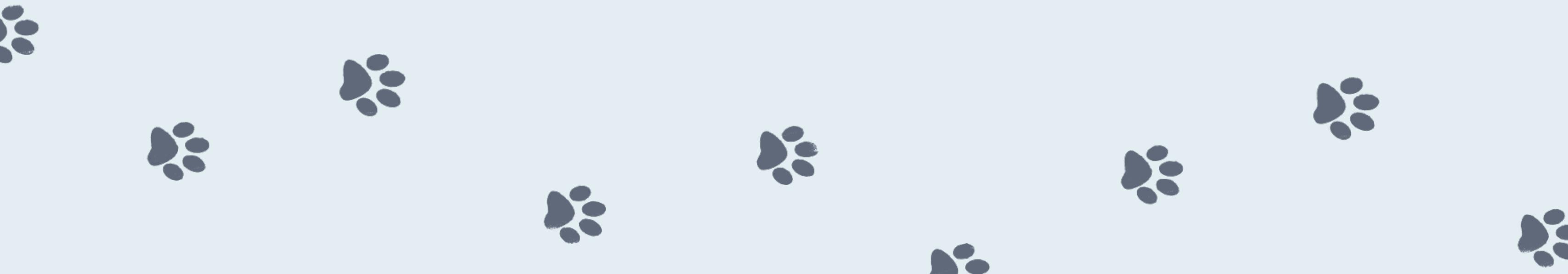
# Rolling a Ball



Start coding! [cdpn.io/fGFDj](https://cdpn.io/fGFDj)

**Keep this exercise open. We'll need it!**

# Transitioning Multiple Properties



~~transition-property: all;~~

Don't do it!!

**transition-property: color, transform;**  
**transition-duration: 2s, 300ms;**  
**transition-delay: 0, 1s;**

*redundant, bleh*

**transition:**

**color 2s,**

**transform 300ms 1s;**



separate sets of values  
with commas

*demo*

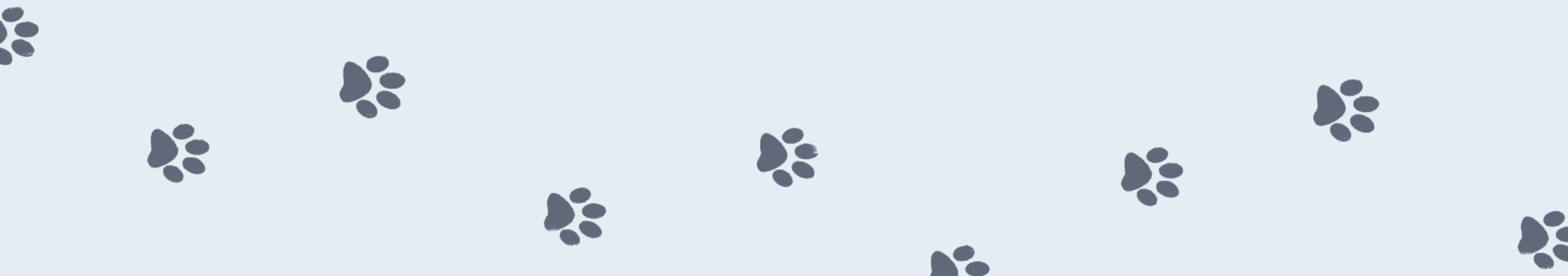
# Changing the Ball's Color



Demo time! [cdpn.io/fGFDj](https://cdpn.io/fGFDj)

**Try transitioning its color, too.**

# Duration



# Three timeframes for user attention



100 ms, instantaneous



1 second, still connected

# Three timeframes for user attention

|

100 ms



1 second



10 seconds, disconnected



## SPEAKING SCHEDULE

Mar 26

SFHTML5, San Francisco

May 9–13

Beyond Tellerand, Düsseldorf &  
DOM in Motion workshop

## ONLINE WORKSHOPS

Apr 2 – UIE

[Improve UX with Animation](#)

Jun 30 – Smashing Online  
Animation Essentials: CSS  
Animations and Transitions

Open Enrollment – Learn with  
Rachel Nabors

Practical Cartooning for  
Technical Folk

## ANIMATION PROJECTS



The Black Brick Road to Oz #47



Alice in Videoland

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Alice in Videoland

# WEB ANIMATION AND MOTION DESIGN TRAINING AND WORKSHOPS

Xmixthinks

## ONLINE WORKSHOPS



Apr 2

UIE

[Improve UX with Animation](#)



Jun 30

Smashing Online

[Animation Essentials: CSS Animations and Transitions](#)



Open Enrollment

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AVAILABLE FOR TRAINING IN HOUSE AND AT CONFERENCES

[rachelnabors.com](http://rachelnabors.com)

“However long your pre-production  
animation, halve its duration...  
then halve it again.”

*-Studio animation rule of thumb*



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250~300 ms:  
*sweet spot for  
many animations*



*faster != better*



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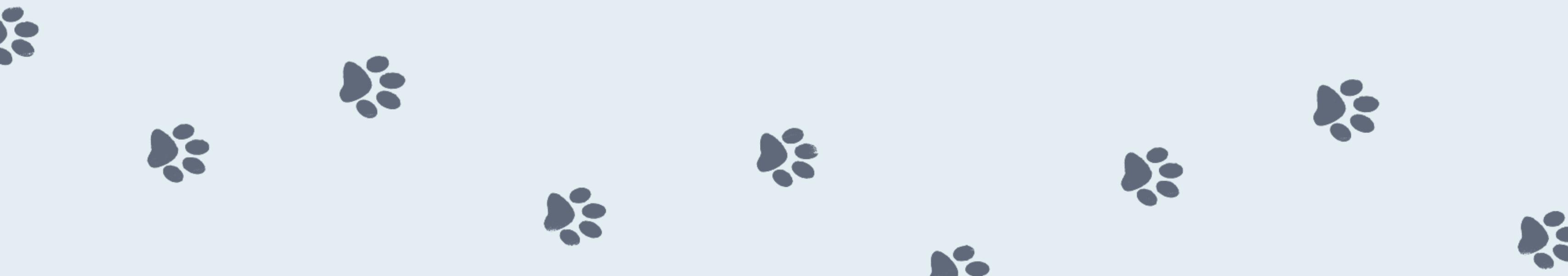
AVAILABLE FOR TRAINING IN HOUSE AND AT CONFERENCES

[rachelnabors.com](http://rachelnabors.com)



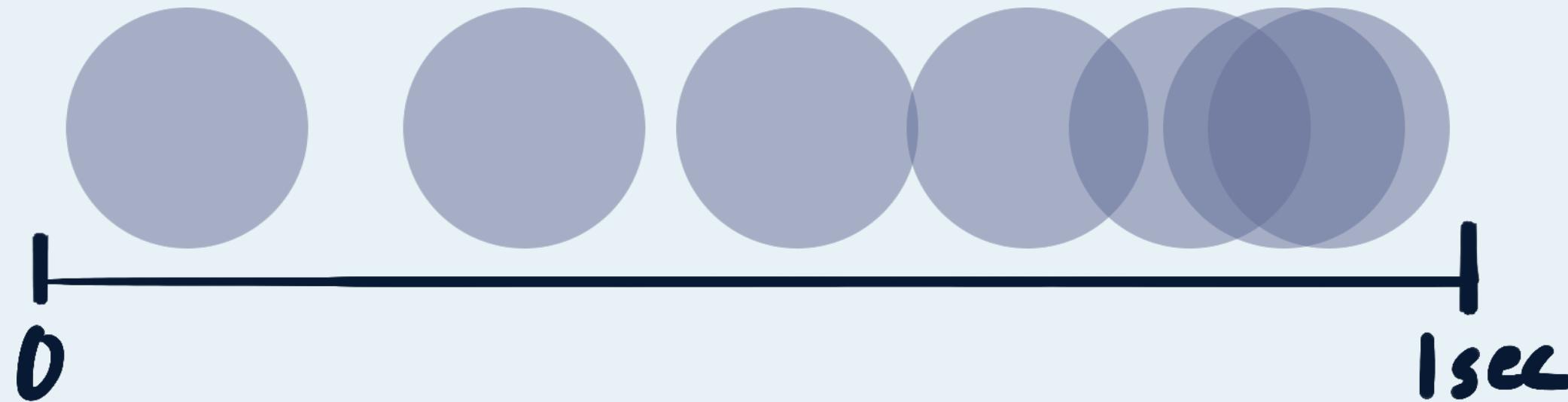
*You can slow down  
transitions with  
Dev Tools to get a  
good look at 'em.*

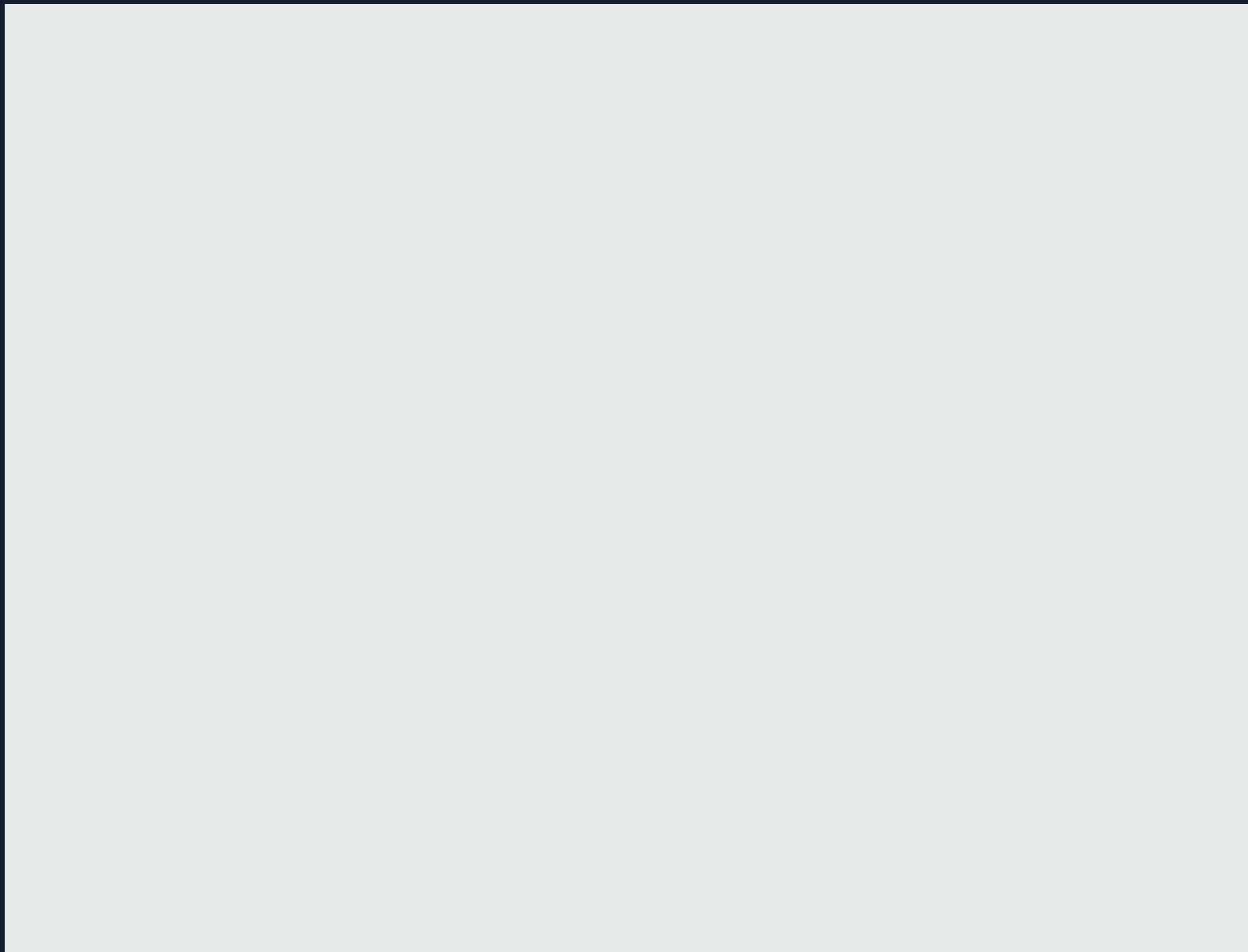
# Timing Functions



# Easing

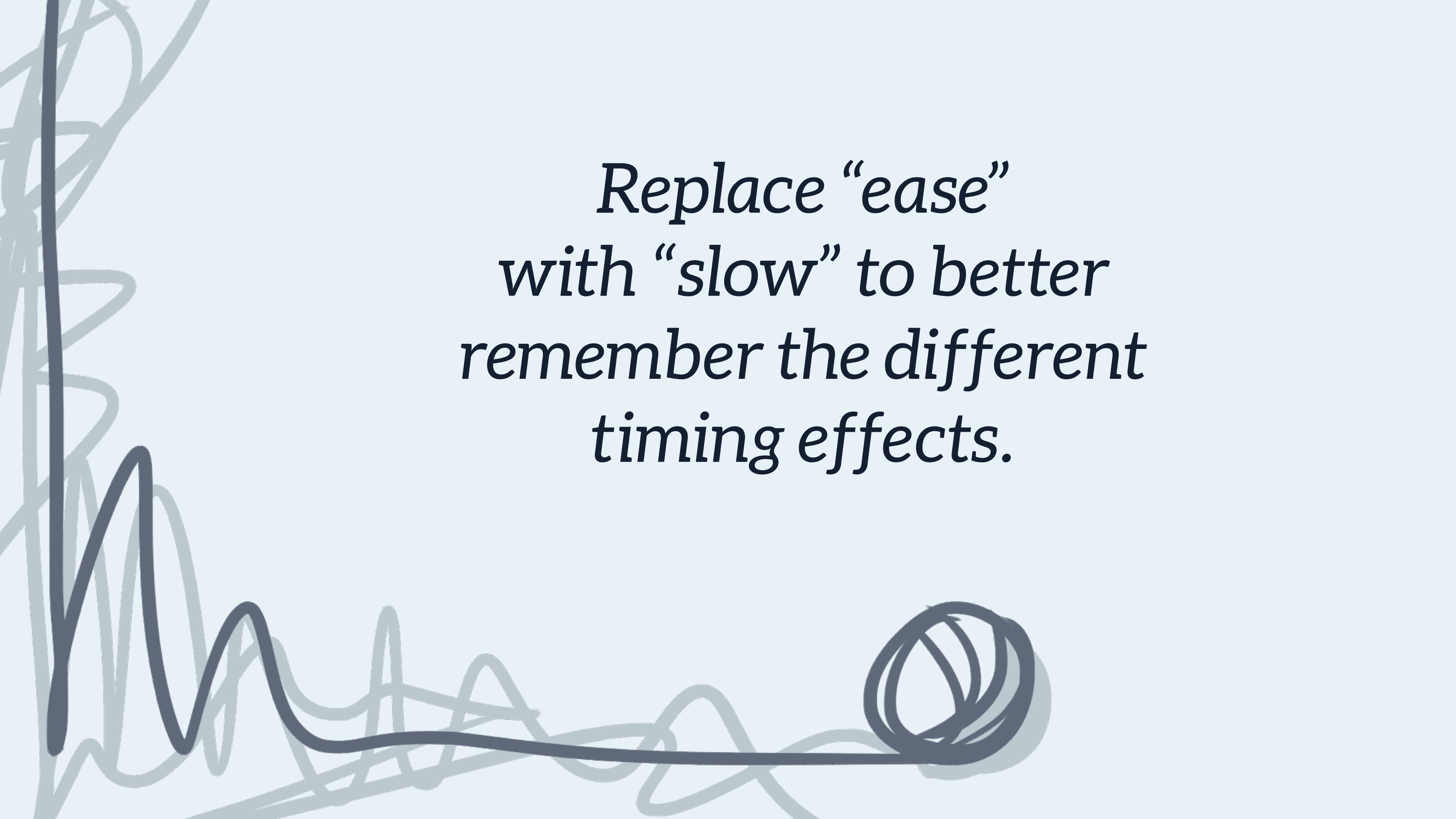
Easing, also known as “cushioning” in studio animation, describes an animation’s rate of change over time.



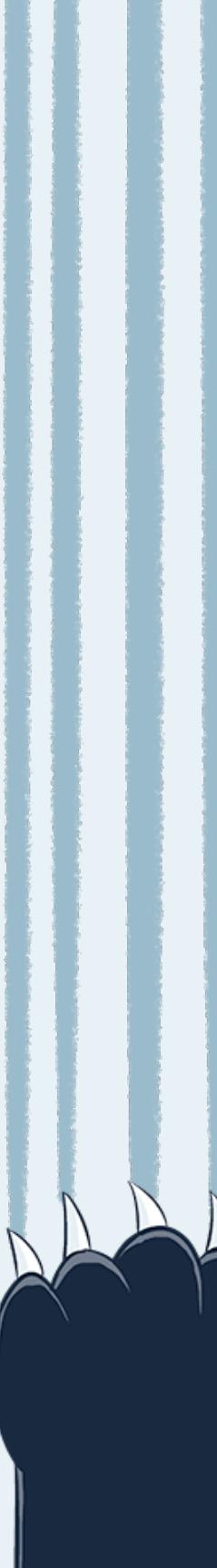


# Timing Function Values

- linear
- ease-in
- ease-out
- ease-in-out
- steps (more on this later)



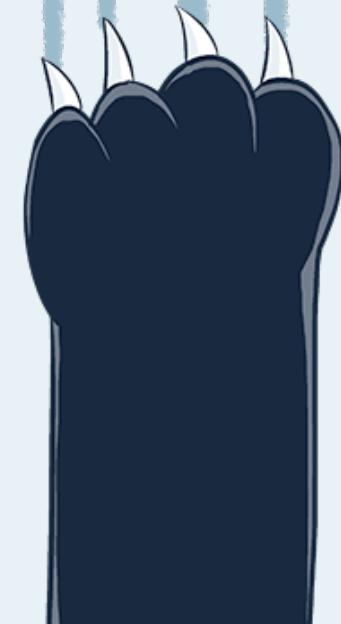
Replace “ease”  
with “slow” to better  
remember the different  
timing effects.



*What you  
really want:*

# cubic-bezier

Make your own at [cubic-bezier.com](https://cubic-bezier.com) or edit with the  
Chrome/Firefox  
Dev Tools!

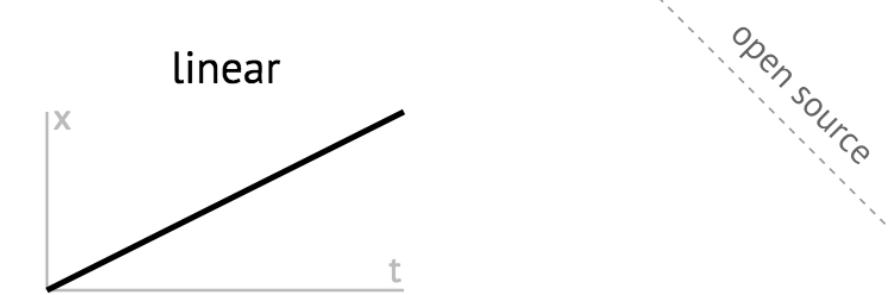


*Loading...*

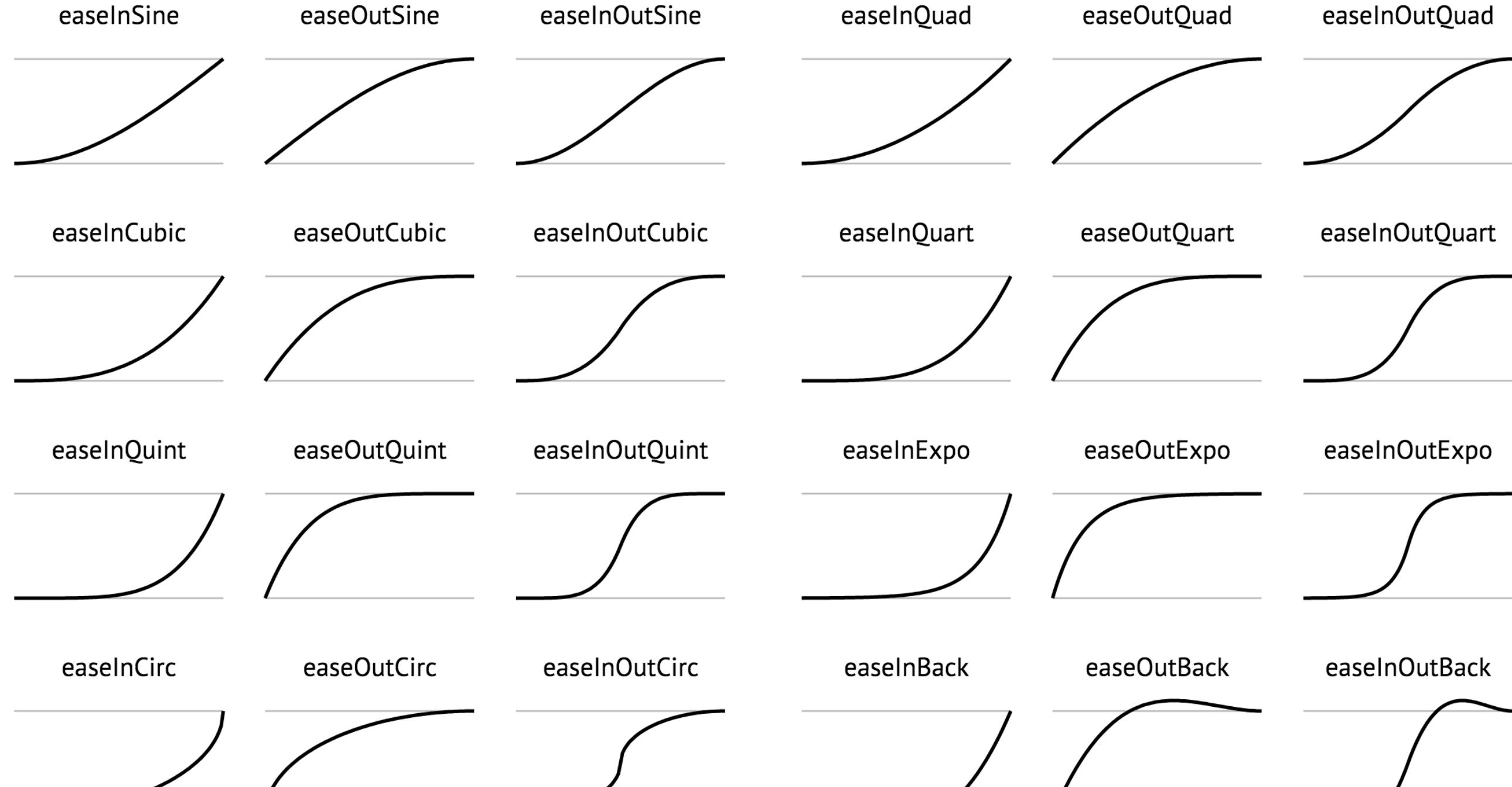
**Easing functions** specify the rate of change of a parameter over time.

Objects in real life don't just start and stop instantly, and almost never move at a constant speed. When we open a drawer, we first move it quickly, and slow it down as it comes out. Drop something on the floor, and it will first accelerate downwards, and then bounce back up after hitting the floor.

This page helps you choose the right easing function.



css+js



*exercise*

# Applying Physics to the Ball



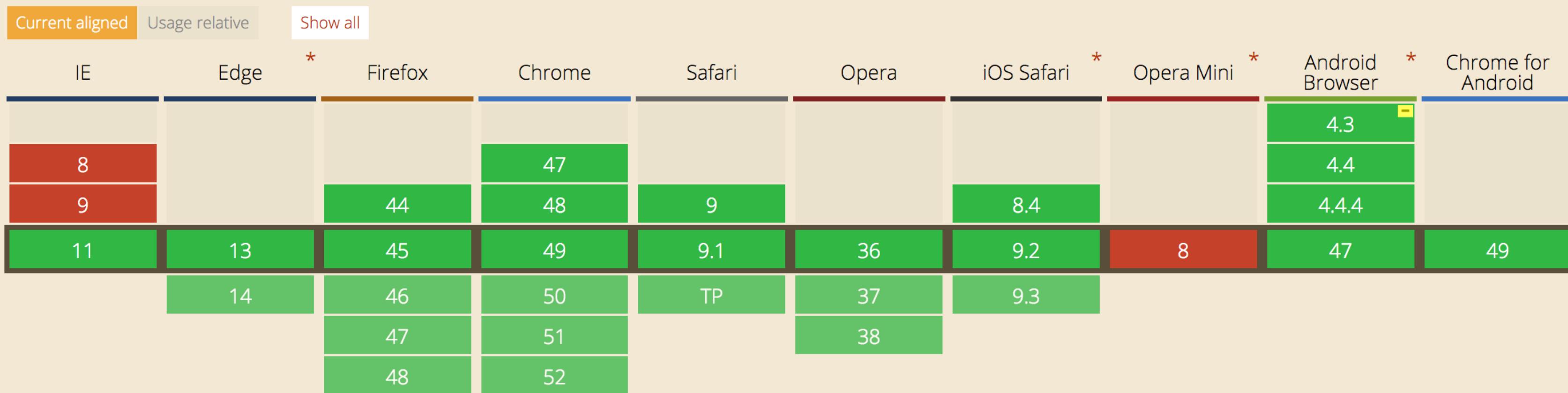
Start coding! [cdpn.io/LVEdXg](https://cdpn.io/LVEdXg)

**Experiment with different easing and durations to find the combination that feels “right” to you.**

# CSS3 Transitions WD

Simple method of animating certain properties of an element, with ability to define property, duration, delay and timing function.

Global	89.09%
unprefixed:	77.95%
U.S.A.	94.38%
unprefixed:	92.64%



Any thing but IE 9 and lower & Opera Mini  
[caniuse.com/#feat=css-transitions](http://caniuse.com/#feat=css-transitions)

# CSS Transitions rock because...

- **Single fire** If you only want something to happen once.
- **Granularity** If you would only animate one or two properties in a given state
- **Bulletproof** If transitions aren't supported, the change happens anyway.



Questions?

# CSS Animations



```
.animated-thing {  
    animation: black-to-white 1s linear 1;  
}  
  
@keyframes black-to-white {  
    0% { background: #000; }  
    100% { background: #fff; }  
}
```



↑  
number of  
times to run

```
.animated-thing {  
  animation:  
    $name  
    $duration  
    $timing-function (optional)  
    $animation-delay (optional)  
    $iteration-count (optional);  
}
```

# Long form animation properties

- **animation-name**: The name of the keyframe block you want to use.
- **animation-duration**: How long the animations takes to go from 0% to 100%
- **animation-iteration-count**: The number of times you want to go from 0% to 100%; use **infinite** to never stop. Defaults to 1.

# Long form animation properties

- **animation-timing-function**: Like **transition-timing-function**
- **animation-delay**: Like **transition-delay**

```
.animated-thing {
```

```
  animation:
```

```
    $name
```

```
    $duration
```

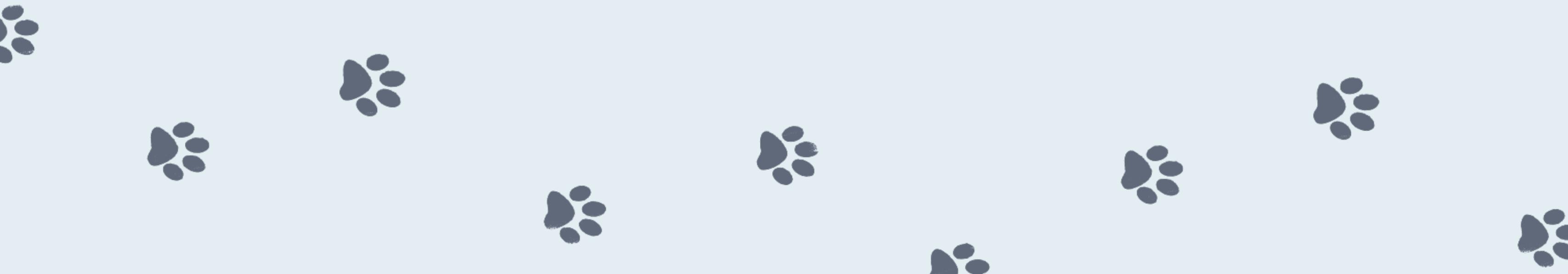
```
    $direction
```

```
    $fill-mode
```

```
    $play-state;
```

```
}
```

# The @keyframes block



```
@keyframes black-to-white {
```

```
0% {
```

```
background: #000;
```

```
color: #fff;
```

```
}
```

```
100% {
```

```
background: #fff;
```

```
color: #000;
```

```
}
```

```
}
```

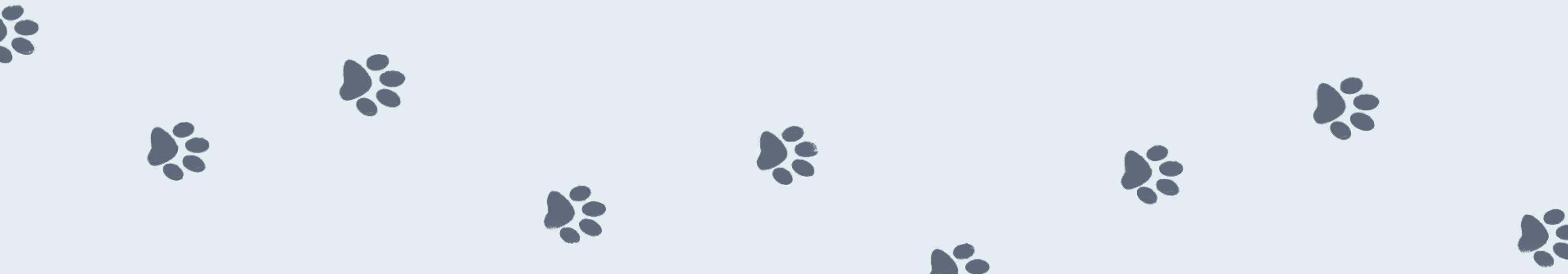
```
@keyframes black-to-white {  
  from {  
    background: #000;  
    color: #fff;  
  }  
  to {  
    background: #fff;  
    color: #000;  
  }  
}
```

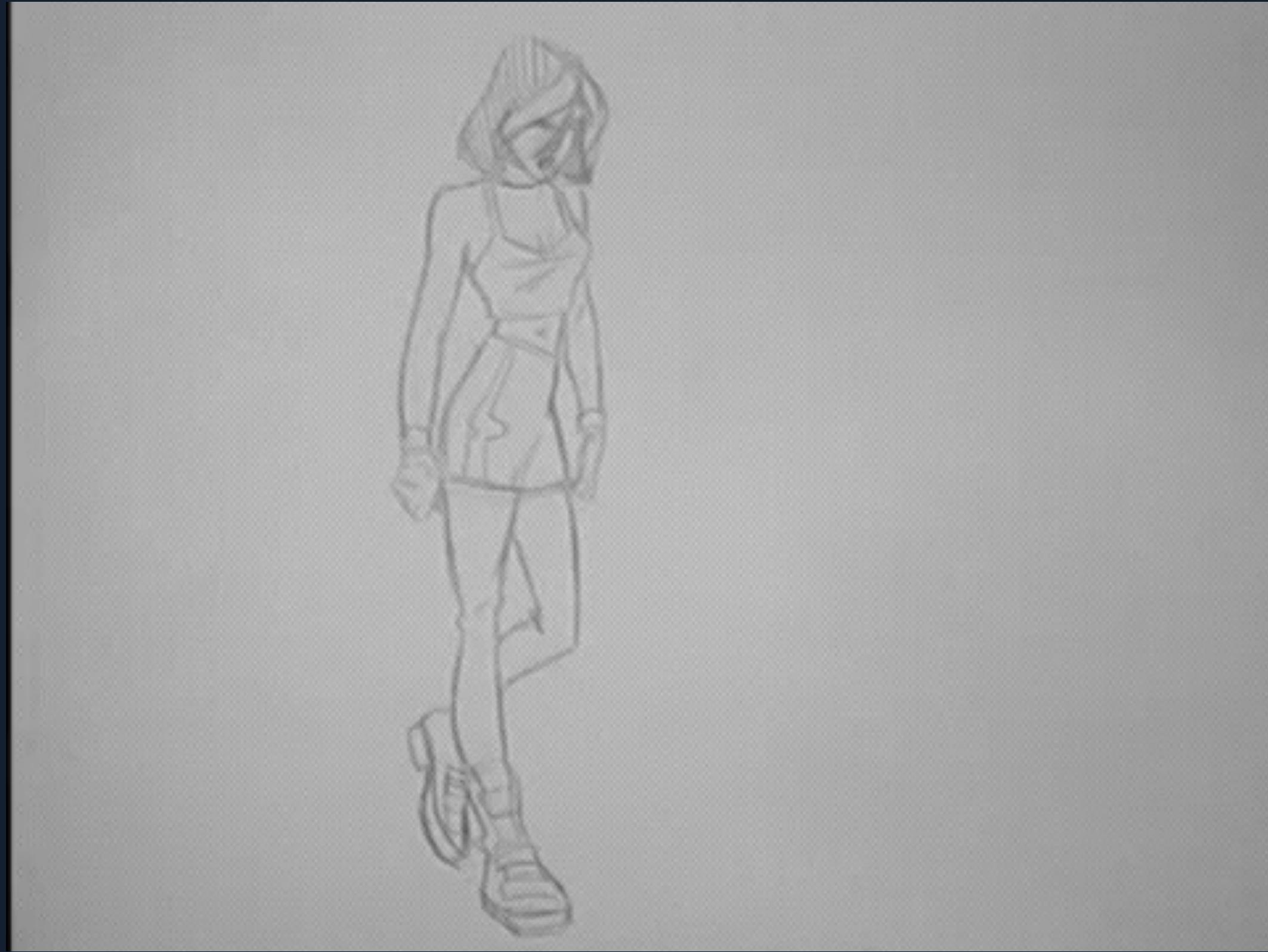
```
@keyframes black-to-red {  
    0% { color: #000; }  
    50% { color: red; }  
    100% { color: #000; }  
}
```

```
@keyframes black-to-red {  
    0%, 100% { color: #000; }  
    50% { color: red; }  
}
```

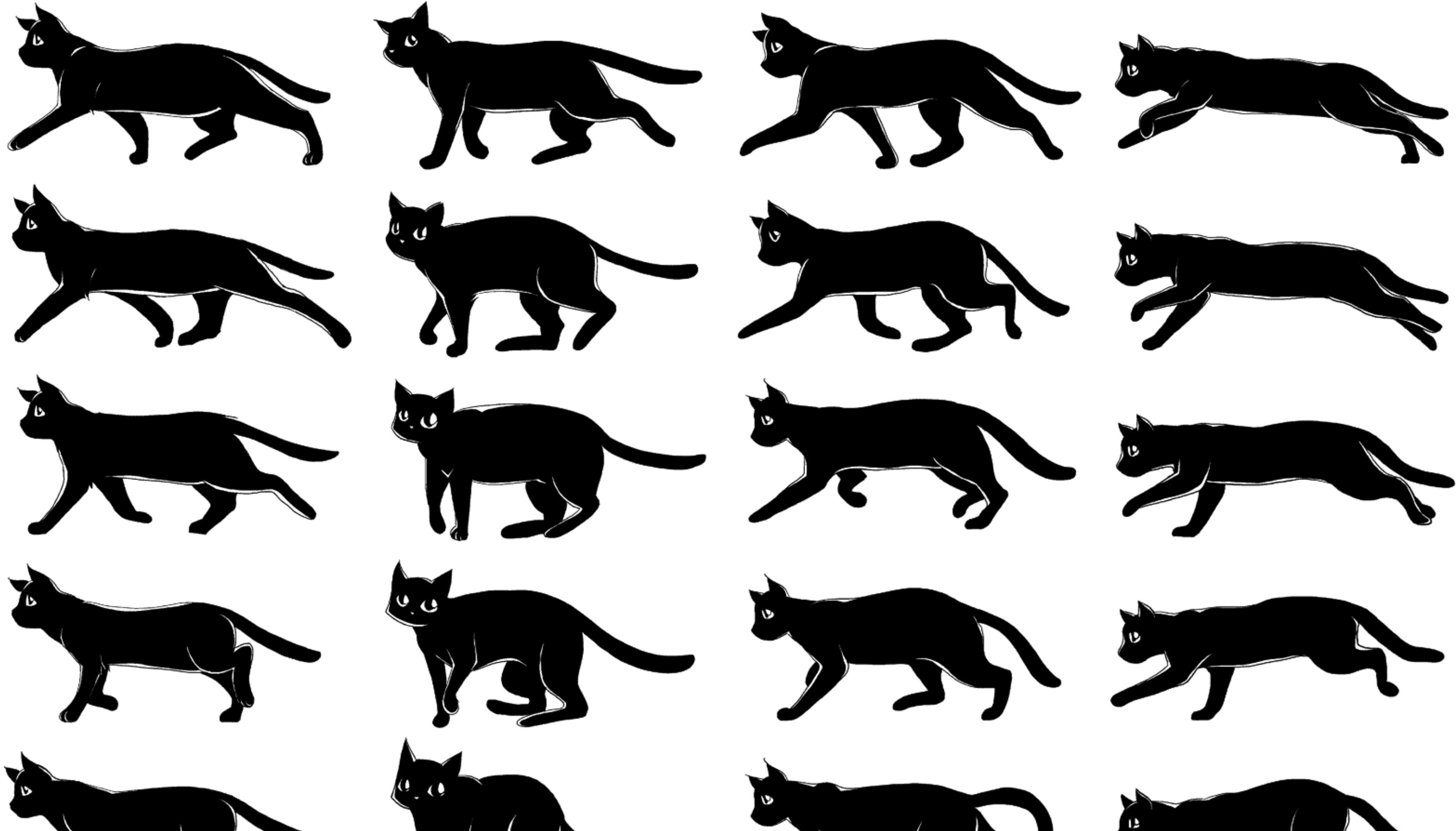
```
.animated-thing {  
  animation:  
    black-to-white 1s linear 1,  
    black-to-red 2s ease-out infinite 2s;  
}
```

# Sprite animation with CSS





*used with the permission of Steven E. Gordon*





# Meet steps()

- **steps(x)** is a timing function...
- ...splits a block of keyframes into **x** equal steps, then hops between them.
- The [documentation](#) by Tab Atkins
- How it works, plus gotchas: [cdpn.io/zeFqy](https://cdpn.io/zeFqy)

*exercise*

# Making a Walk-Cycle



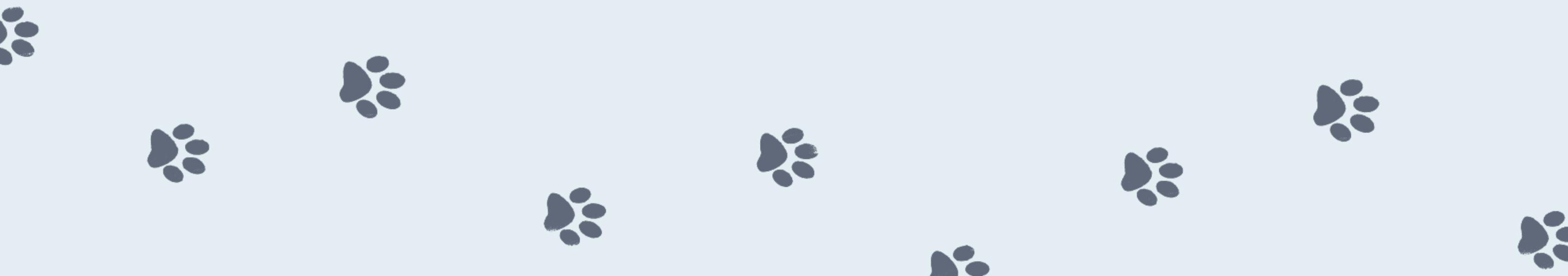
Start coding! [cdpn.io/cdqga](https://cdpn.io/cdqga)

The sprite: [stash.rachelnabors.com/animation-workshop/  
sprite\\_catwalk.png](http://stash.rachelnabors.com/animation-workshop/sprite_catwalk.png)



I

# Advanced Animation Properties



```
.animated-thing {
```

```
  animation:
```

```
    $name
```

```
    $duration
```

```
    $fill-mode
```

```
}
```

# Long form advanced animation properties

- **animation-fill-mode**: can be **backwards** (the element displays 0% values before the animation starts). Can be set to **forwards** (retains 100% values after animation finishes), **both**, or **none** (default).

*demo*

# Forwards and Backwards



Demo time! [cdpn.io/wMvKQv](https://cdpn.io/wMvKQv)

**See how forwards and backwards change the starting and ending persistence of an animation.**

```
.animated-thing {
```

```
  animation:
```

```
    $name
```

```
    $duration
```

```
    $fill-mode
```

```
    $play-state
```

```
    $direction;
```

```
}
```

# Long form advanced animation properties

- **animation-play-state**: defaults to **running** but can be set to **paused**.
- **animation-direction**: defaults to **normal** but can be set to **alternate**, **reverse**, **alternate-reverse**

*exercise*

# Wag the Cat



Start coding! [cdpn.io/AfDBF](https://cdpn.io/AfDBF)

**Play with Tuna's tail! Change the default advanced CSS animation properties.**

# CSS Animation - WD

Complex method of animating certain properties of an element

Global

89.05% + 0.02% = 89.07%

unprefixed:

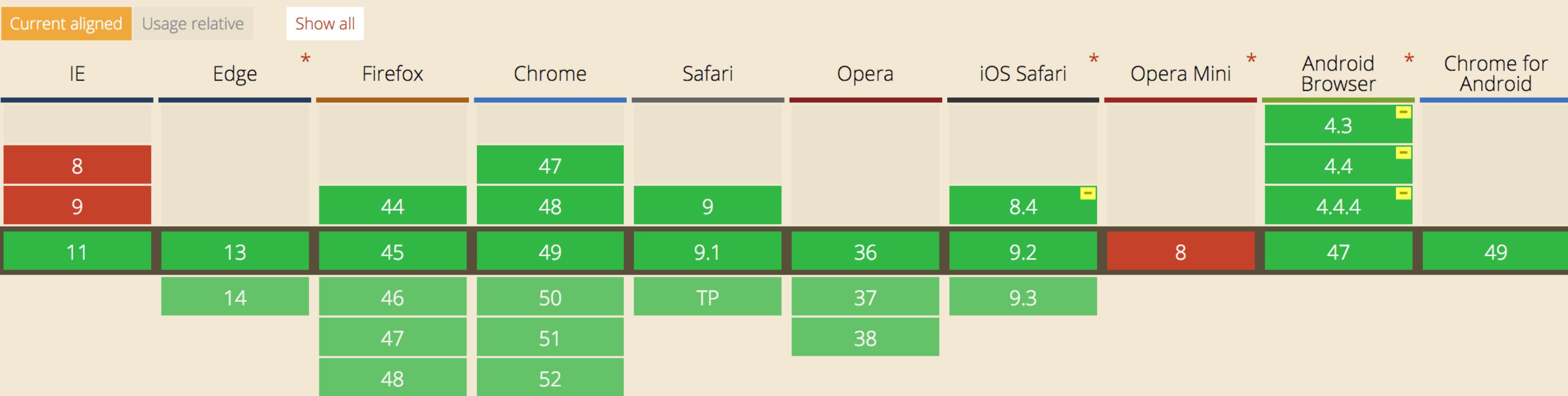
71.81%

U.S.A.

94.36% + 0.01% = 94.37%

unprefixed:

85.32%



Not available on IE 9 and lower & Opera Mini.

Safari and Android could still use **-webkit-** at this time.

Consult [caniuse.com/#feat=css-animation](http://caniuse.com/#feat=css-animation)

# CSS Animations rock because...

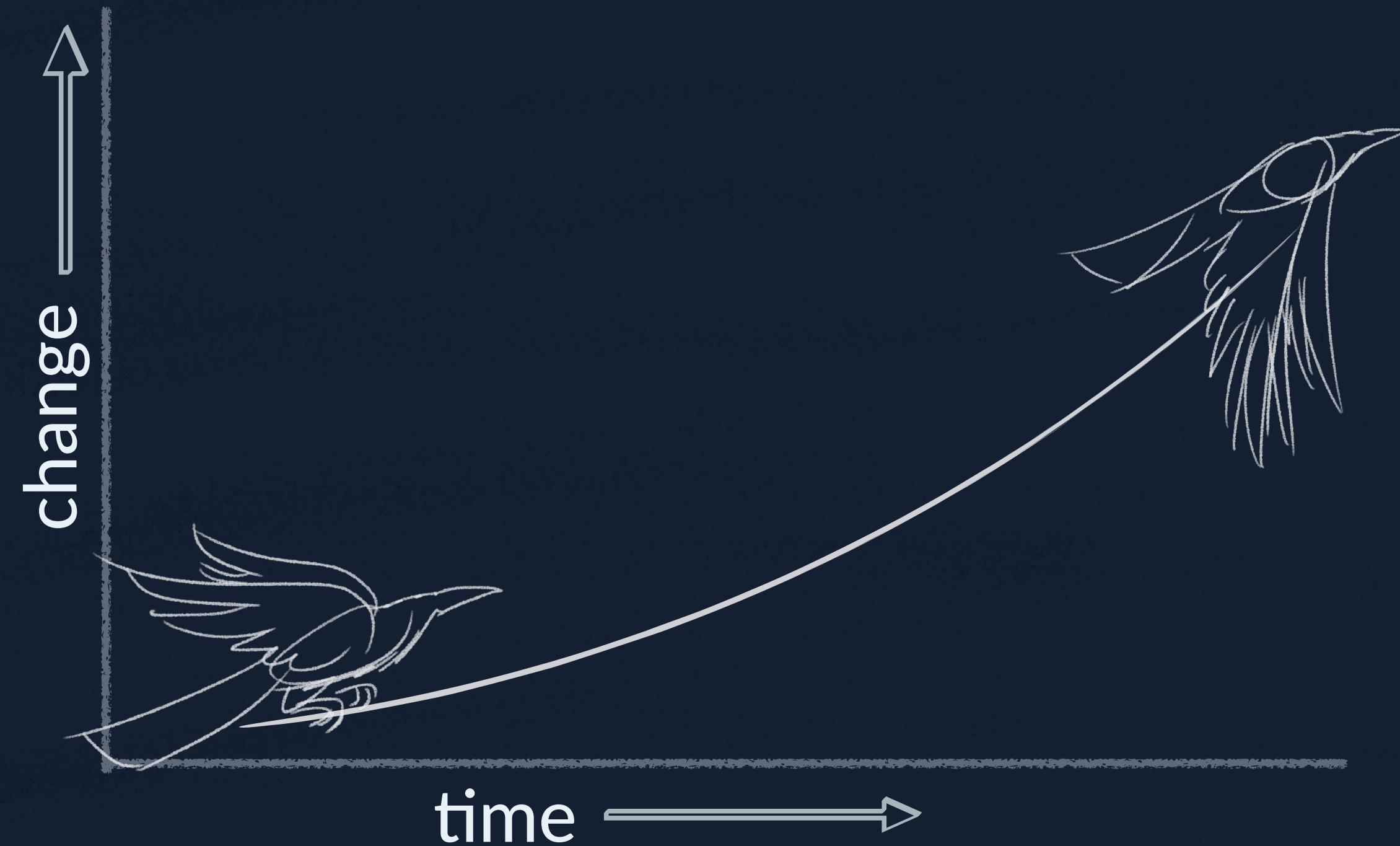
- **Looping** Can loop infinitely
- **Self starting** Doesn't require trigger like **transition**
- **Repeating** You can set how many time it repeats
- **Alternating** Can alternate between the end state and start state
- **Grouping** Each animation can change a number of properties



Questions?

# Animation in Design









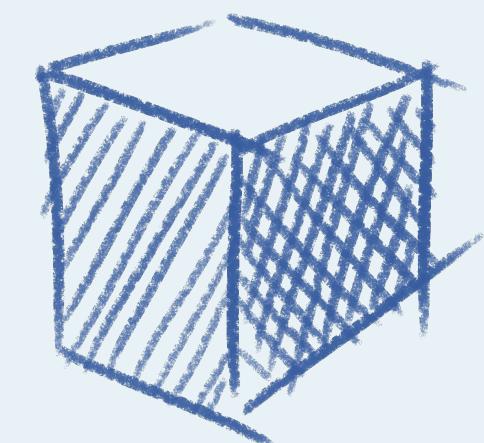


# You use animation to indicate an element's...

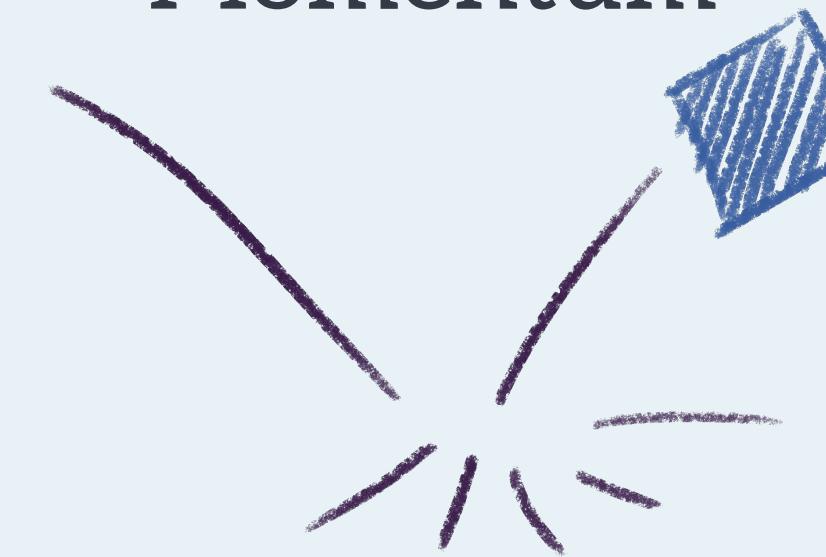
Direction



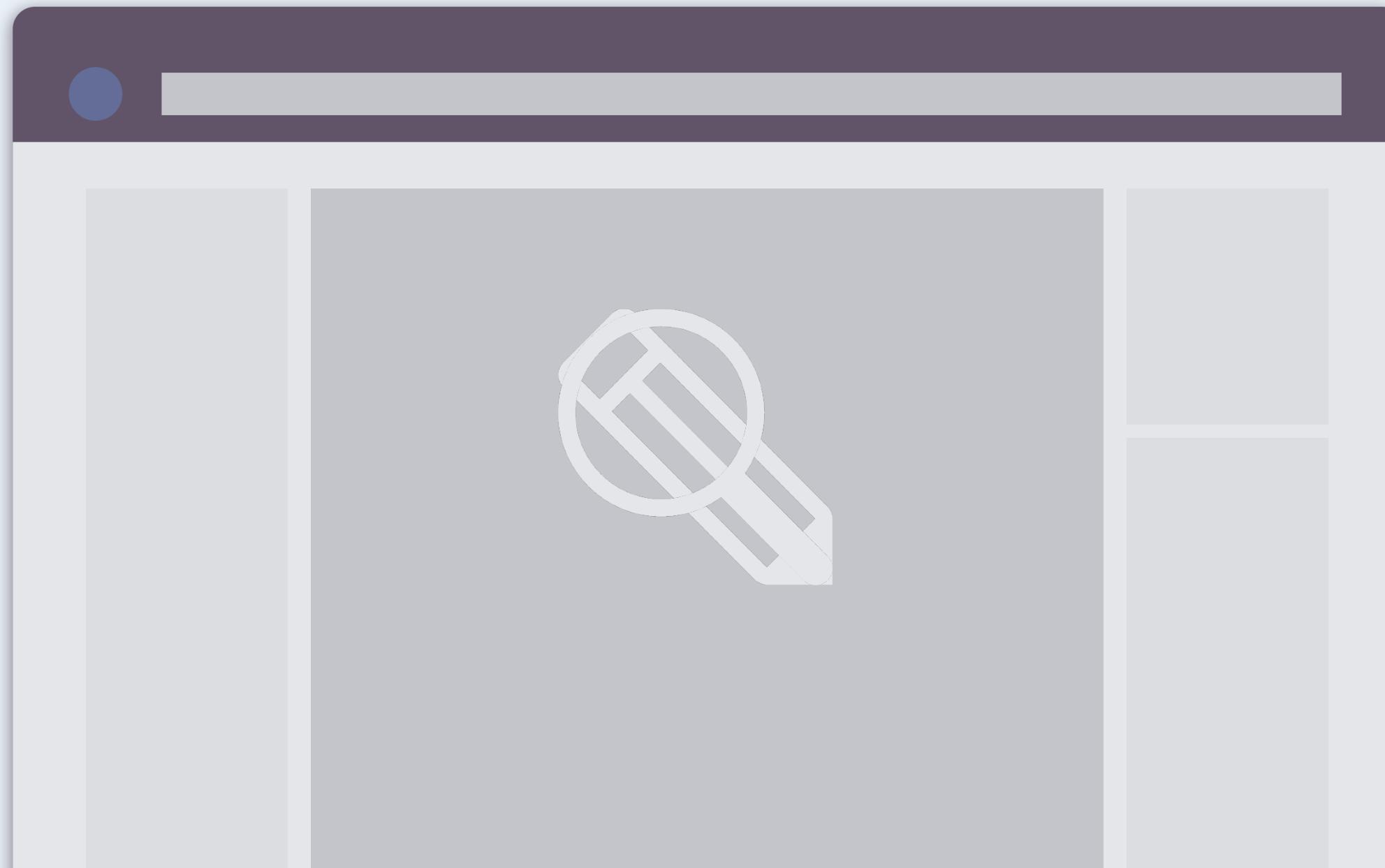
Solidity



Momentum



# Stateful Transitions



R  
Rachel Nabors



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The Black Brick Road to Oz #47

X M i X t . C o m



[RachelNabors.com](http://RachelNabors.com)

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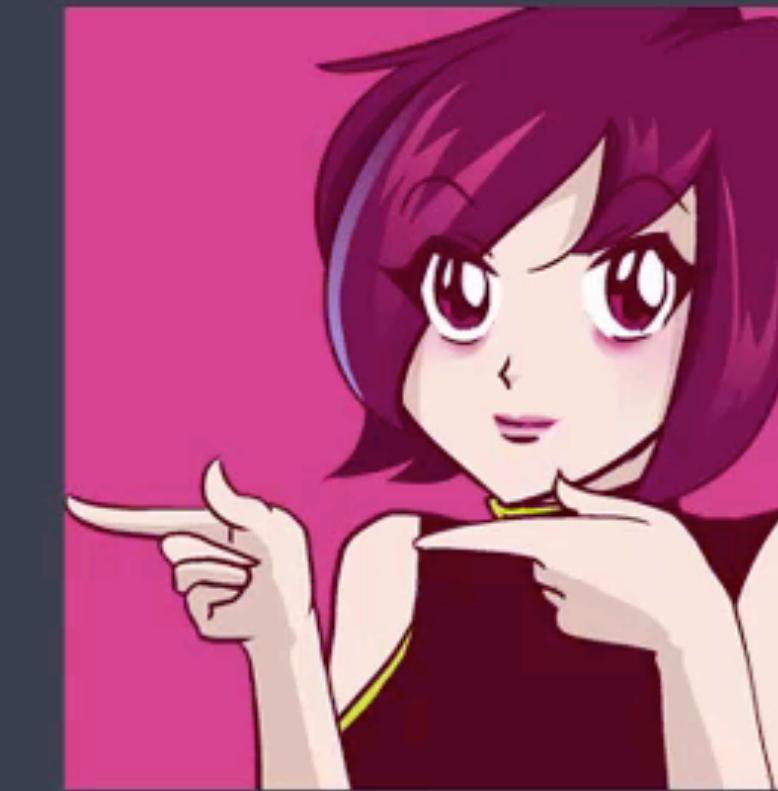
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Animation Essentials: CSS  
Animations and Transitions

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Still Loading...

[Q](#)

Rachel Nabors (Sign Out)

Wishlist (0)

Cart (0)

[SHOP ▾](#)[COMMUNITY ▾](#)[OUR STORY ▾](#)[STORES](#)[FLUEBLOG](#)[Home > Shop > Women's > Bekkie \(Black\)](#)< Previous > Next< Back to Shop[Q Take a Closer Look](#)

#### DESCRIPTION

Sun-soaked sidewalks are considered difficult terrain for the dark, brooding boots of the wintery rock and roll, which is why John set out to create a style to encourage the ladies of music to step out of the cool, dimly lit basement venues and into the



TRUTHS

# BEKKIE

Women's (US)

\$365<sub>USD</sub>

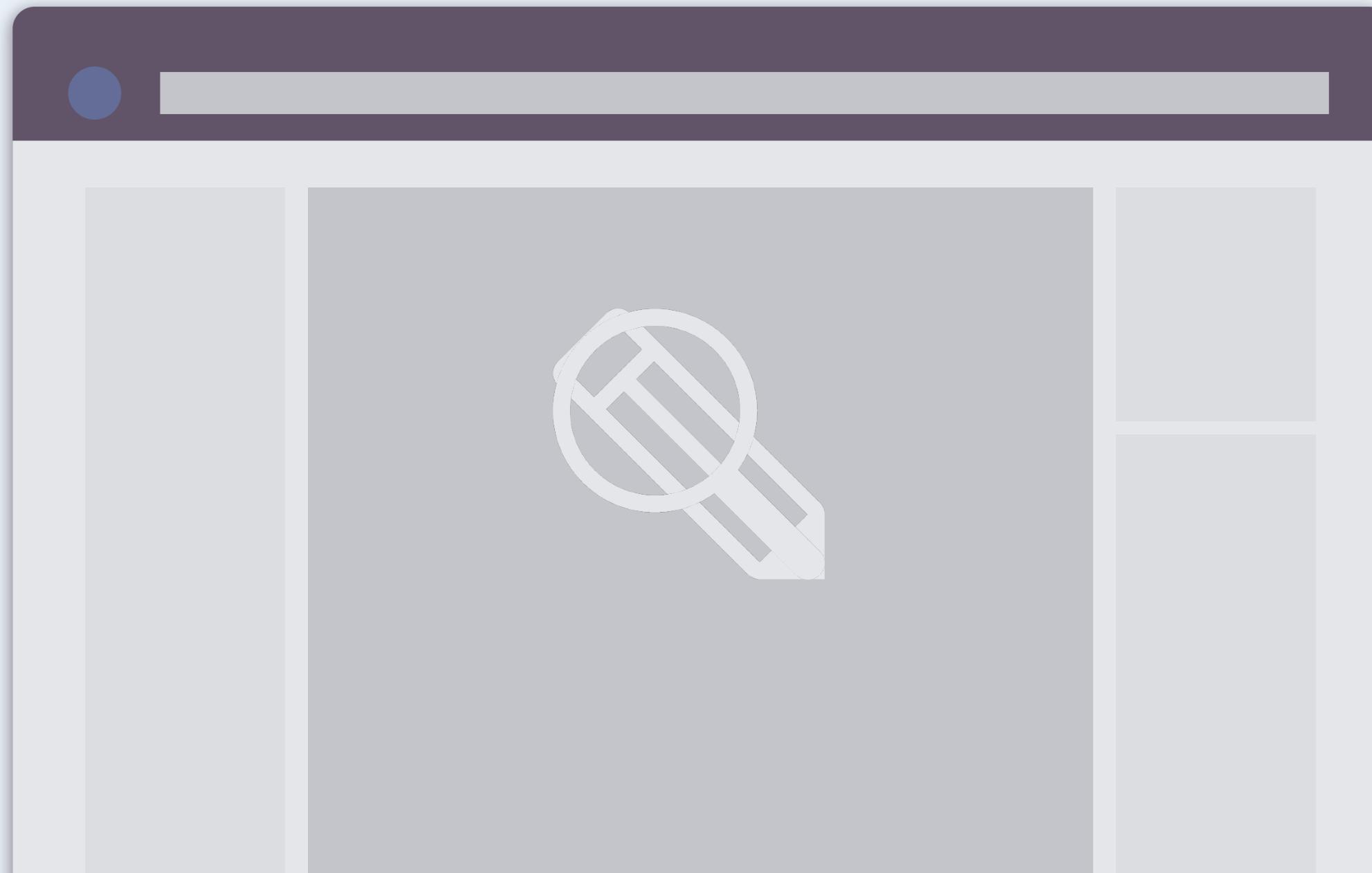
12

Hurry! Only 1 left!

[ADD TO CART](#)[+ Add to Wishlist](#)

Share This

# Stateful Transitions are useful for indicating...

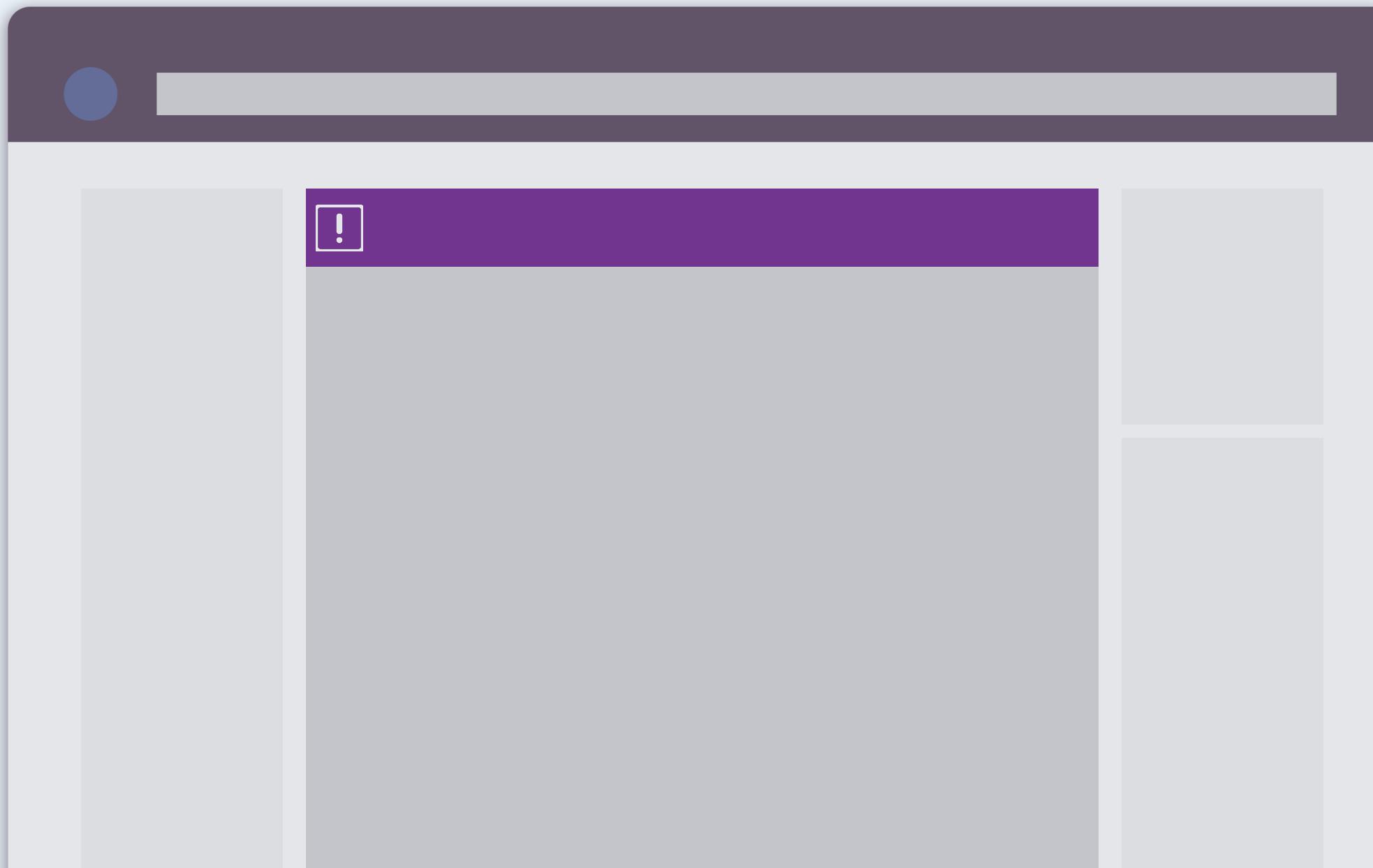


# Stateful Transitions are useful for indicating...

- Change in task flow location
- Where you've been
- Where you are now



# Supplemental Animations





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[Français](#)

[24 Ways](#)

[The State of the Animation 2014](#)

[Smashing Mag](#)

[Giving Them the Crank](#)

[The Pastry Box Project](#)

[Web Animation at Work](#)

[A List Apart](#)

[Alice in Videoland: Designing an interactive](#)

[HTML5 storybook](#)

[Adobe Inspire](#)

[New Pastures for Old Developers](#)

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GOOD Magazine | Cities

Rachel

magazine.good.is/cities

MAGAZINE COMMUNITY

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VALUES MATTER EXPAND FOR MORE

## CITIES



### This Apartment Building Is A Micro-City For An Entire Alaskan Town

Whittier, Alaska's 14-story Begich Towers has its own post office.

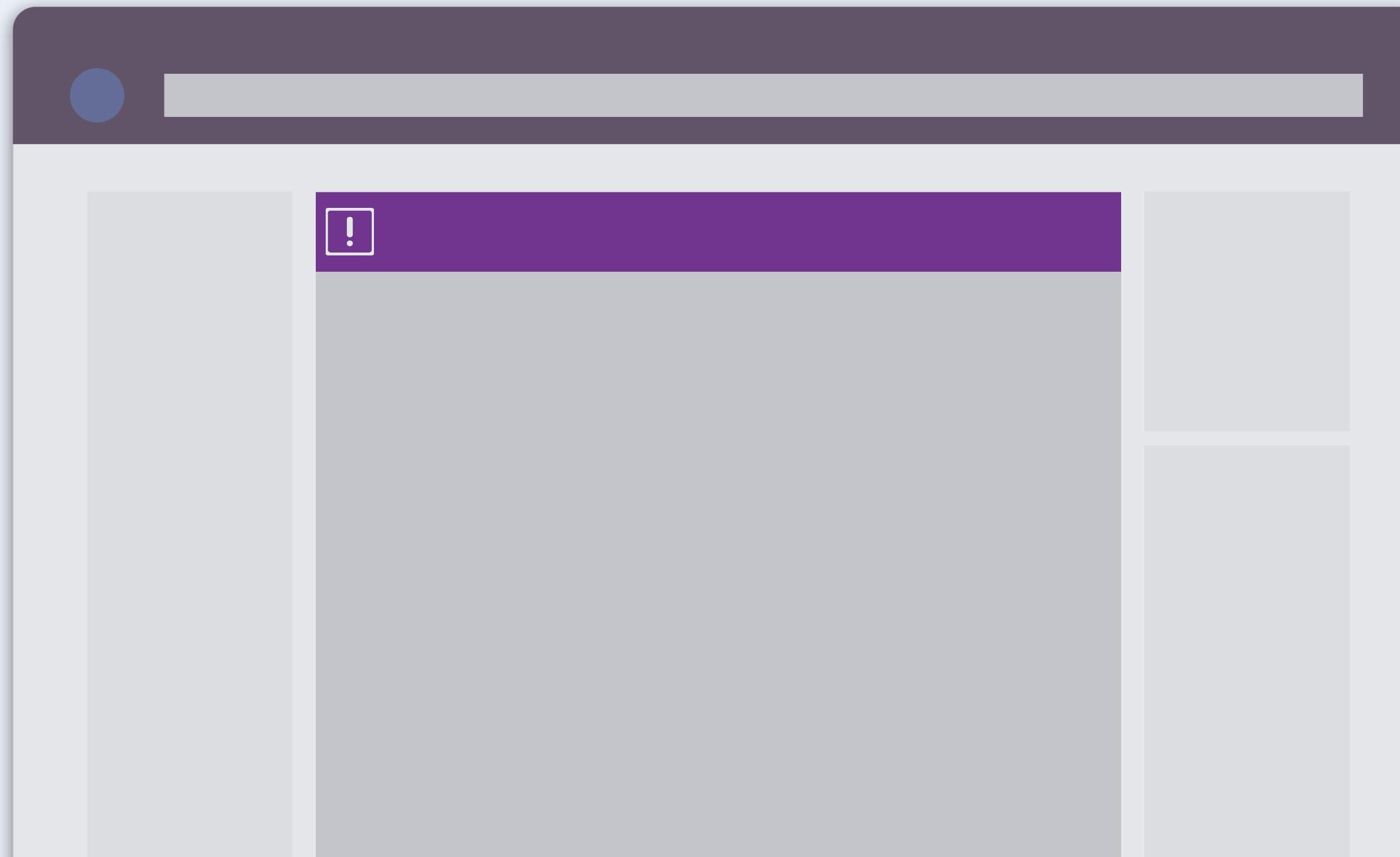


### Why Can't We Party in the Street?

It's getting more and more difficult for Americans to gather on public streets, out of joy or anger, and that's a problem. by

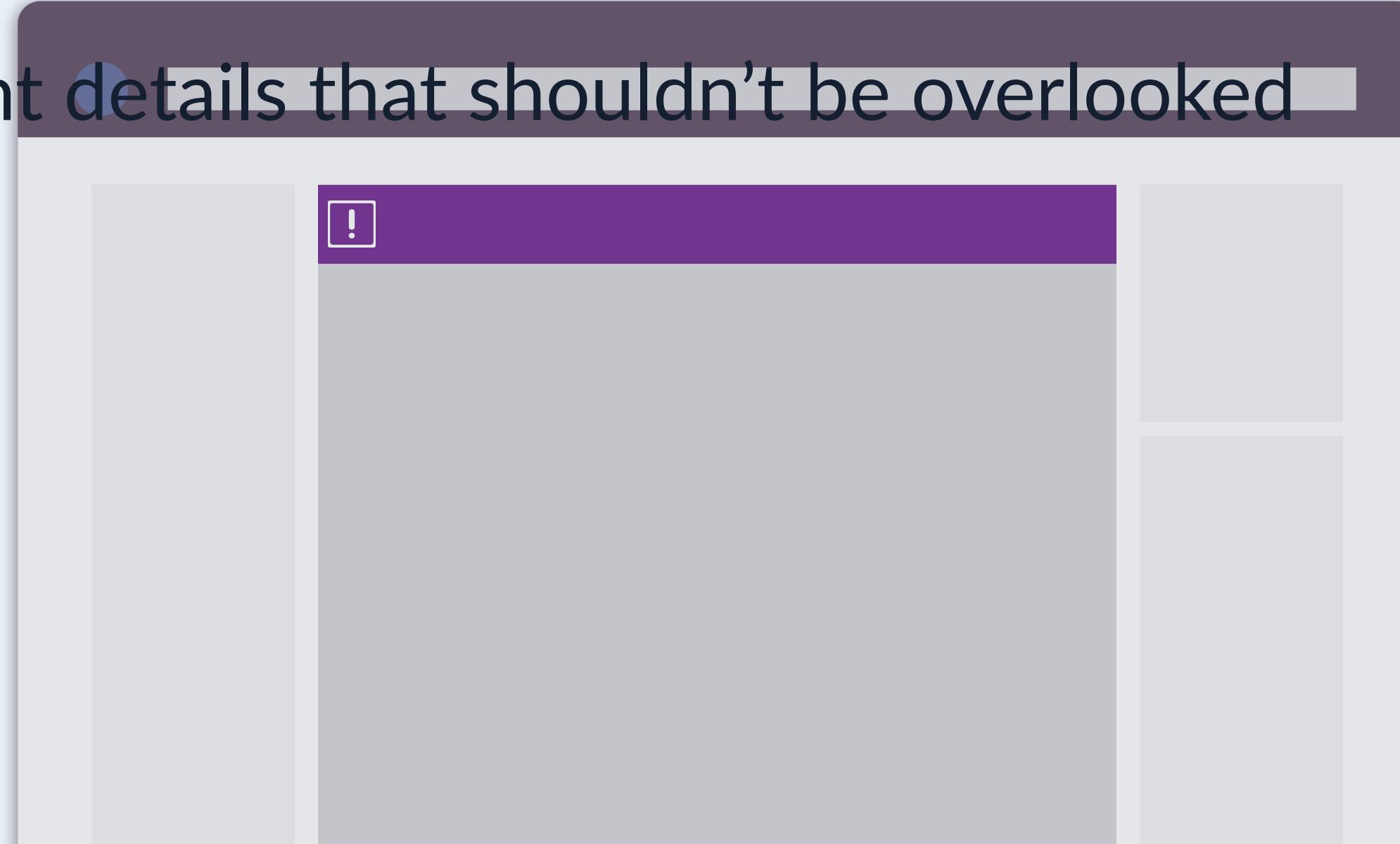
Window size: 1440 x 900  
Viewport size: 1440 x 828

# Supplemental Animations are useful for indicating...

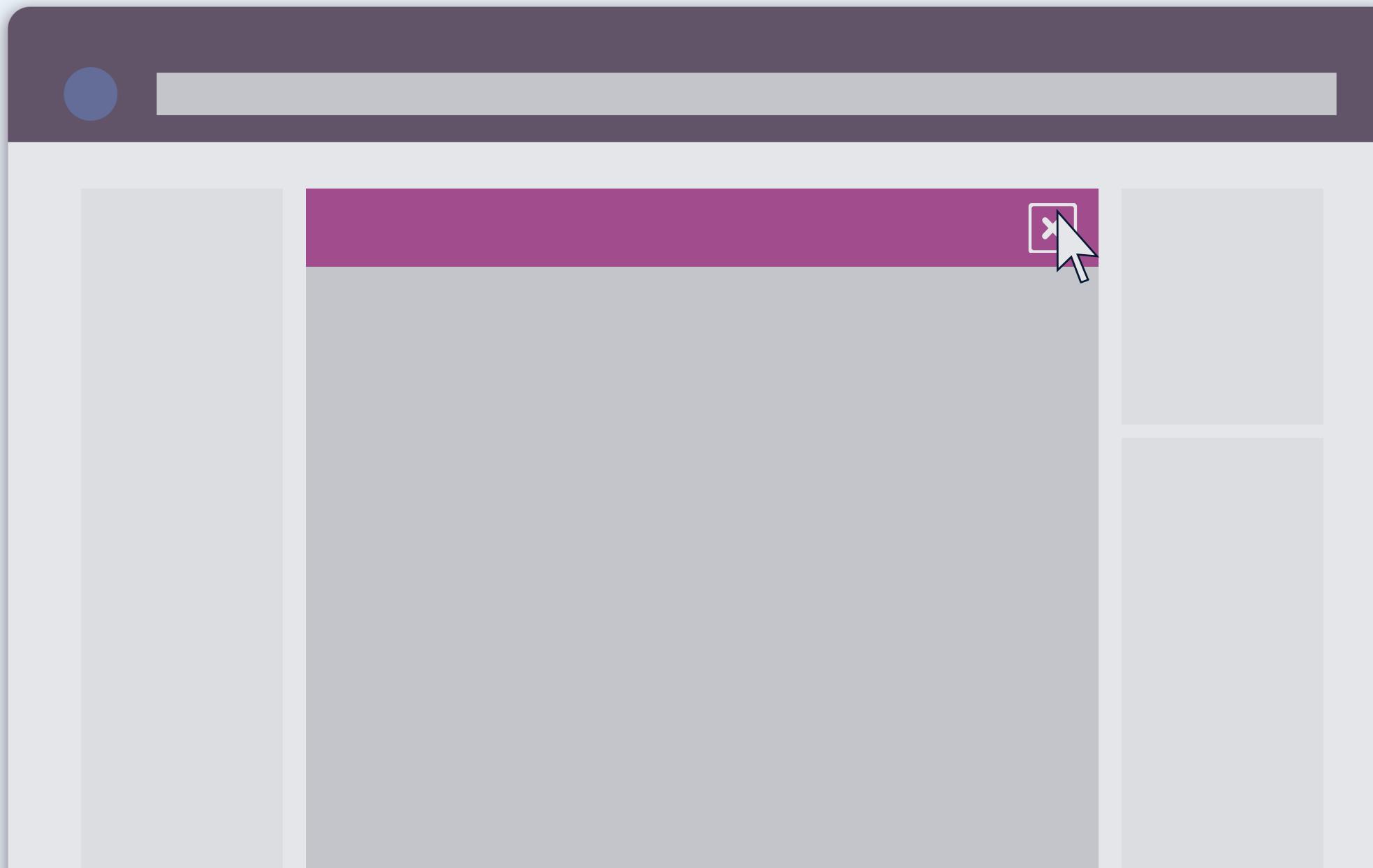


# Supplemental Animations are useful for indicating...

- Change in information
- What is possible for users
- Important  details that shouldn't be overlooked



# Causal Effects





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## ANIMATION PROJECTS



The Black Brick Road to Oz #47



Alice in Videoland

XnixHut

## COMMENTS

8 Comments

Rachel Nabors

Rachel Nabors ▾

Recommend

Share

Sort by Best ▾



Join the discussion...



**Michael Schofield** · a month ago

I think it is really helpful to think of accessibility as part of the measurable user experience, rather than as something apart. Peter Morville's Facets of the User Experience\*, presented as a honeycomb, shows that the accessibility of a service or design plays just as important a role in determining the holistic value of the UX as the aesthetic.

Accessibility can also be visualized as part of the Kano model, which among other things shows that products/designs have a basic feature-set that isn't going to win the designer kudos for incorporating, but their lack has a real negative impact on the UX. It's like, a Word Processor would be a terrible Word Processor if you couldn't save. In the same way, if folks think of accessibility as a basic feature of whatever they're working on, then failing to make XYZ accessible prematurely caps the overall potential

## DO YOU LOVE WEB ANIMATION AND DIGITAL STORYTELLING?

Sign up for my mailing list and get updates when I post new projects, blogs, workshops, and shennigans.

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[◀ Physics and Web Animation](#)

[The Hating Game ▶](#)

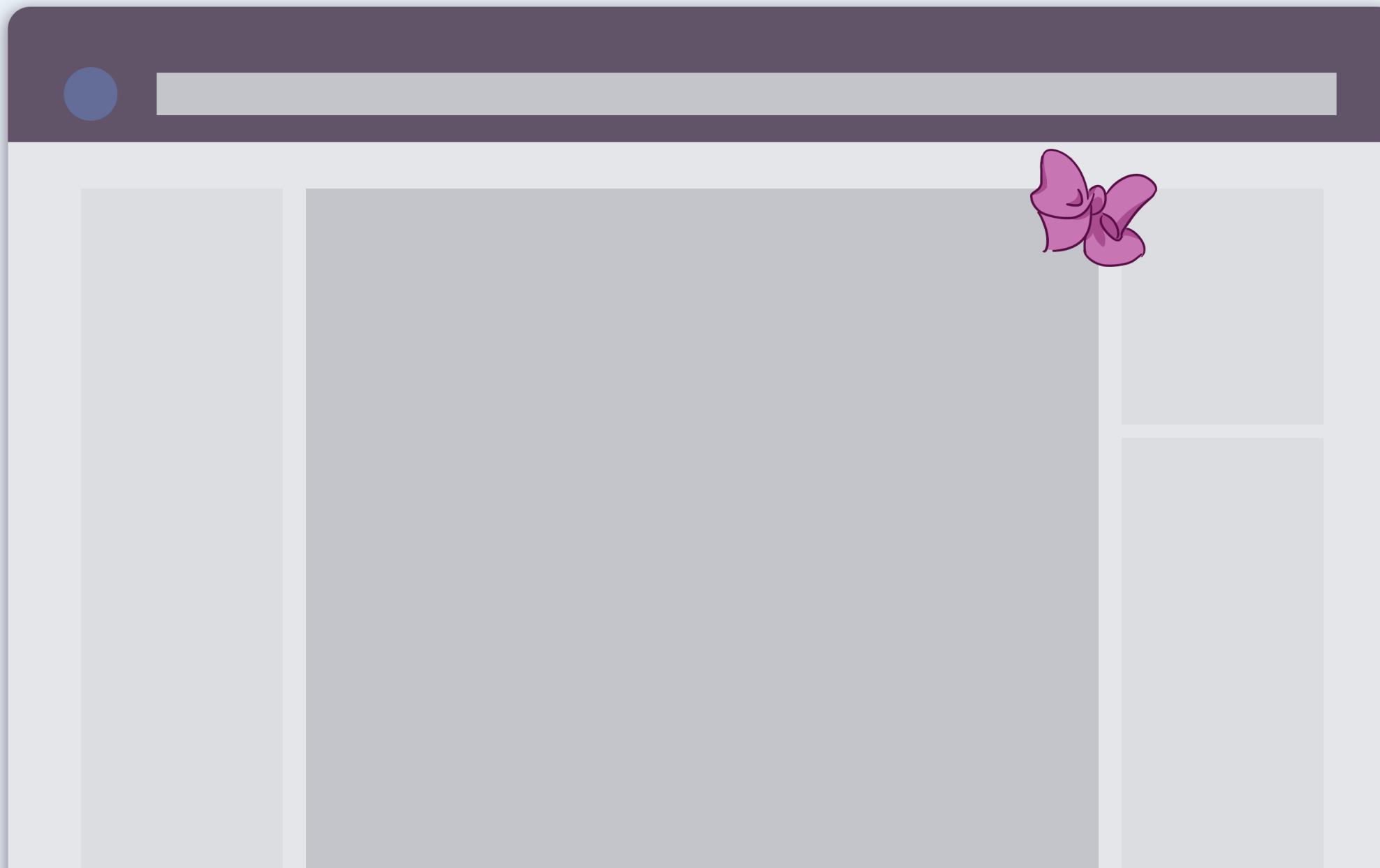
[rachelnabors.com](http://rachelnabors.com)



[cdpn.io/xGNYjV](https://cdpn.io/xGNYjV)



# Decorative Animations





## ONLINE WORKSHOPS

Apr 2 – UIE

Improve UX with Animation

Jun 30 – Smashing Online  
Animation Essentials: CSS  
Animations and Transitions

Open Enrollment – Learn  
with Rachel Nabors

Practical Cartooning for  
Technical Folk

## ♥ ANIMATION PROJECTS



The Black Brick Road to Oz #47



mix  
mix  
mix  
mix  
mix

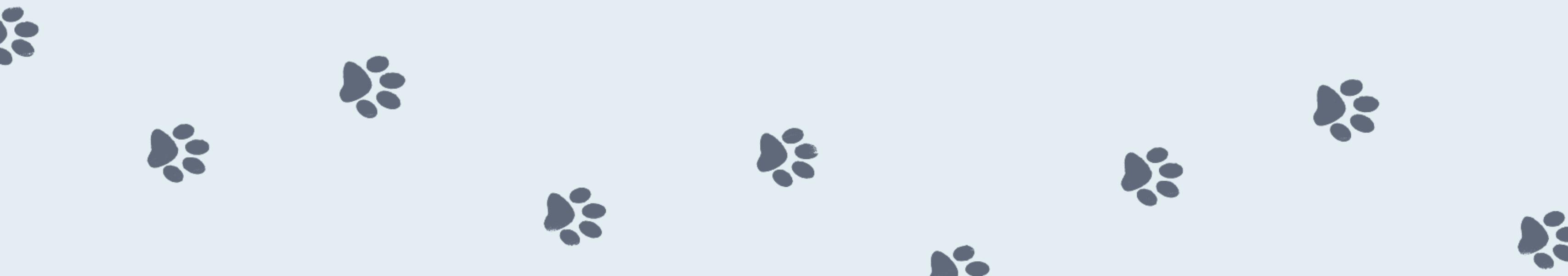
Before getting into front-end development, I was making [award-winning comics for teenage girls](#). Now I travel the world, [speaking](#) about web animation and [giving workshops](#). My articles on the topic have been published on [Smashing Mag](#), [A List Apart](#), and [24 Ways](#) ([twice!](#)). When not biking around my new home city of Portland, Oregon, USA, I make interactive comics at my company [Tin Magpie](#) where I advocate on behalf of the creative community for a more interactive web.

I also run a newsletter called [Web Animation Weekly](#), and I'm always soliciting [submissions!](#)



*[polygon.com/a/xbox-one-review](https://polygon.com/a/xbox-one-review)*

# Connecting the Dots

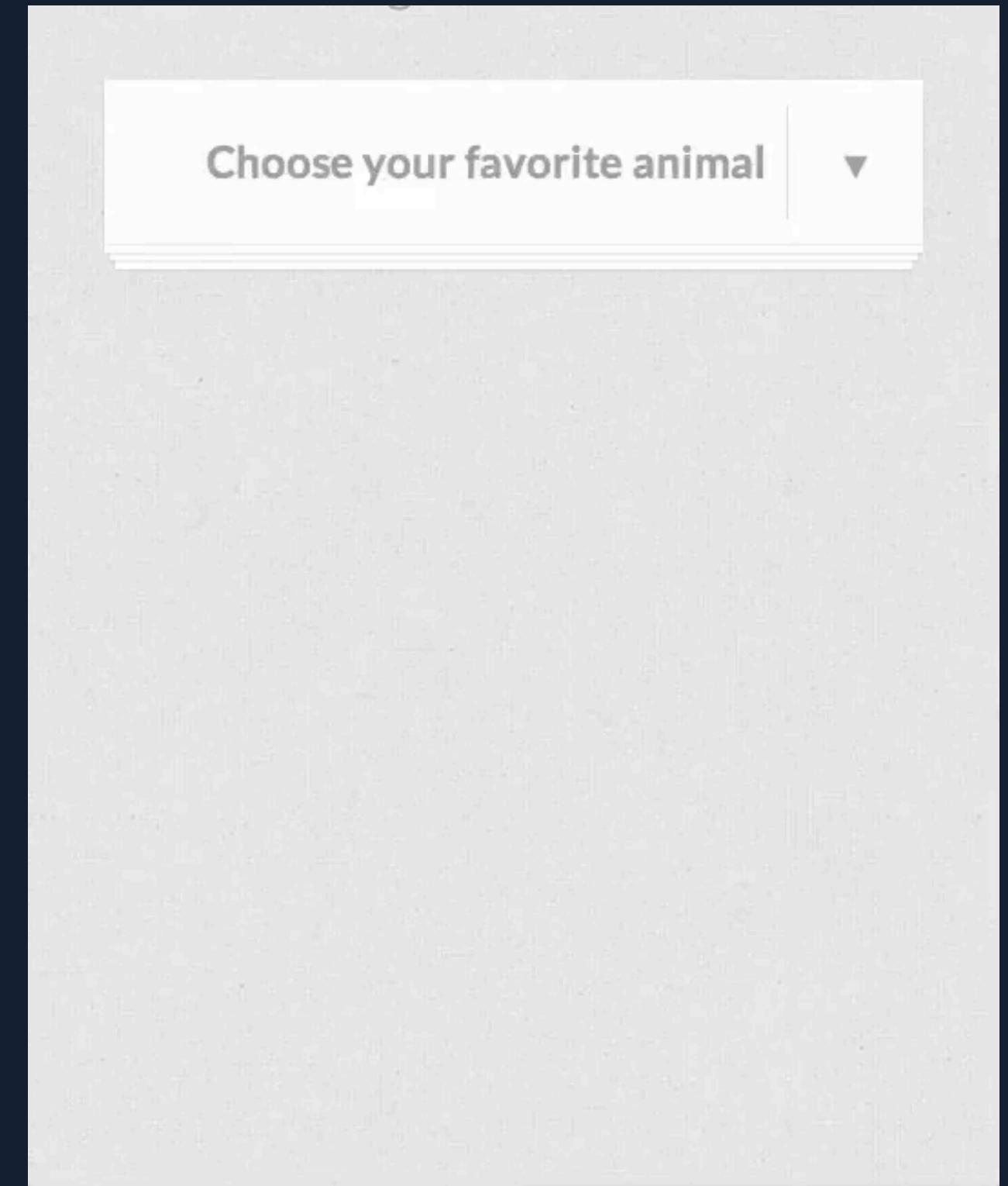


# *Jump Cut*

From film, when the camera cuts directly to a different perspective.



*Inner Sanctum, 1948*



*UI credit: codrops.com*

Choose your favorite animal



Choose your favorite animal



Monkey



Bear



Squirrel



Elephant

## Choose your favorite animal



Sloth



Whale



Panda



Tiger



squirrel



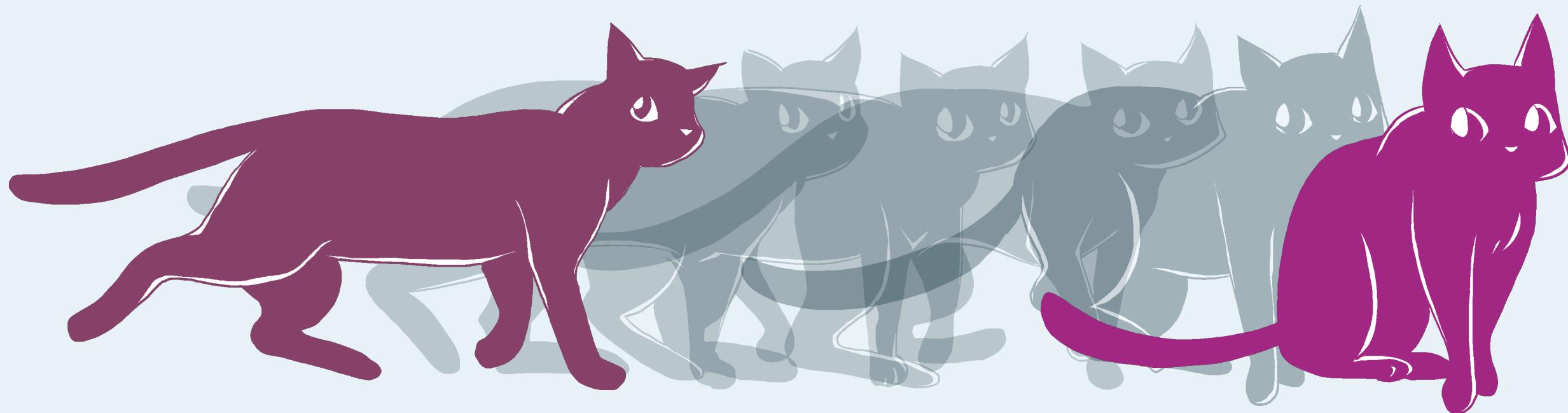
Elephant



Elephant

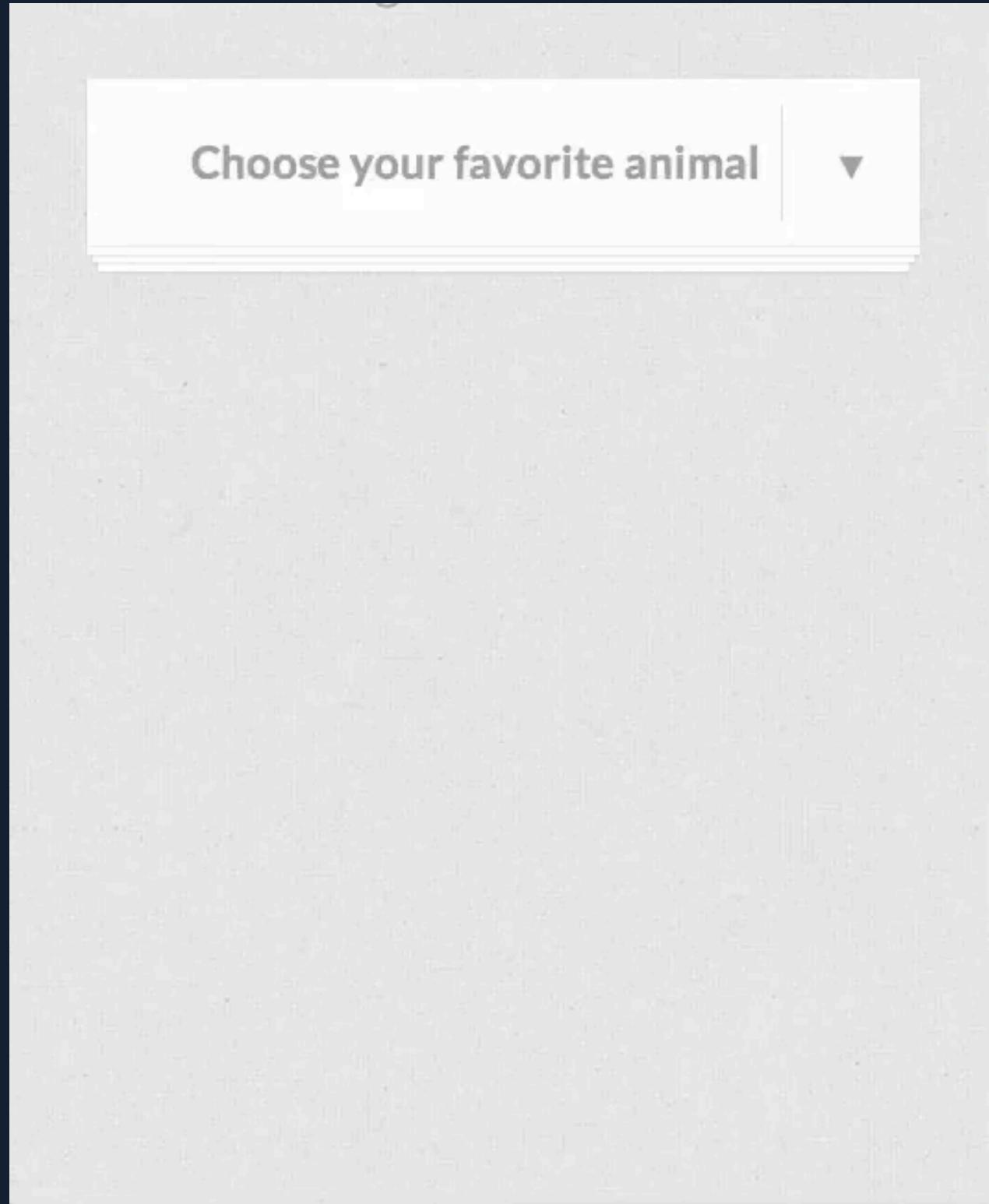
# *In-Betweening*

From animation, drawing all the poses “in between” two important poses.





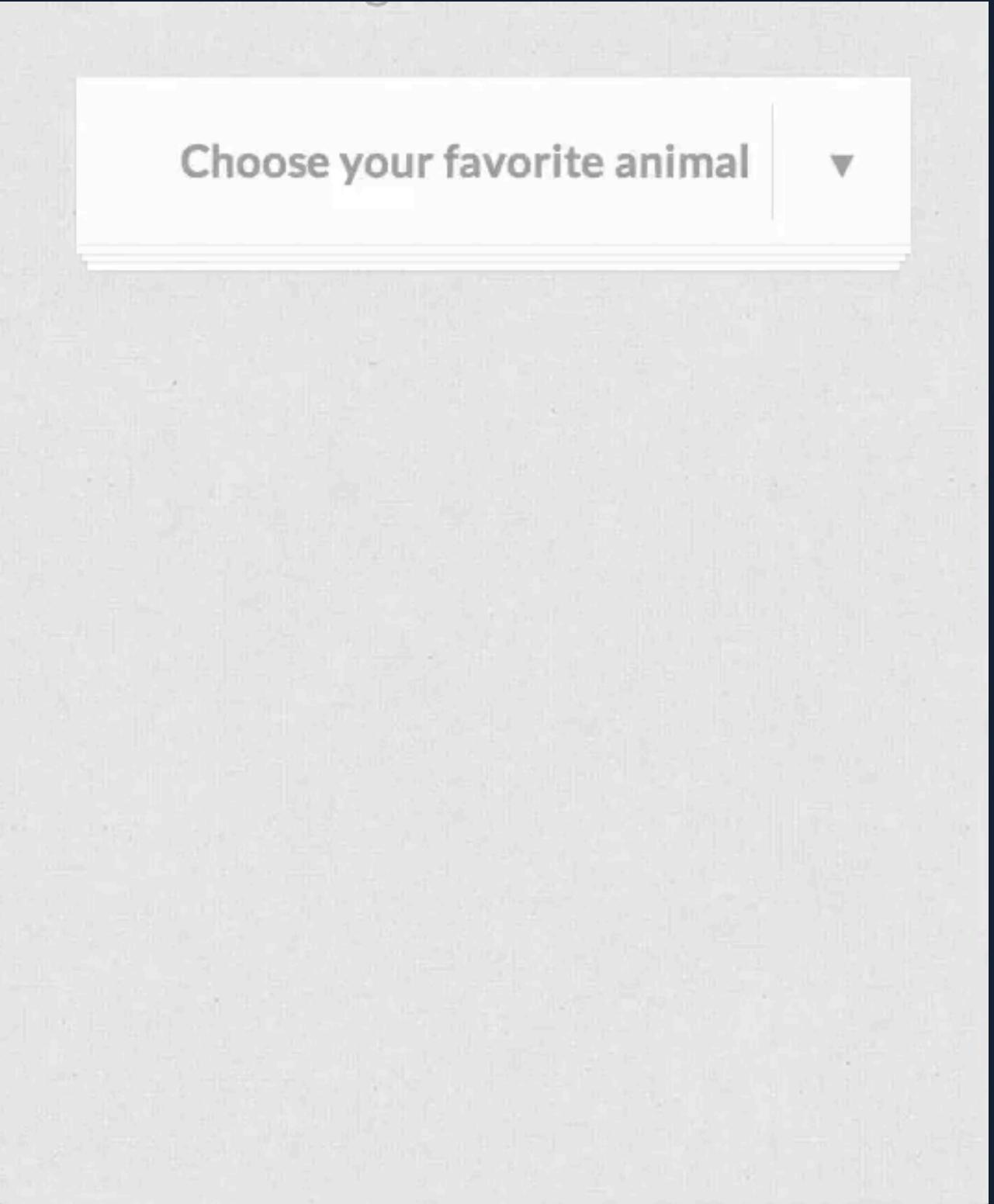
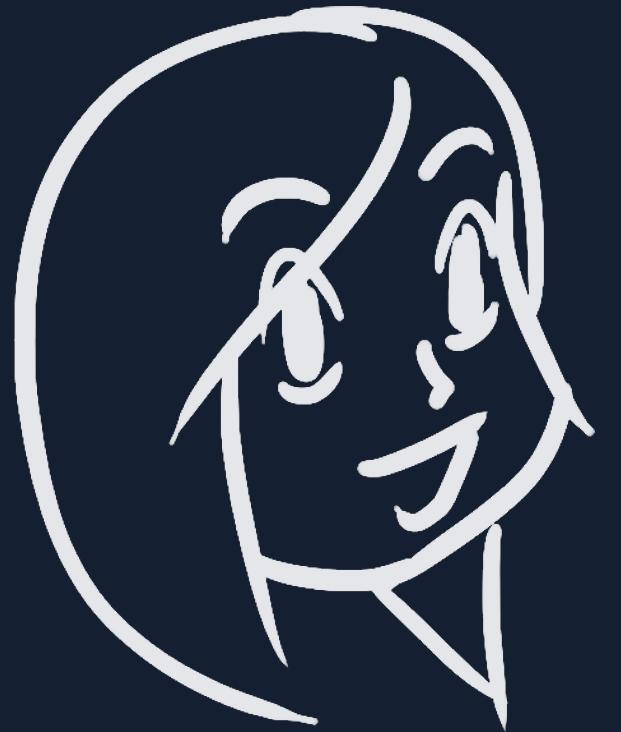
I understand  
this!



What just  
happened?



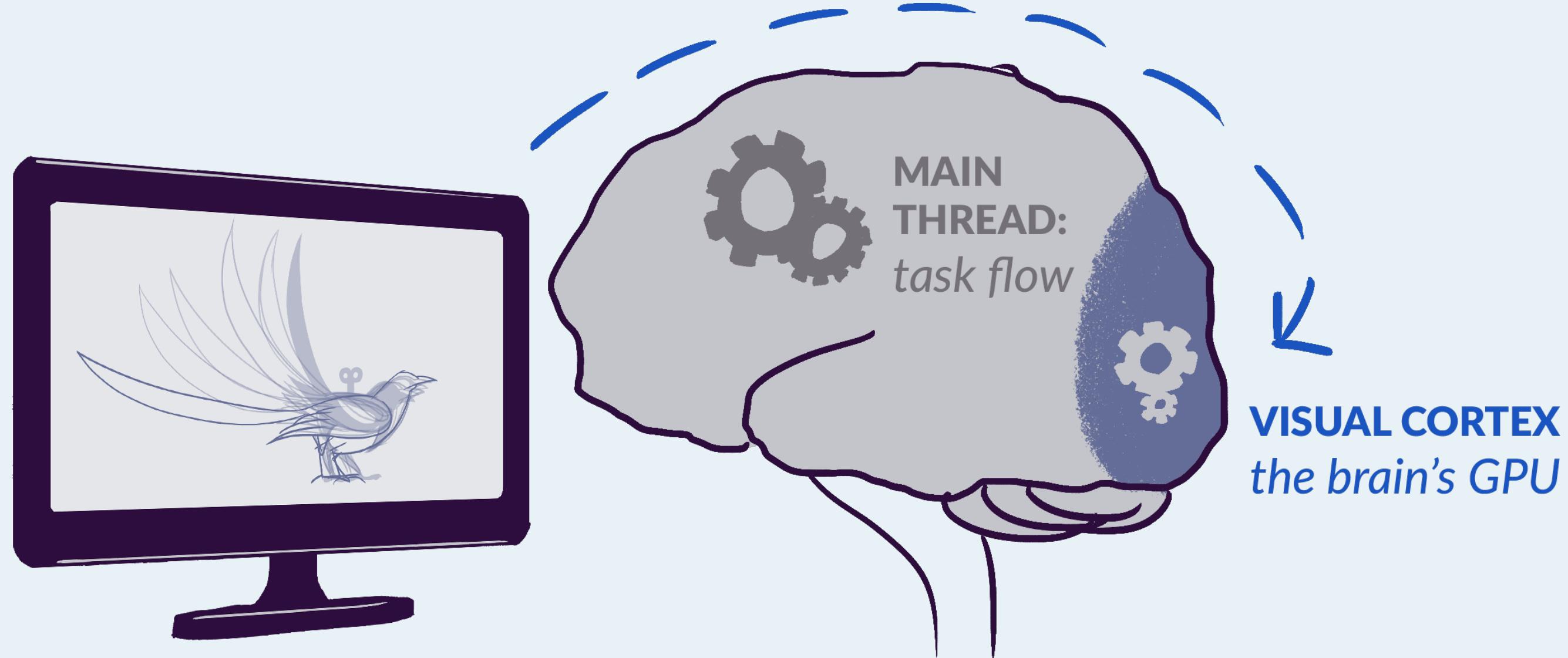
I'm bored.



“...(A)imation allows the user to continue thinking about the task domain, with no need to shift contexts to the interface domain. By eliminating sudden visual changes, animation lessens the chance that the user is surprised.”

*Scott E. Hudson and John T. Stasko (1993)*

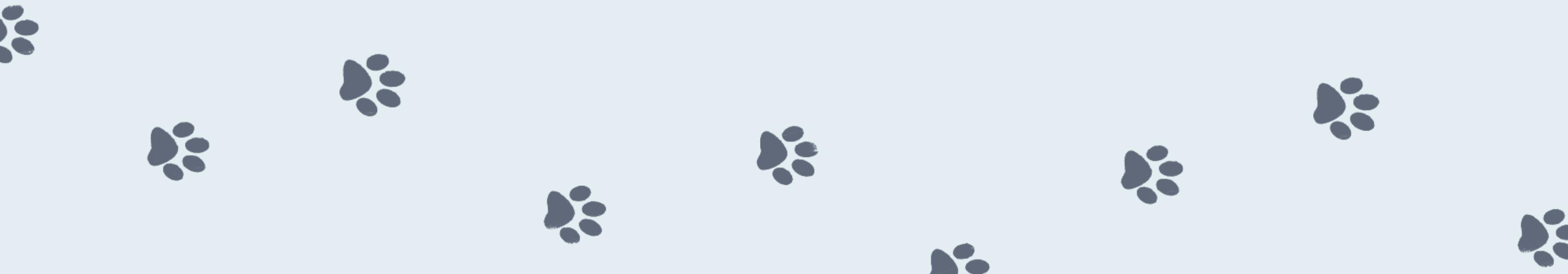






*Jank destroys the precious  
illusion of life.*

# Drawing Attention



“(T)hese speeded responses appeared to be due to the perceived **animacy** of the objects... We conclude that animate motion does indeed capture visual attention.”

***It's Alive! Animate Motion Captures Attention***  
**(2010)**

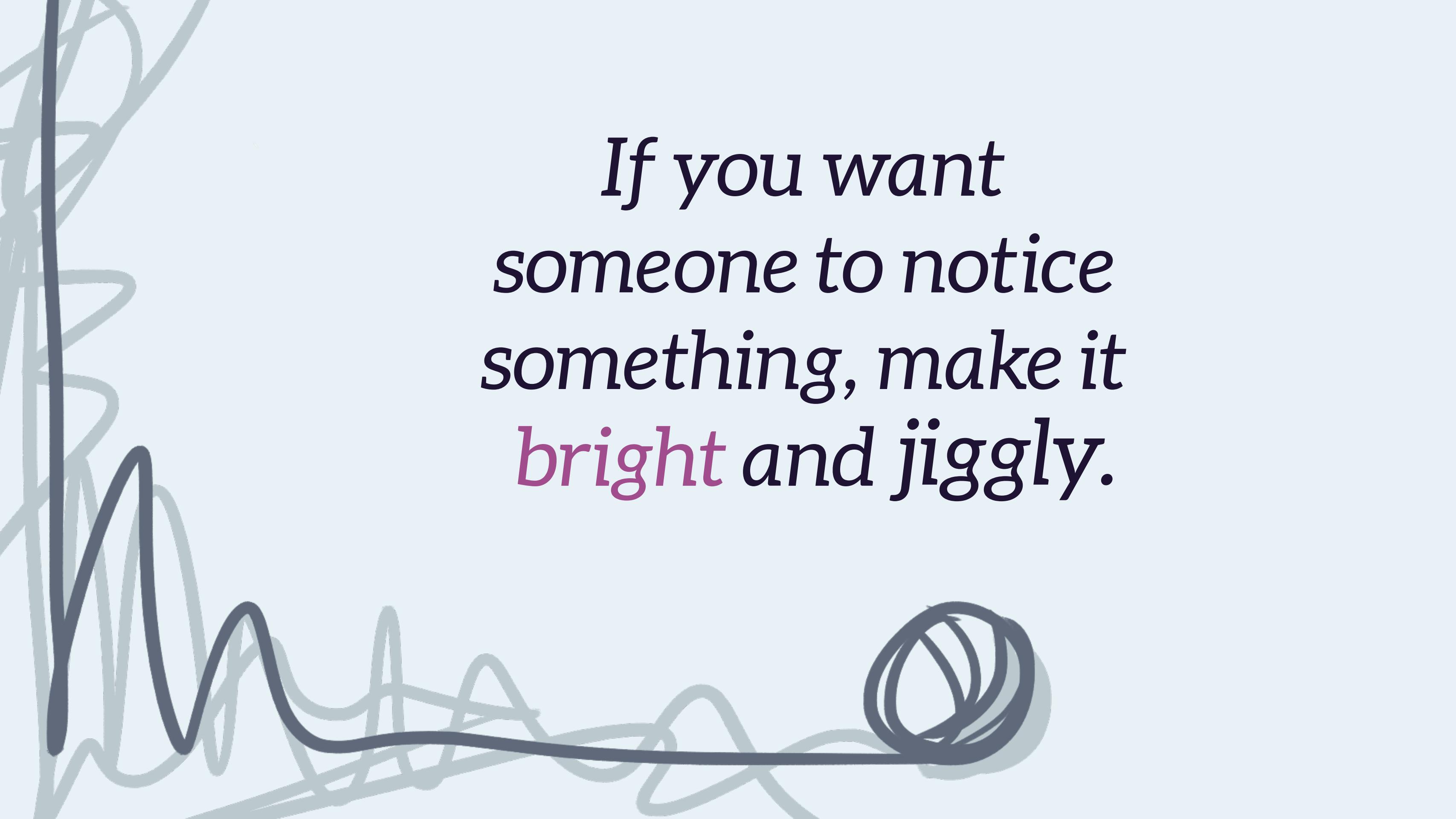


# *Animacy*

How “alive” something appears to be.







*If you want  
someone to notice  
something, make it  
bright and jiggly.*

178

Like

1

g+1



email

# The 5 Most Annoying Banner Ads On The Internet

By Luke McKinney | April 04, 2007 | 910,292 views

f Share

Tweet

Add To Favorites

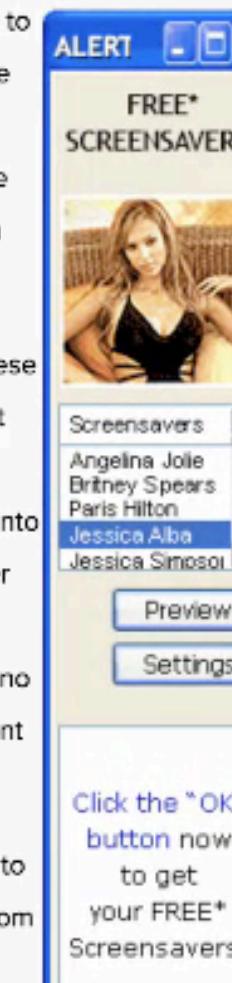


## #1. Jiggling Animation

Left till last to let your hate glands get up and working to full capacity, compared to this vile monstrosity any of the other abominations are as pleasing and enjoyable as an oil massage by three celebrities of your choice. The inventor of this refinement to advertising technology followed in the trail-blazing footsteps of the person who discovered knives could be twisted, and the man who came up with pissing in someones face after kicking them in the testicles.

Of course it's the animated banner ads. What else could it be? The makers of these eye-wrenching monstrosities have fixated on "Get their attention," forgetting that it's part of the larger sentence, "Get their attention so they want to buy our product/service, and ideally aren't motivated to track us down, cement our legs into the pavement, and slowly tear our heads off with a length of chain and a monster truck." I see a lot of cute ladies walking down the street; if my sexy body doesn't attract her attention punching her in the gut is not an effective fallback strategy, no matter how much attention it then gets me from her and her new law enforcement officer friends.

When reading a page I don't want my peripheral vision yanked at by a flickering to the side. The part of my brain that evolved on the Serengeti plains to save me from wild tiger-saurs should not be accessible to someone selling penis-enlargement



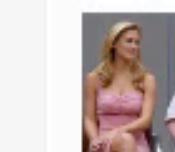
## flashback



6 Things Men Do to Get Laid That Science Says Turn Women Off  
By Kathy Benjamin  
7,749,431 views



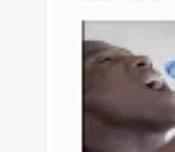
12 Classic Movie Moments Made Possible by Abuse and Murder  
By Orrin R. K., Geoffrey Cubbage, Eddie Rodriguez  
5,398,806 views



5 Recurring Movie Extras You Won't Believe You Never Noticed  
By Aaron Short  
1,933,356 views



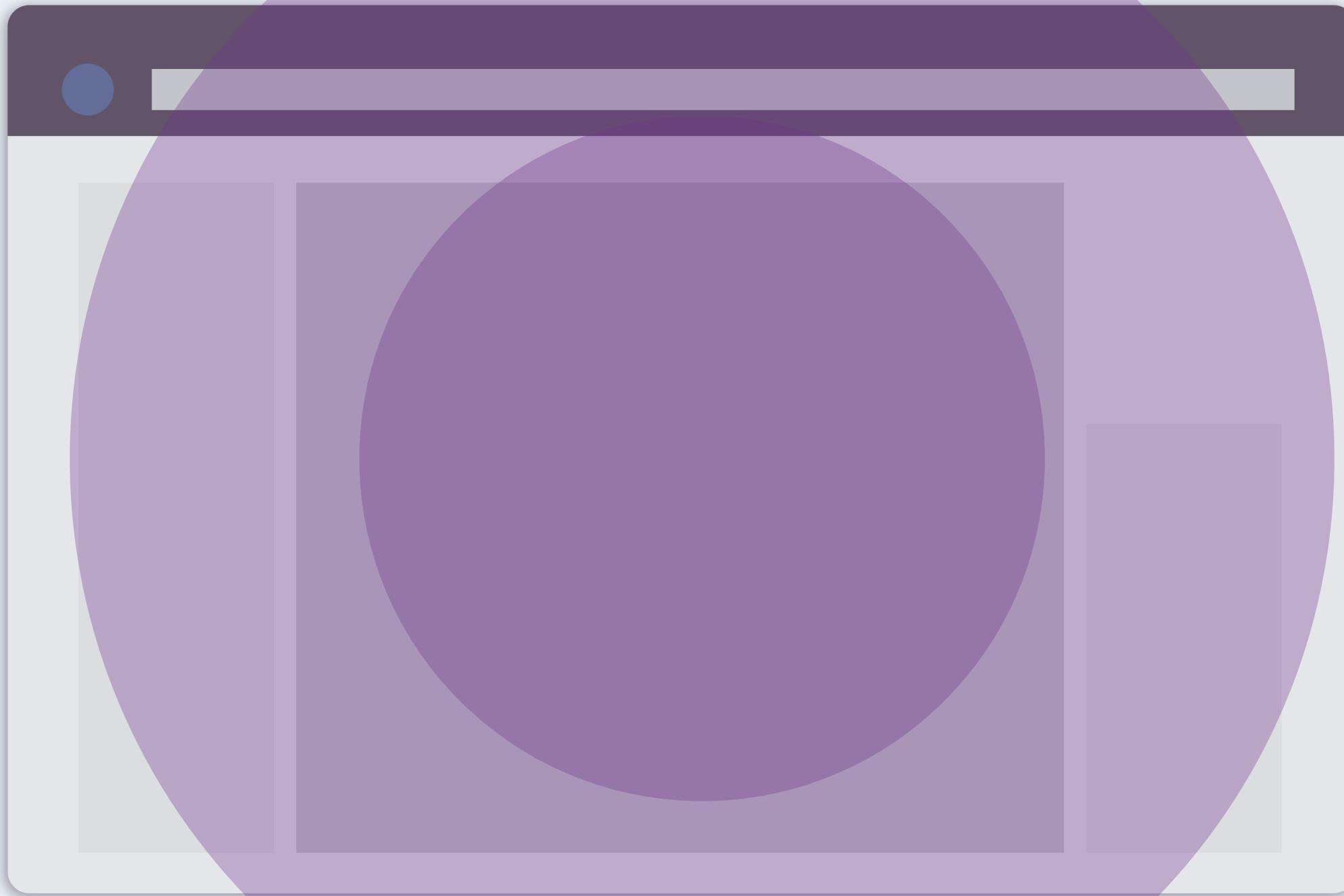
5 Computer Hacks from Movies You Won't Believe Are Possible  
By Benjamin Buso  
1,693,089 views



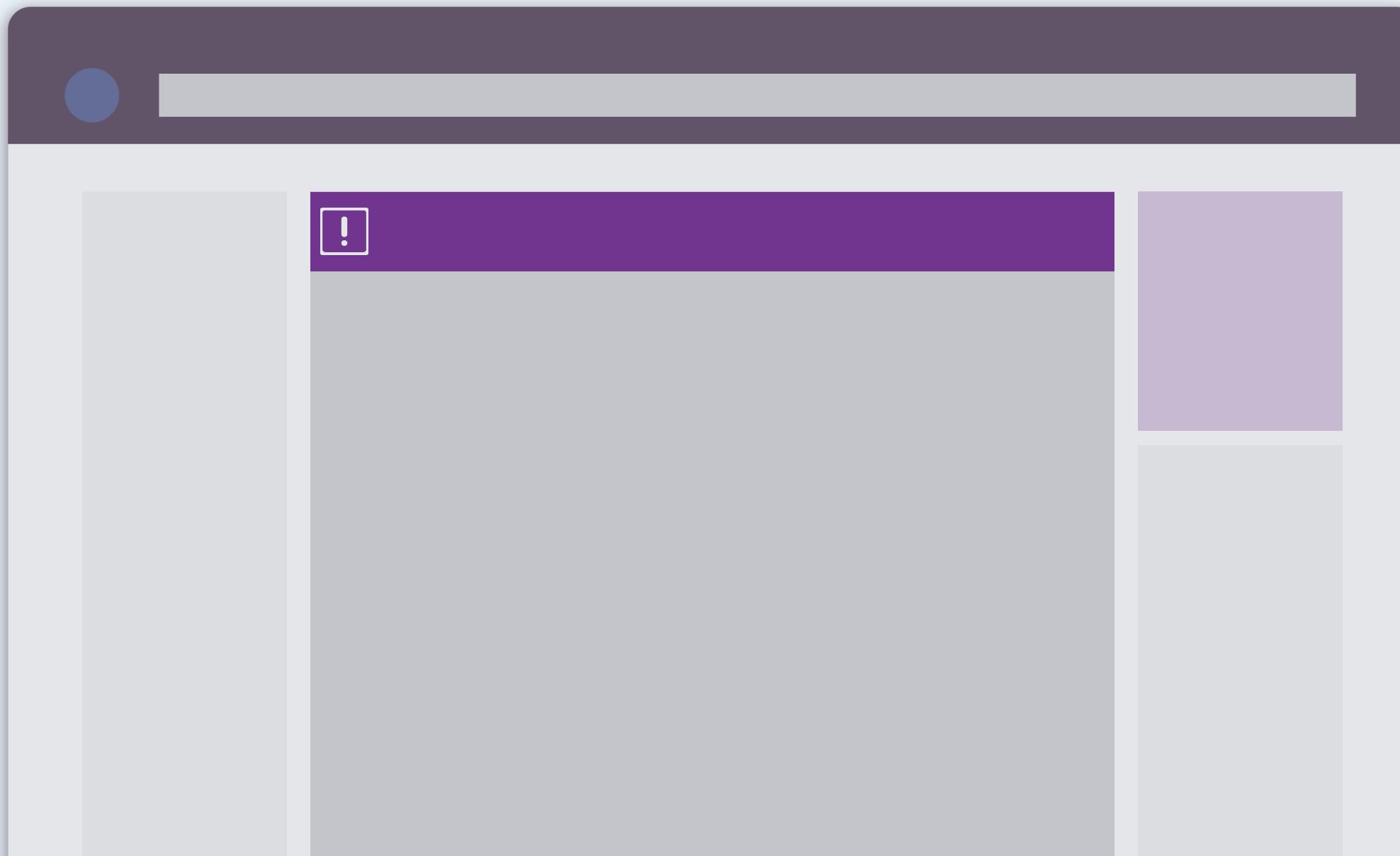
6 Fitness Tips Everyone's Heard (That Don't Work at All)  
By Christina H  
1,662,294 views

Viral on Cracked

See More



# Animacy and Our Cone of Vision





*When everything  
vies for our attention,  
we don't know what  
to focus on.*



# Review!

Waiting for www.alovelikepi.com...

*alovelikepi.com*



Questions?

# Stateful Animations



# Static Animations

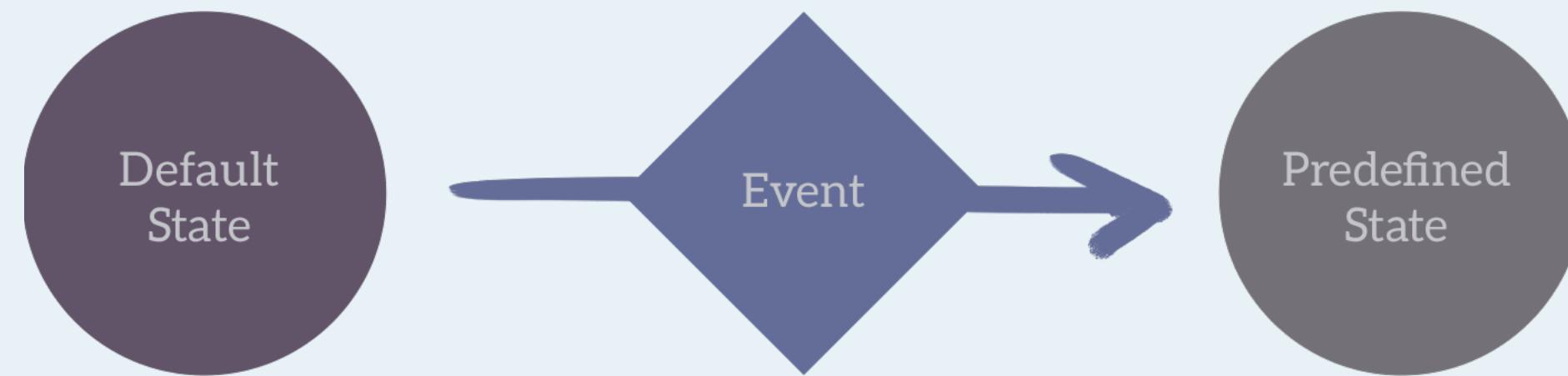


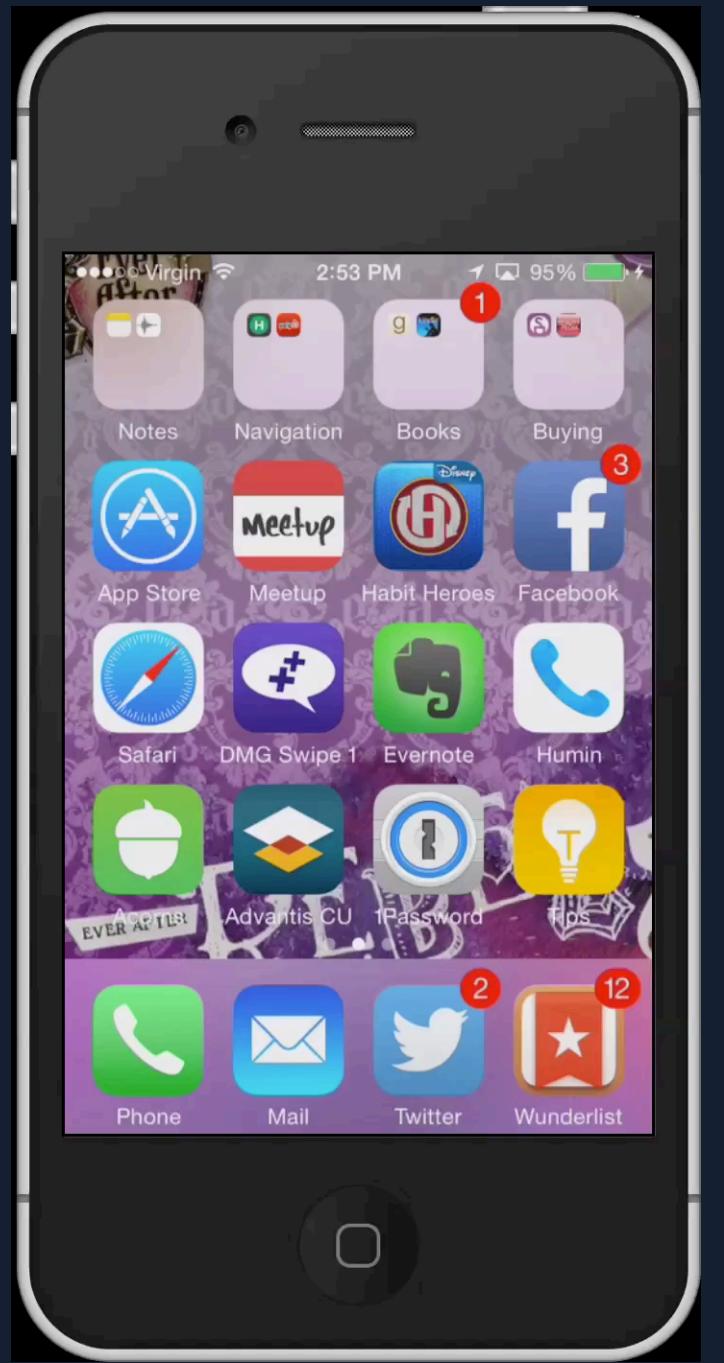


***Loading***

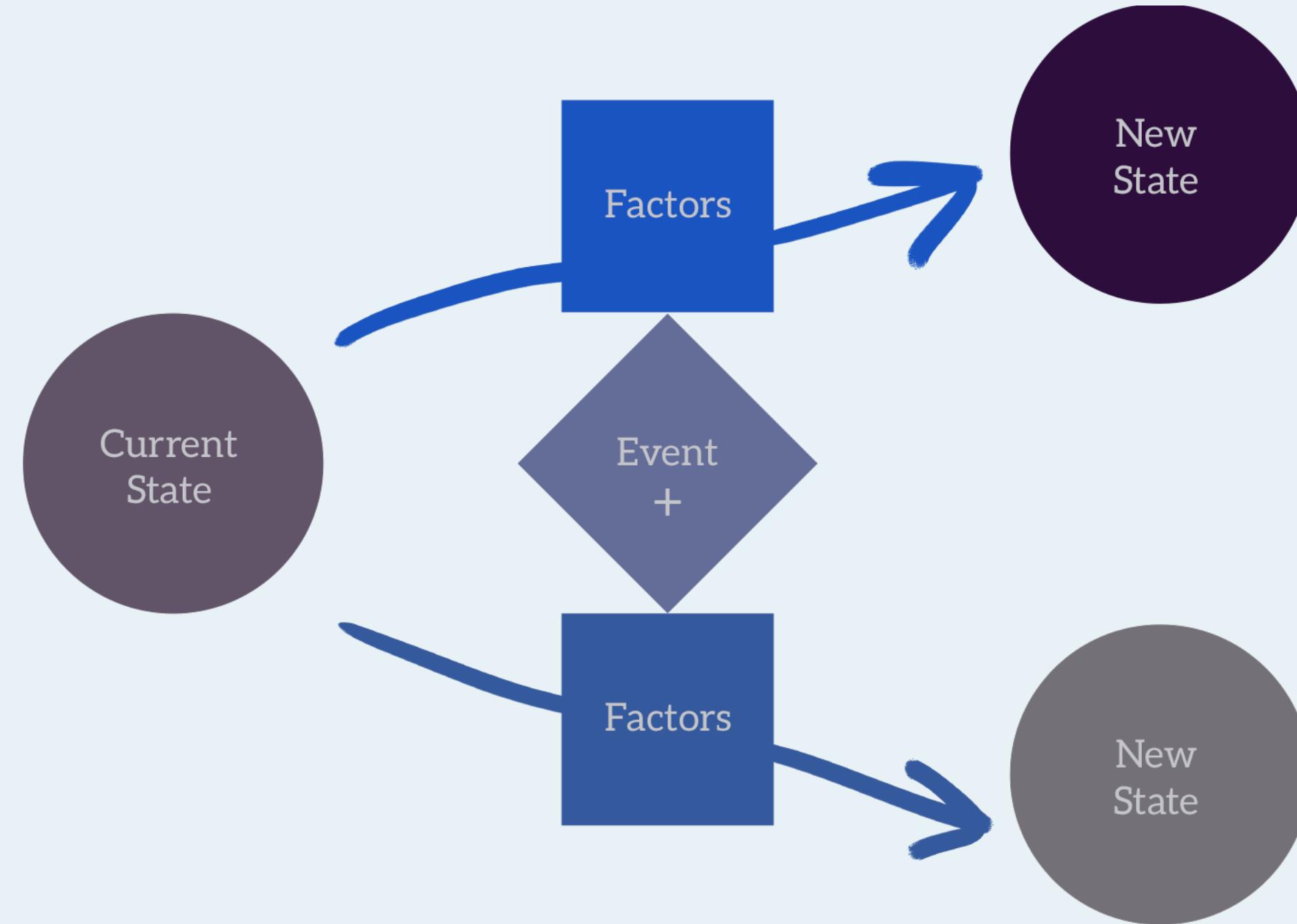
Please adjust your audio

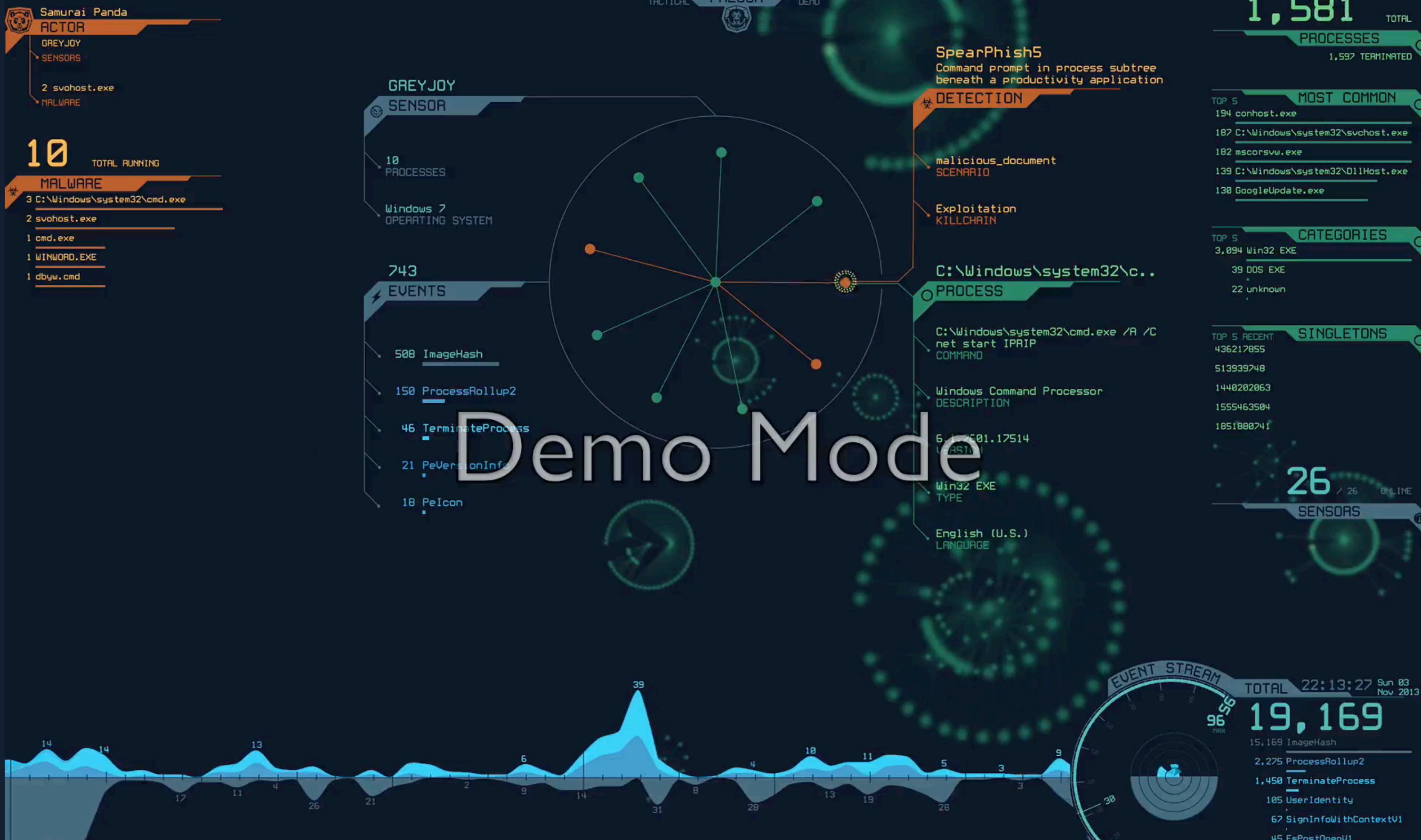
# Stateful Animations



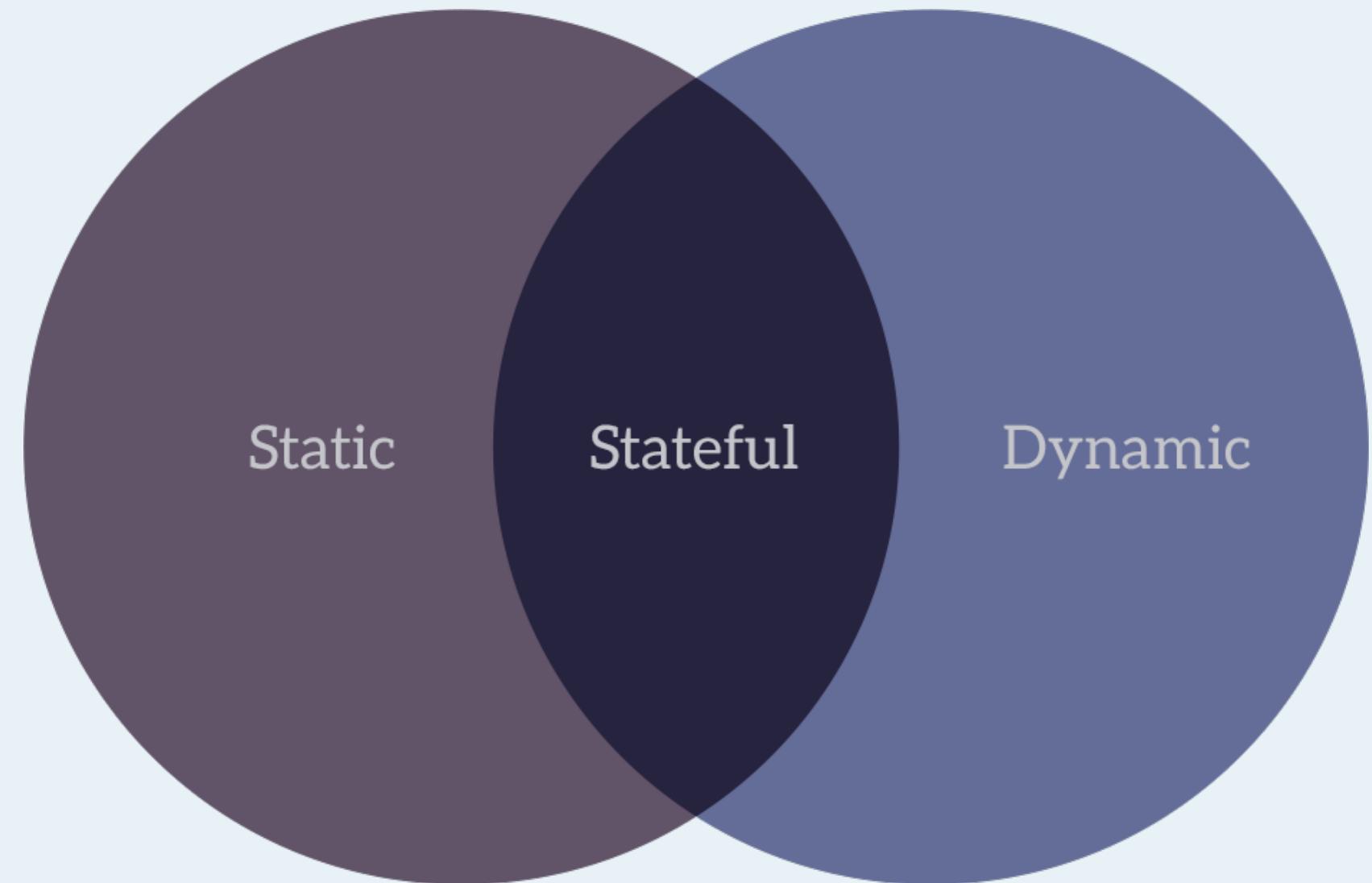


# Dynamic Animations

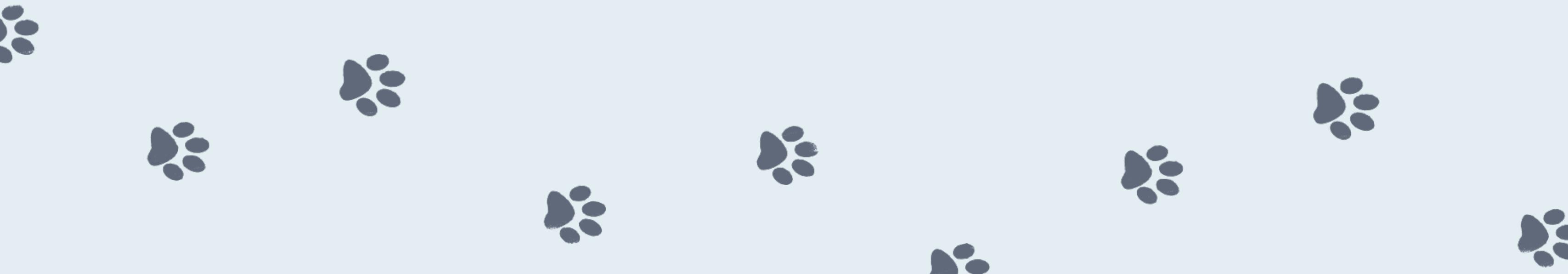




Credit: CrowdStrike: Alex Graul, Senior UI Developer



# Triggering States



# Ways of triggering states

## Browser events

- Loading
- Scrolling

## Human events

- Hovering
- Clicking

## Timed events

- Timeouts
- Choreography

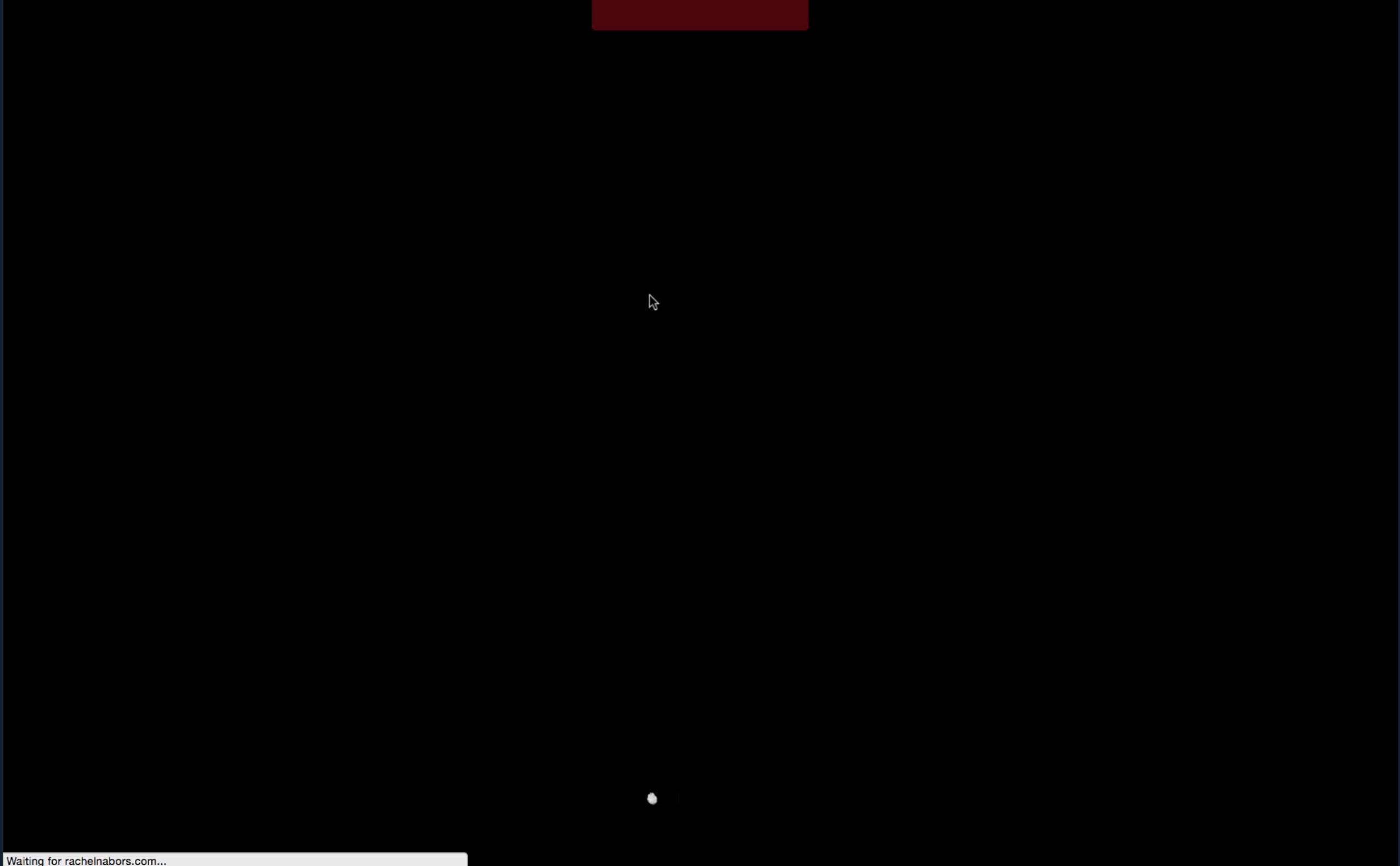
*exercise*

# Sensing Visual Play Readiness



Start coding! [cdpn.io/JDcwI](https://cdpn.io/JDcwI)

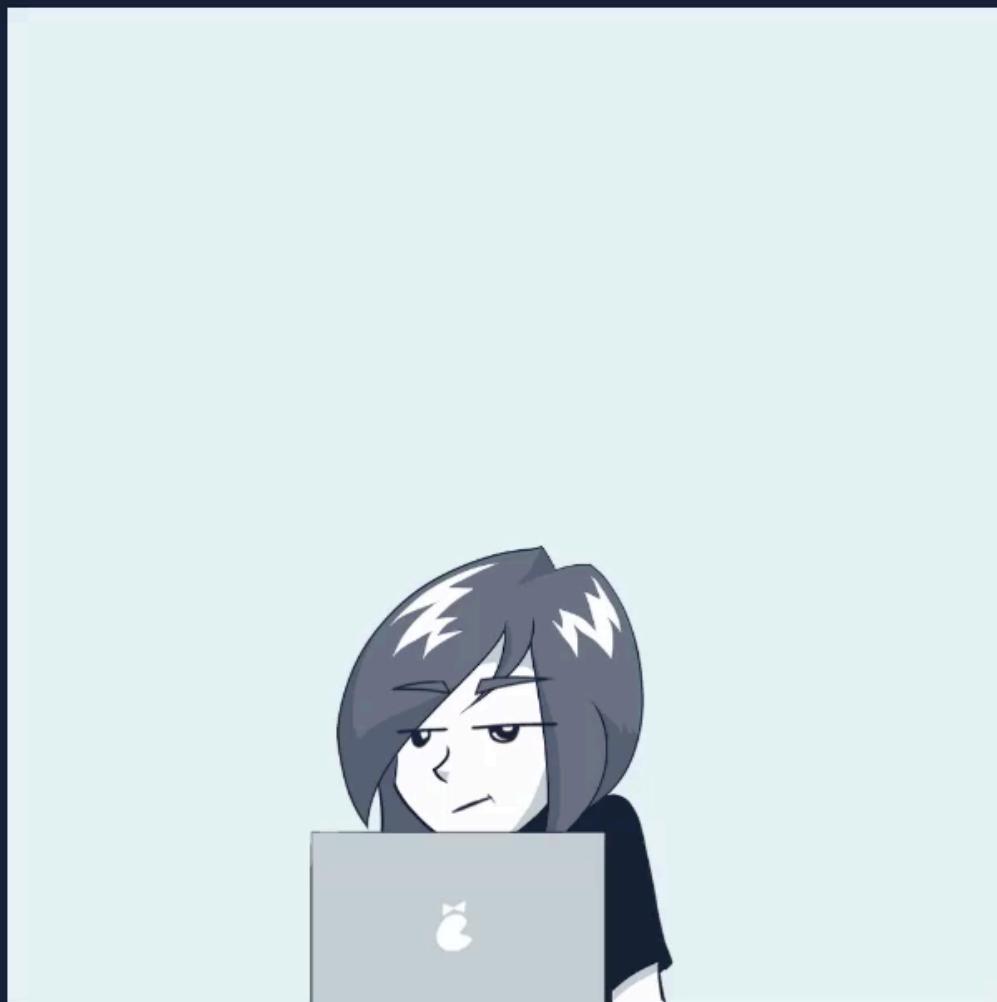
Show and hide elements with classes like `.loading`



Waiting for rachelnabors.com...

*rachelnabors.com/blackbrickroad*

Alertness   Fullness   Engagement



FULL MEAL   SNACK   SLEEP   EXERCISE   READ

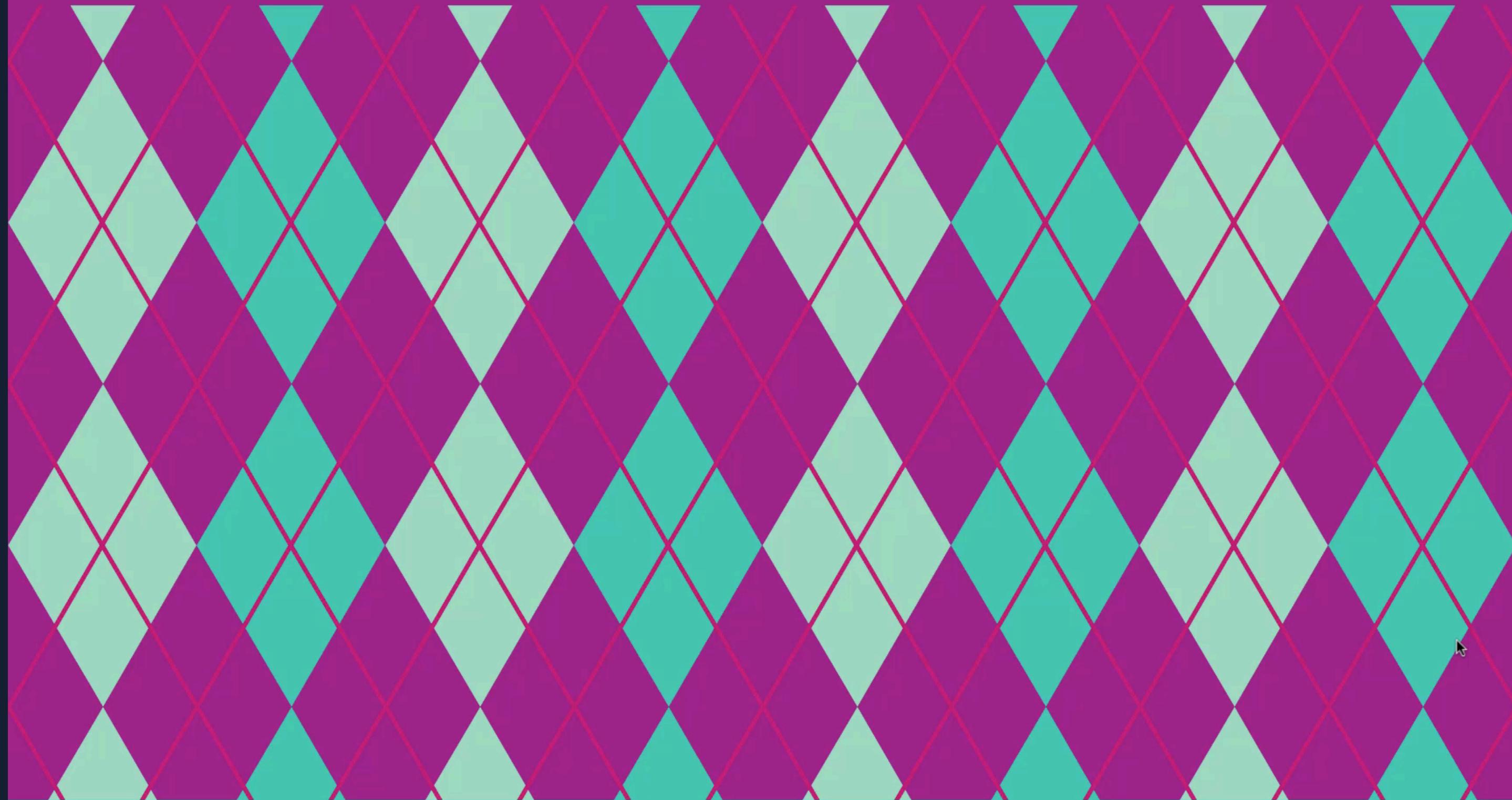
Rachel the Great copyright © 2003–2014 Rachel Nabors; Code is free like the air.



**WARNING**  
*don't try this at home  
without the supervision of  
a trained UX expert*



# Alice in Videoland



Waiting for rachelnabors.com...

A retelling of Lewis Carroll's classic in pixels and HTML by [Rachel Nabors](#)

[rachelnabors.com/alice-in-videoland/book](http://rachelnabors.com/alice-in-videoland/book)

# Libraries

- **Skrollr** creates dynamic animations by interpolating property values based on scroll position.
- **Waypoints** triggers events based on where the person has scrolled to

*exercise*

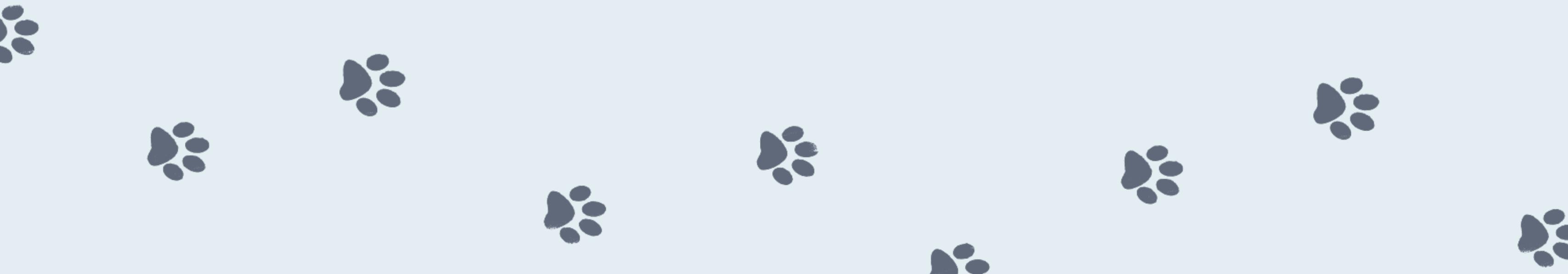
# Falling up the Hole



Start coding! [cdpn.io/jafIt](https://cdpn.io/jafIt)

**Use skrollr.js to make Tuna “fall” up the hole past Alice!**

# Managing State





## SPEAKING SCHEDULE

May 9–13

Beyond Tellerand, Düsseldorf & DOM in Motion workshop

May 26–27

At the Front, Copenhagen & Motion: in Design and Development workshop

Jun 24–26

Code, Melbourne & DOM in Motion workshop

Jul 8

Cascadia CSS, Washington

## ONLINE WORKSHOPS

Jun 30 – Smashing Online

Animation Essentials: CSS Animations and Transitions

Open Enrollment – Learn with

Rachel Nabors

Practical Cartooning for Technical Folk

## ♥ ANIMATION PROJECTS



The Black Brick Road to Oz #47



Alice in Videoland

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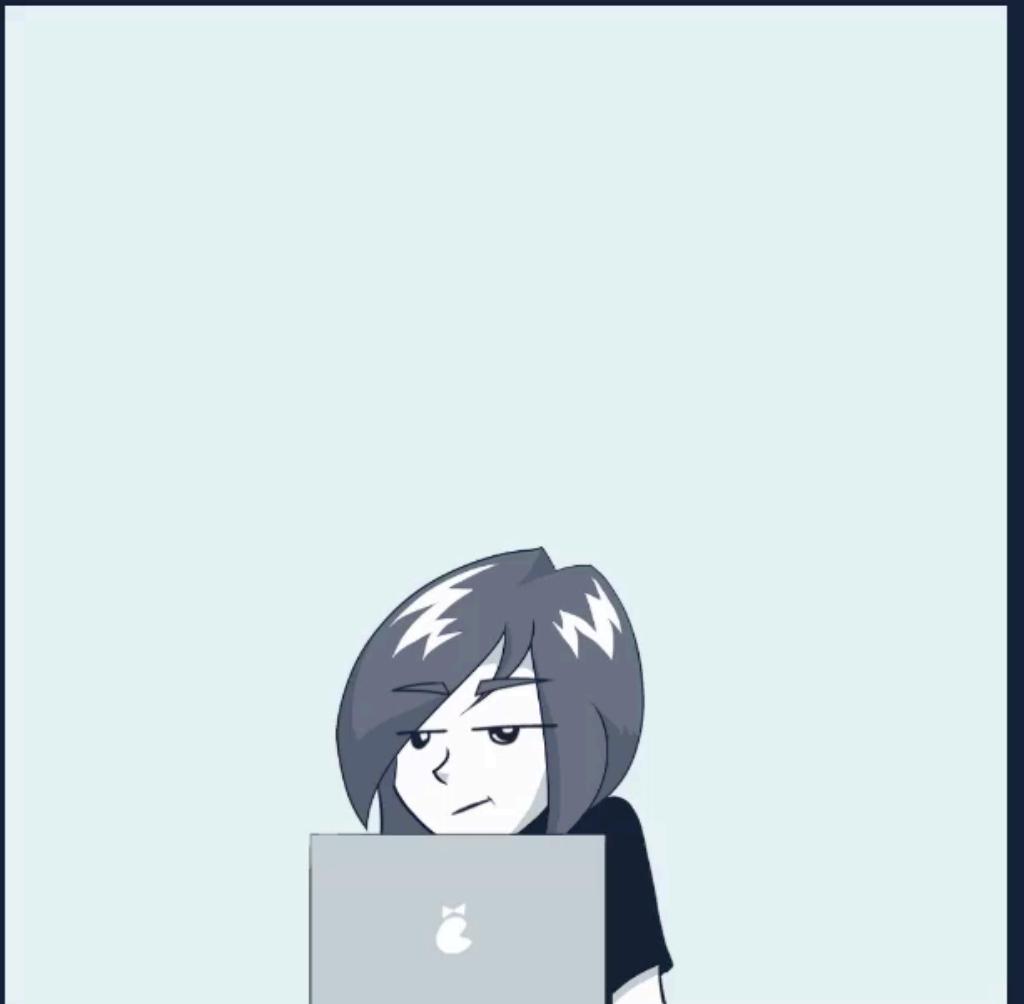
X n i x H i s t o r y



Loading...



Alertness   Fullness   Engagement



FULL MEAL   SNACK   SLEEP   EXERCISE   READ

Rachel the Great copyright © 2003–2014 Rachel Nabors; Code is free like the air.





# GSAP

GreenSock Animation Platform

# ELMOJI!



core.js — site

FOLDERS

- site
  - css
  - fonts
  - img
    - 1944CB0F0E8D748A.png
    - 1944CB0F0E8D748E.png
    - 9A68A7E8EB2679B.png
    - balloon.svg
    - bg\_points-trans.svg
    - bg\_stars-trans.svg
    - button-start.svg
    - button\_play-again.svg
    - D0C8973E96248CCB.png
    - D0C8973E96248CCC.png
    - D0C8973E96248CCD.png
    - D0C8973E96248CCF.png
    - egg-case.svg
    - egg.svg
    - egg\_button.svg
    - elmo.svg
    - fail-text.svg
    - g\_elmo-sad.svg
    - g\_zzz.svg
    - loading.svg
    - logo\_elmoji.svg
    - meter\_bar.svg
    - meter\_food.svg
    - meter\_happy.svg
    - meter\_sleep.svg
    - play-text.svg
    - prop\_blanket.svg
    - scene\_elmos-room.svg
    - scene\_kitchen.svg
    - scene\_outside.svg
    - spinner.gif
    - table.svg
  - js
    - core.js
    - svg-injector\_1.1.3-RC.min.
    - TweenMax.min.js

core.js

```
493     });
494   });
495
496   document.getElementById("sleep").addEventListener("click", function(){
497     var doing = "sleeping";
498     updateAction(doing, "room", function(){
499       var letsSleep = new TimelineLite({
500         onComplete: function(e){
501           happinessMeter.incrementMeter("rest", 3);
502           happinessMeter.decrementMeter("engagement", 1);
503           uiReset(doing, letsSleep);
504         }
505       });
506       letsSleep.staggerTo("#sleep-sfx svg", 0.5, {scale:1, rotation:20, autoAlpha:1, delay:1.4,
507         repeat: 2, repeatDelay:1.2}, 0.4,"snoozin")
508       .staggerTo("#sleep-sfx svg", 0.5, {scale:0, autoAlpha:1}, 0.4)
509       .to(elmo.lips, .001, {autoAlpha:1}, 0)
510       .to(elmo.mouthSmall, .001, {autoAlpha:1}, 1.4)
511       .to(blanket, .25, {autoAlpha:1}, 1.4)
512       .to([elmo.pupilsClosed, elmo.curledBody], .25, {autoAlpha:1}, 1.4)
513       .to([elmo.pupils, elmo.standingBody], .25, {autoAlpha:0}, 1.4)
514       .to(elmo.mouthSmall, .5, {transformOrigin: "top center",scale:"1.5, 1.5", yoyo:true,
515         repeat: 11},1.4)
516       .to([elmo.mouthSmall,elmo.pupilsClosed], .001, {autoAlpha:0}, "wake-up")
517       .to([elmo.curledBody, blanket], .25, {autoAlpha:0}, "wake-up")
518       .to("#sleep-sfx svg", .25, {autoAlpha:1}, "wake-up")
519       .to([elmo.pupils, elmo.standingBody], .25, {autoAlpha:1}, "wake-up")
520       .to(elmo.lips, .001, {autoAlpha:0})
521     });
522   });
523
524   document.getElementById("play").addEventListener("click", function(){
```



*What's good for  
the Declarative  
CSS Goose is not so  
great for the  
Functional JS  
Gander.*

# Libraries for managing state

- **JavaScript Finite State Machine**
  - linear state transitions easily
  - many-to-many states gets complicated
- **jStorage**
  - stashes values in localStorage
  - great for *storing* state
  - library agnostic
  - as seen on [RachelNabors.com](http://RachelNabors.com)



Questions?

# Sequencing



```
.sequenced-thing {
```

```
  animation:
```

```
    sequence1 1s 2,
```

```
    sequence2 3s 2s infinite;
```

```
}
```

↑  
the 2nd time  
measurement = delay

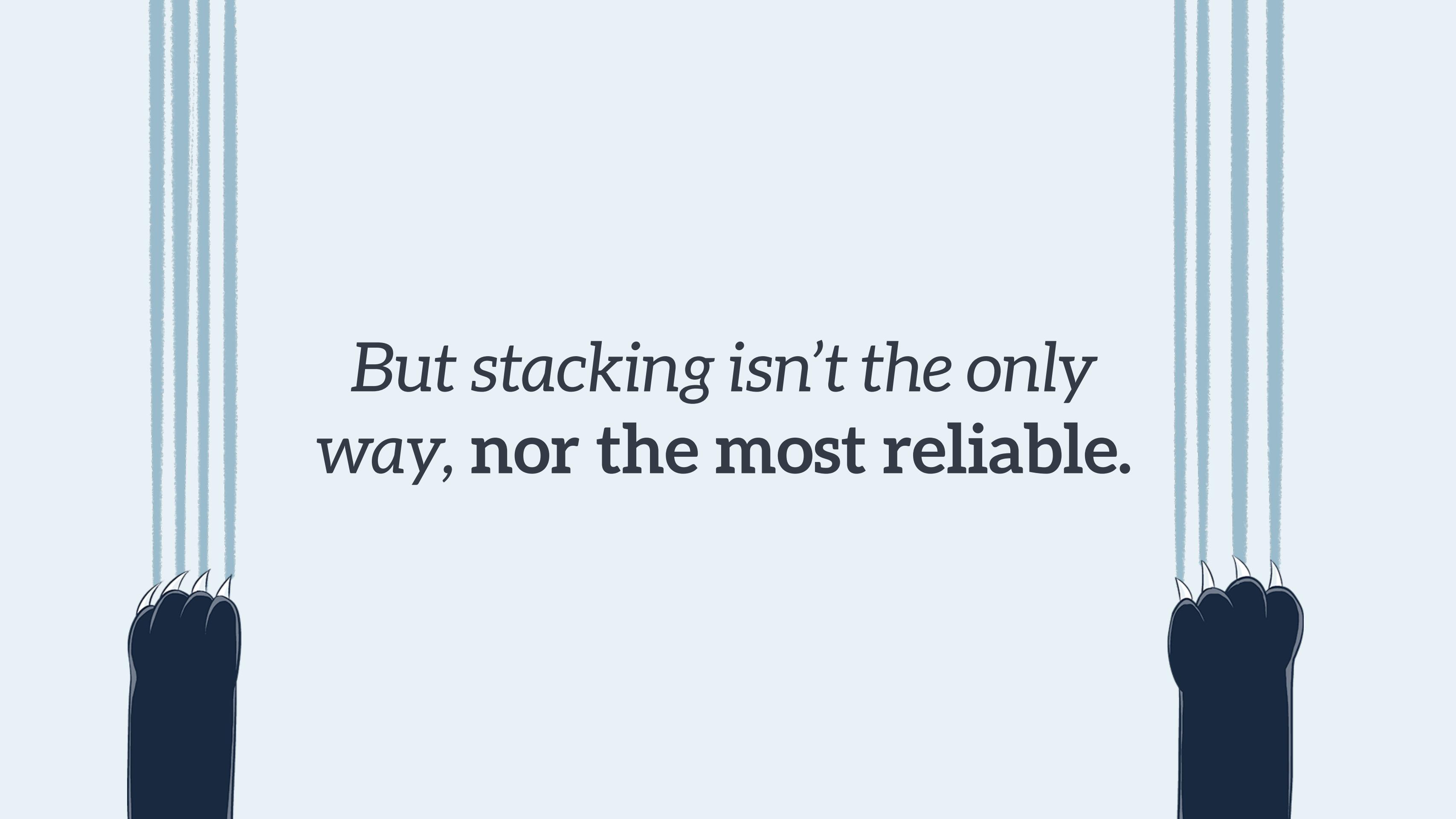
*exercise*

# Sitting Tuna Down

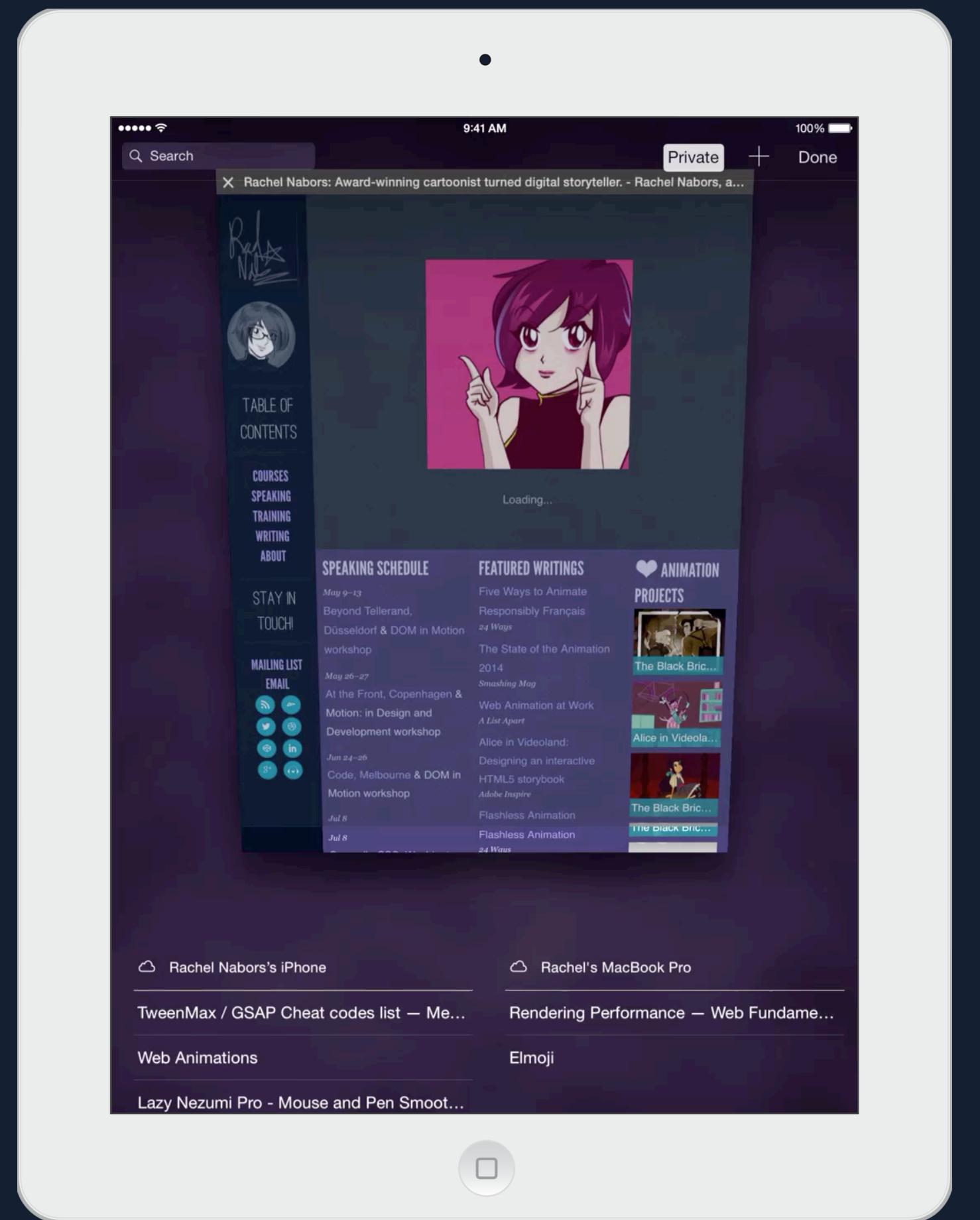


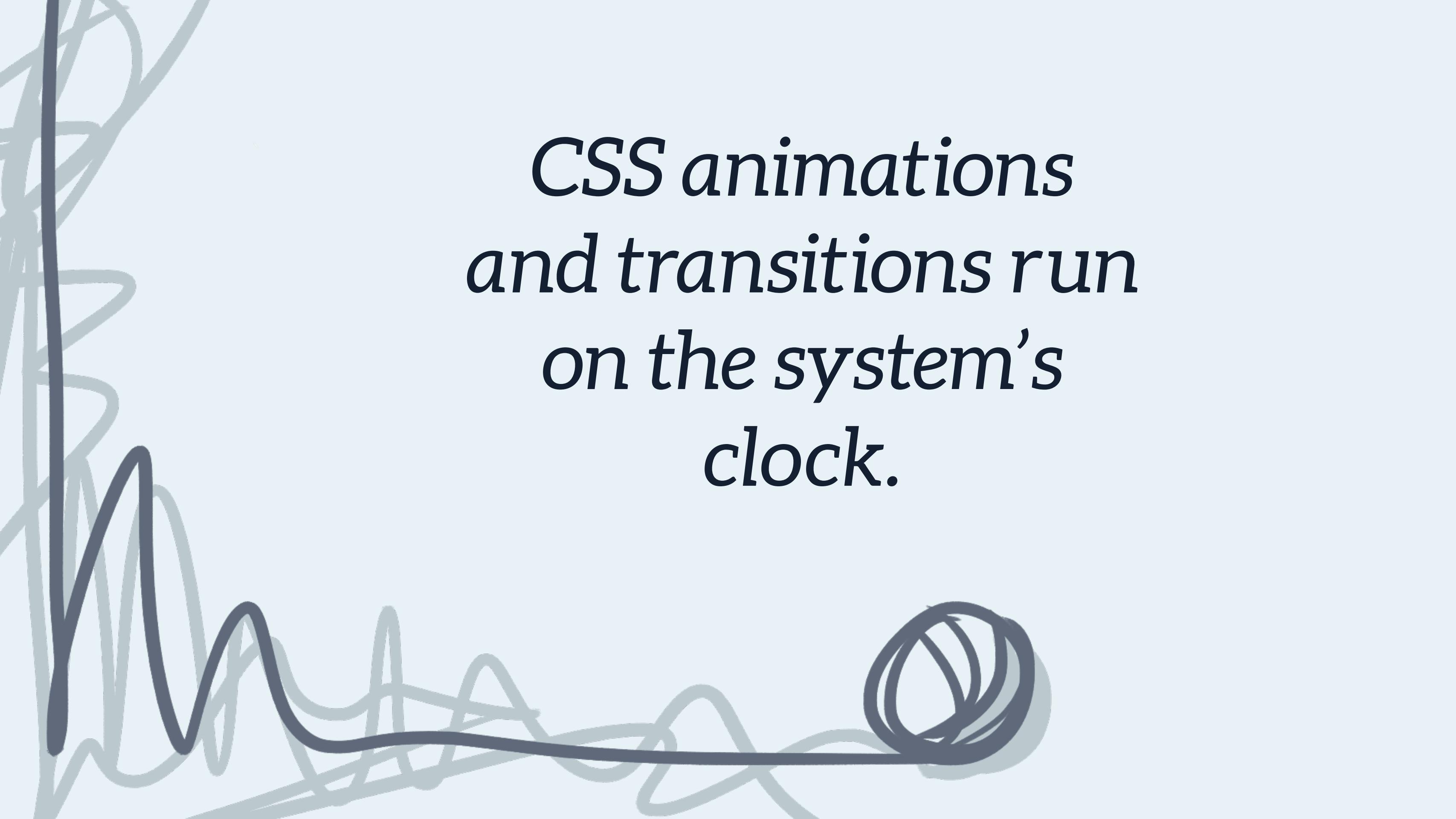
Start coding! [cdpn.io/Djcyaa](https://cdpn.io/Djcyaa)

**Using animation-delay , start a sitting animation after the walking animation.**



*But stacking isn't the only  
way, nor the most reliable.*



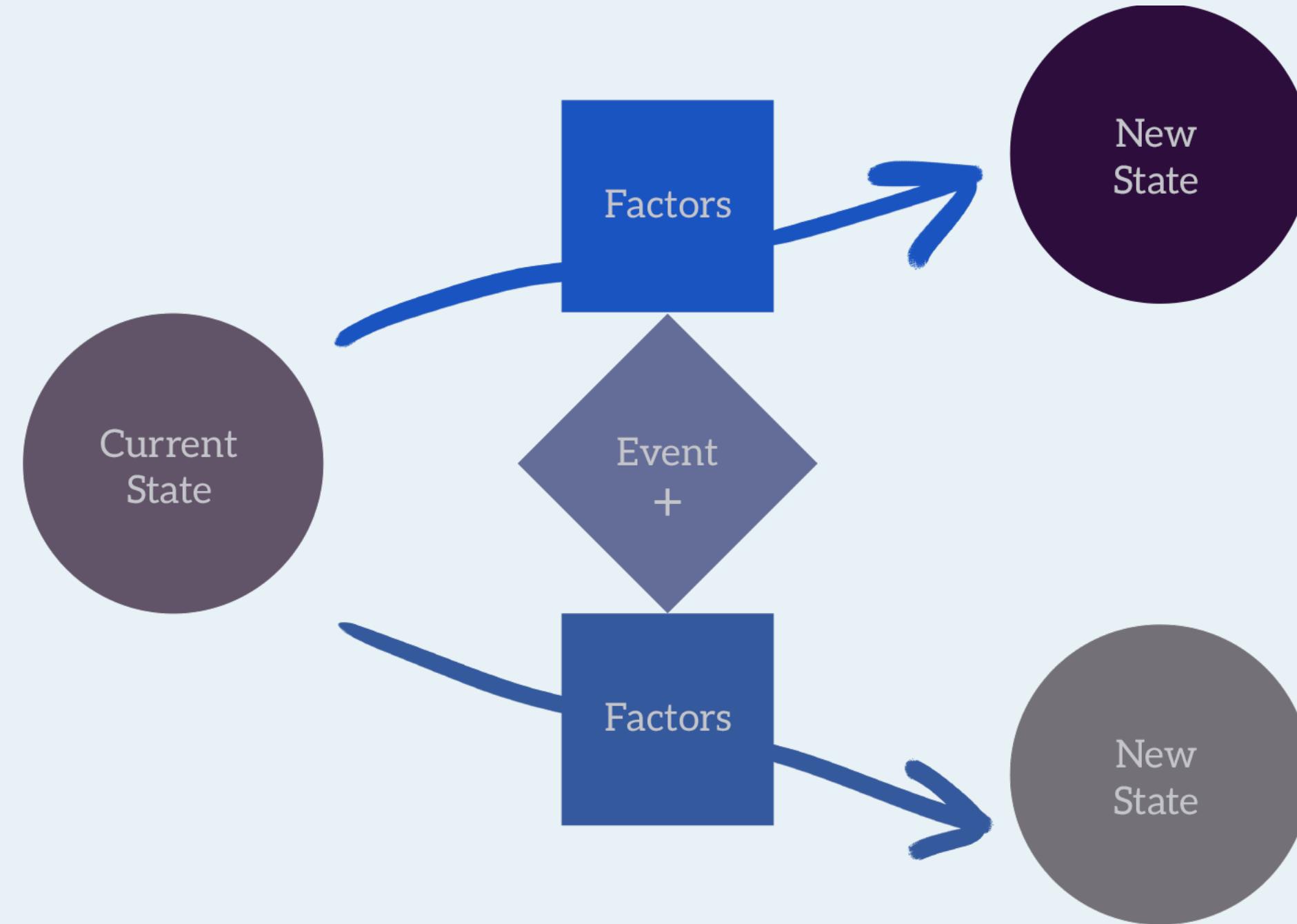


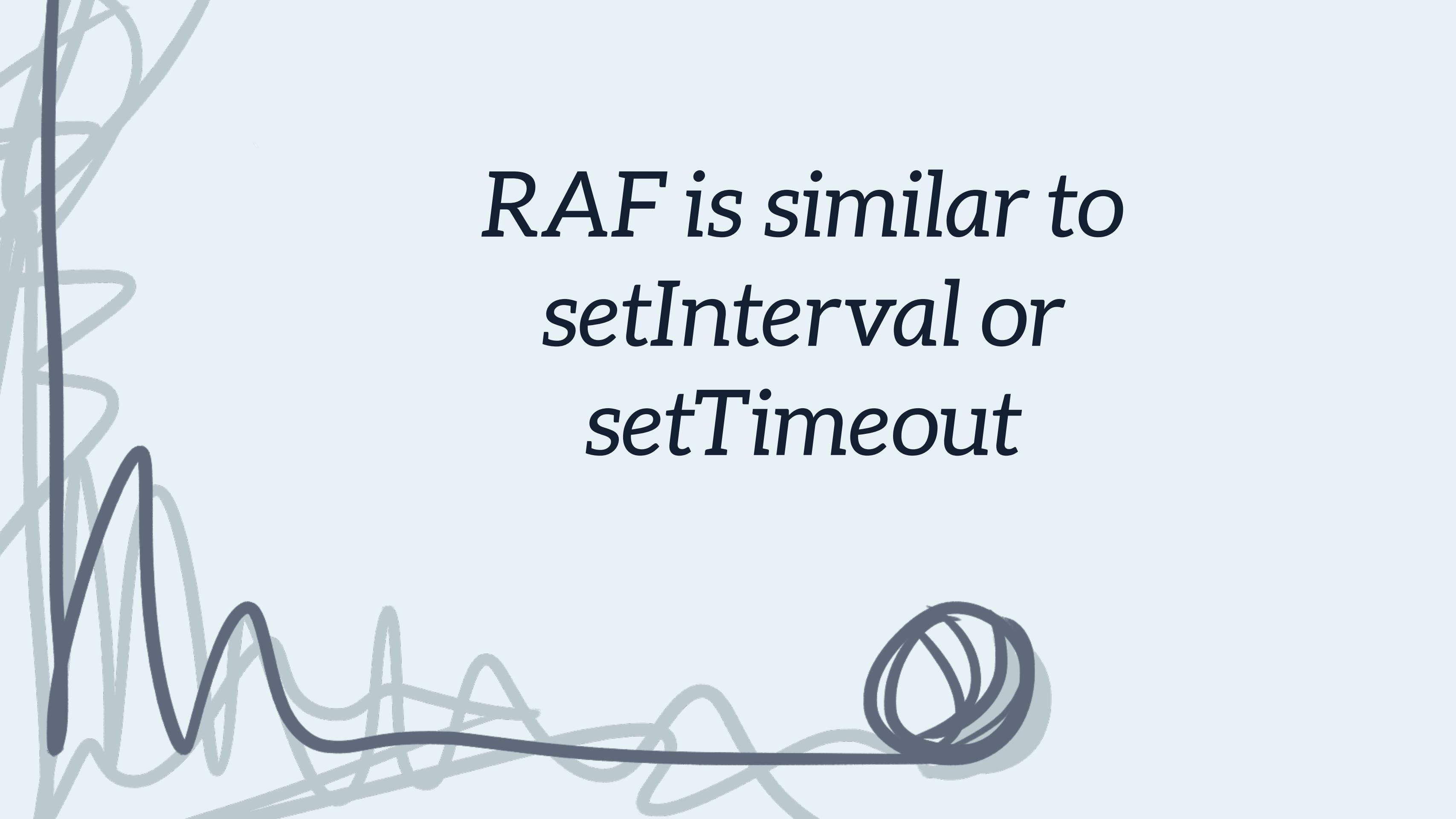
*CSS animations  
and transitions run  
on the system's  
clock.*



*We're gonna need a more  
robust technique.*

# Dynamic Animations





*RAF is similar to  
setInterval or  
setTimeout*

```
function animationFun() {  
    requestAnimationFrame(animationFun);  
}  
  
requestAnimationFrame(animationFun);
```

↑  
recursion!!

```
var animationWatcher =  
requestAnimationFrame(animationFun);  
  
cancelAnimationFrame(animationWatcher)  
;
```

```
var animationWatcher;  
  
function animationFun {  
    animationWatcher =  
        requestAnimationFrame(animationFun);  
}  
animationFun();  
  
cancelAnimationFrame(animationWatcher);
```

works like  
clearTimeout

*exercise*

# Sitting Tuna Down with RAF

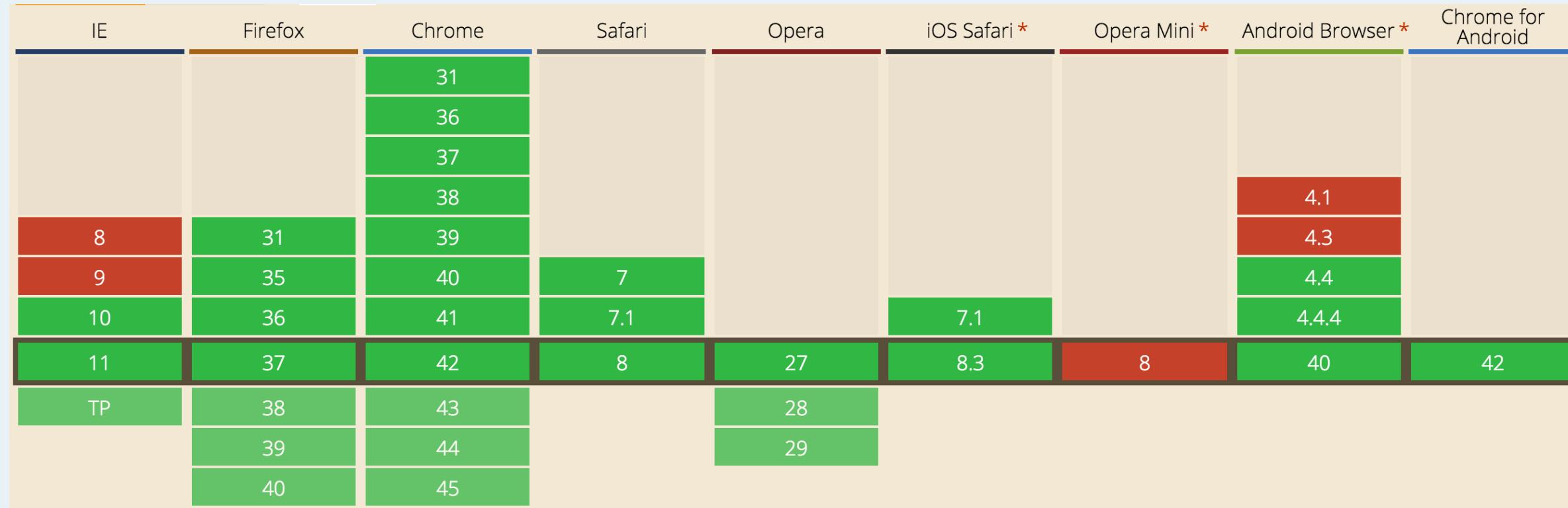


Start coding! [cdpn.io/BNyEPR](https://cdpn.io/BNyEPR)

**Using `requestAnimationFrame`, give Tuna a walking class when he finishes running.**

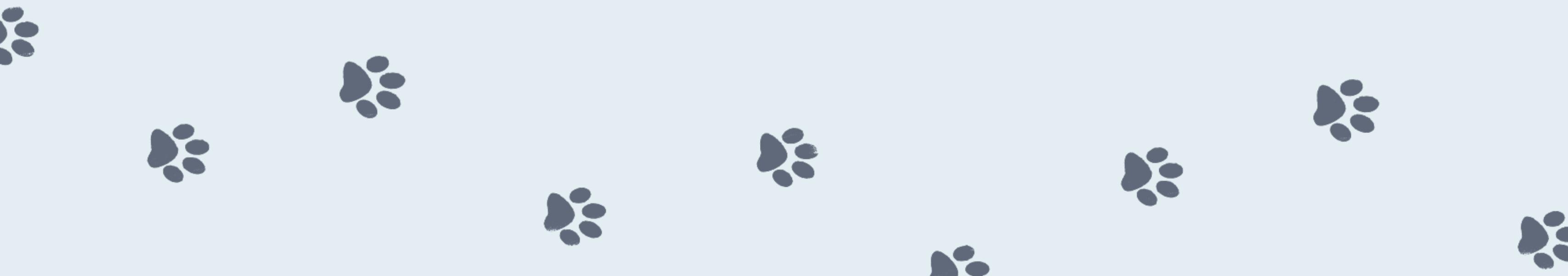
# What requestAnimationFrame can do for you...

- **Saves energy!** Doesn't run when the tab is out of focus.
- **Let's the browser optimize** depending on resources available.
- **Runs smoothly** as possible.



IE 9 and lower & Opera Mini need a polyfill:  
[caniuse.com/#feat=requestanimationframe](http://caniuse.com/#feat=requestanimationframe)

# Chaining Animations with Event Listeners



# Four must-have JavaScript event listeners

- **animationstart**
- **animationend**
- **animationiteration**
- **transitionend**



*They will fire for  
every animation/  
transition on the  
element.*

# Browser prefixes requires (of course)

- **webkitAnimationIteration** for Webkit
- **MSAnimationIteration** for IE 10
- Everyone else is **animationiteration**

*exercise*

# Sitting Tuna Down with event listeners



Start coding! [cdpn.io/pliqj](https://cdpn.io/pliqj)

**Using animationend, add the .sit class after Tuna's done walking**



Questions?

# Performance



		Blink	Gecko	WebKit	EdgeHTML		Blink	Gecko	WebKit	EdgeHTML
		Change from default					Subsequent updates			
align-content										
align-items										
align-self										
backface-visibility										
background-attachment										
background-blend-mode										
background-clip										
background-color										
background-image										
background-origin										



*The two CSS  
properties considered  
most performant:  
**opacity**  
**transform***

# Handy alternatives

- **transform: scale()** instead of **width** or **height**
- **transform: translate()** instead of **position**
- **opacity** instead of **z-index** or **visibility: hidden**

*exercise*

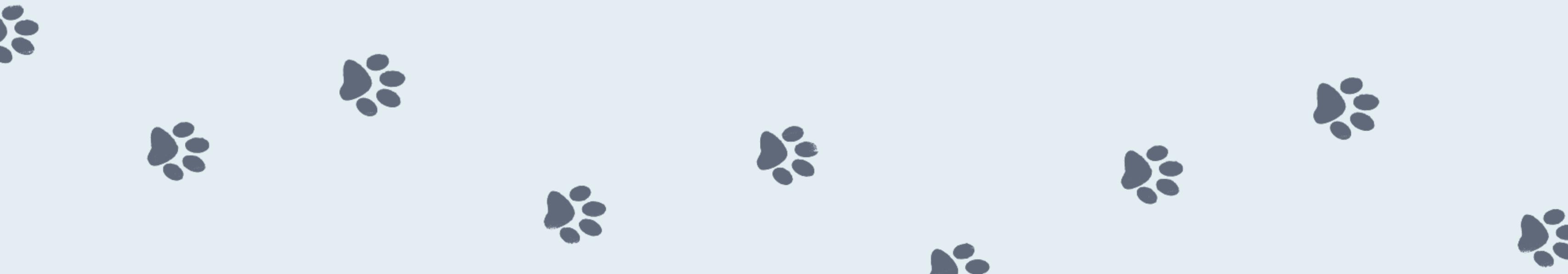
# Walk the cat... again!



Start coding! [cdpn.io/QbwXry](https://cdpn.io/QbwXry)

**Find a way to walk the cat without using expensive background positioning.**

# will-change



# Hardware acceleration

AKA “kicking it to the GPU”:

```
.resource-sink {  
  transform: translateZ(0);  
}
```

Please don't do this.



*Hacks are not future-friendly.*



```
.in-view .animated-thing {  
  will-change: transform;  
}  
/*
```

```
.in-view .animated-thing:hover {  
  transform: translateY(5%);  
}
```



*Don't slap  
will-change  
on everything.*

*When we  
will-change  
everything, we  
optimize nothing.*

# CSS will-change property - WD

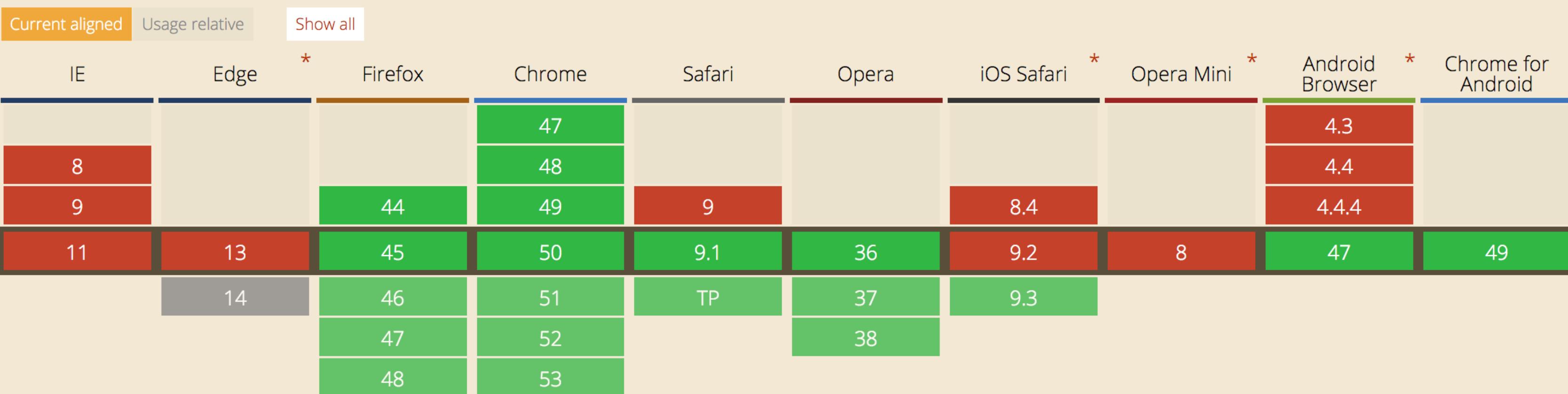
Global

56.61%

U.S.A.

53.23%

Method of optimizing animations by informing the browser which elements will change and what properties will change.



[caniuse.com/#feat=will-change](https://caniuse.com/#feat=will-change)

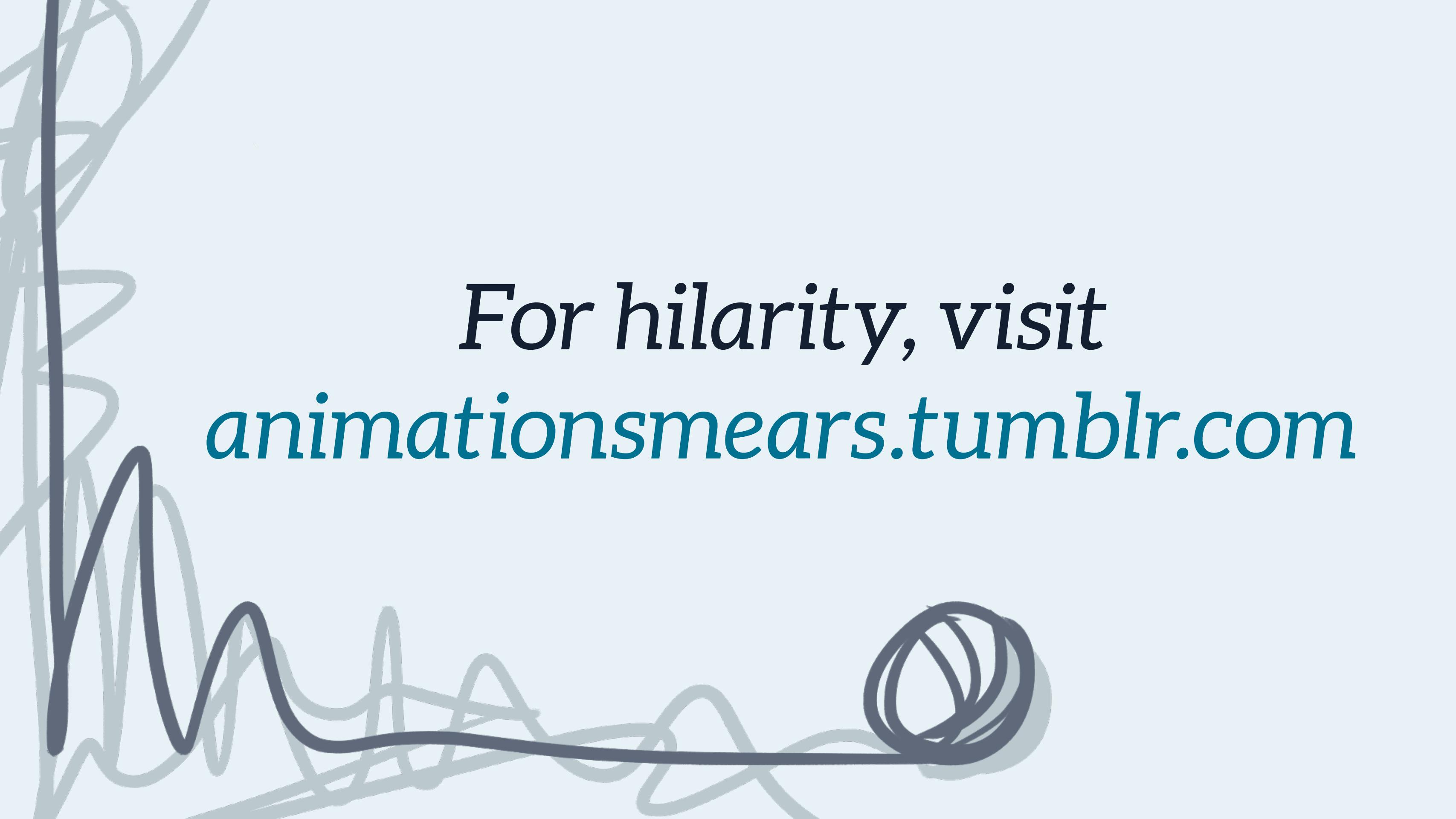
**FPS**

# Frames per Second (FPS)

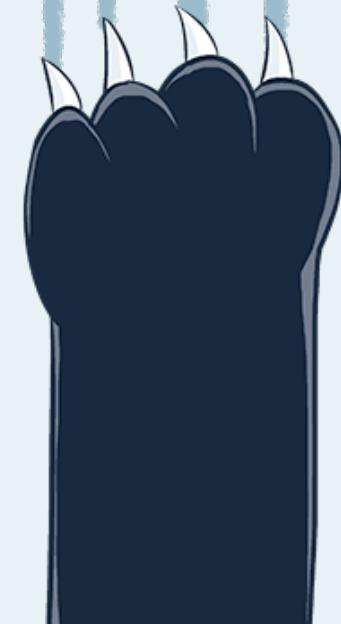
- Frame Rate on the computer is not the same as it is in the movie theatre.
- Optimal frame rates to maintain the “illusion of life”:
  - Movies: 24 FPS
  - Computer screens: 60 FPS
- How do movies get away with it??



I took this photo. Credit: me.



For hilarity, visit  
*[animationsmears.tumblr.com](http://animationsmears.tumblr.com)*



*Consistency is more  
important than FPS.*

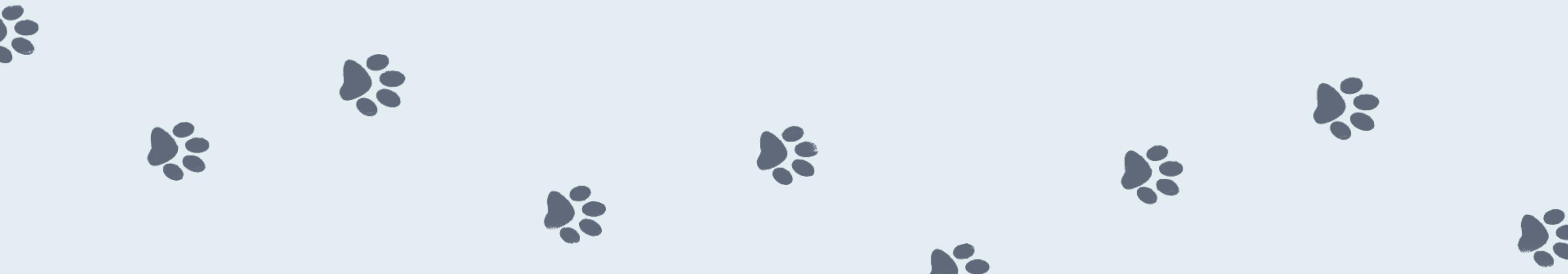
# Chrome's FPS Meter

1. Open your Developer Tools.
2. Press the Escape Key to **bring up the console window**.
3. Choose the **Rendering** tab.
4. Check the **Show FPS Meter** option.

# Try using these in wonderful new places...

- The Cat in Byakkoya at [cdpn.io/rCost](https://cdpn.io/rCost)
- CSS Awards at [cssawds.com](https://cssawds.com)

# Spotting Jank and Bottlenecks with Dev Tools



# Paint Flashing

To enable Chrome's paint rectangles:

1. Open your Developer Tools.
2. Press the Escape Key to **bring up a console window.**
3. Choose the **Rendering** tab.
4. Check **Enable Paint Flashing.**

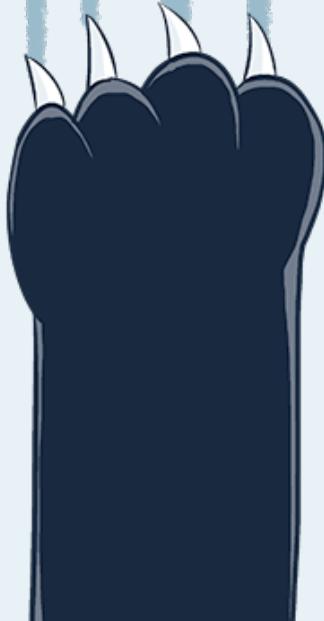
# The Timeline Tool

To use Chrome's timeline tool:

1. Open your **Developer Tools**.
2. Go to the **Timeline tab**.
3. Press the “**record circle**.”
4. Do stuff.
5. Press the “**record circle**” again to stop.
6. Inspect!



*Best perf tip ever:  
Don't animate it if  
it isn't visible.*



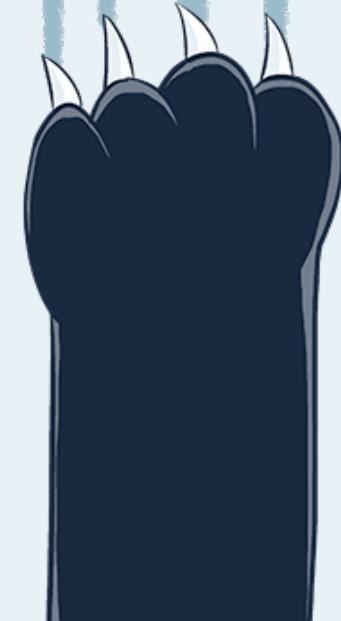


Questions?



*Animation Tools in the Browser*

***DevToolsChallenger.com***

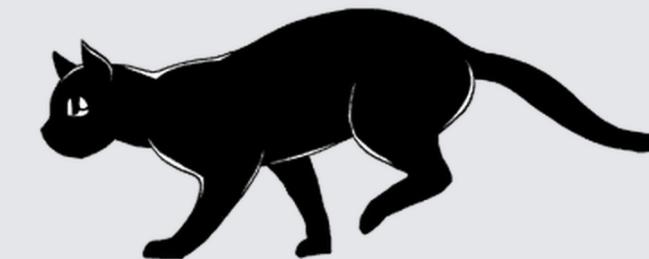
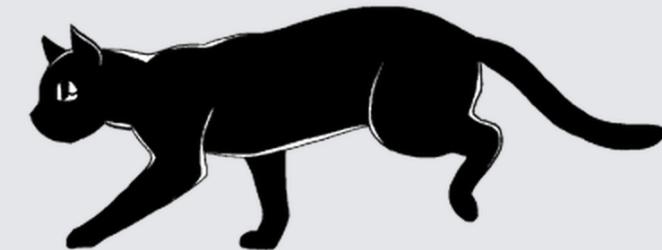
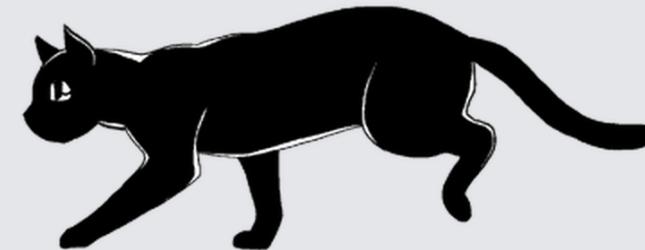
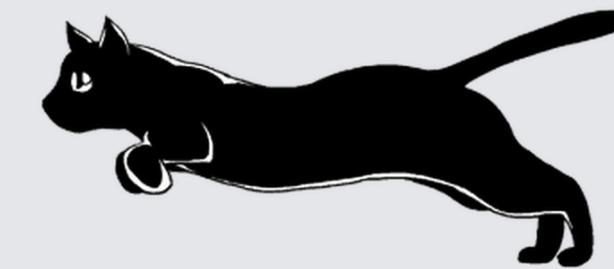


# The Web Animations API and What's Next



Animate cats with CSS?

Add a Cat



Synch cats with WAAPI?

Add a Cat



Speed things up

Slow things down





*For more on the Web  
Animation API:  
[rachelnabors.com/waapi](http://rachelnabors.com/waapi)*



Questions?

# Let's be animation friends!

@*RachelNabors* & *RachelNabors.com*

*slack.animationatwork.com*

*WebAnimationWeekly.com*

5 minute survey *goo.gl/B8ap2d*

