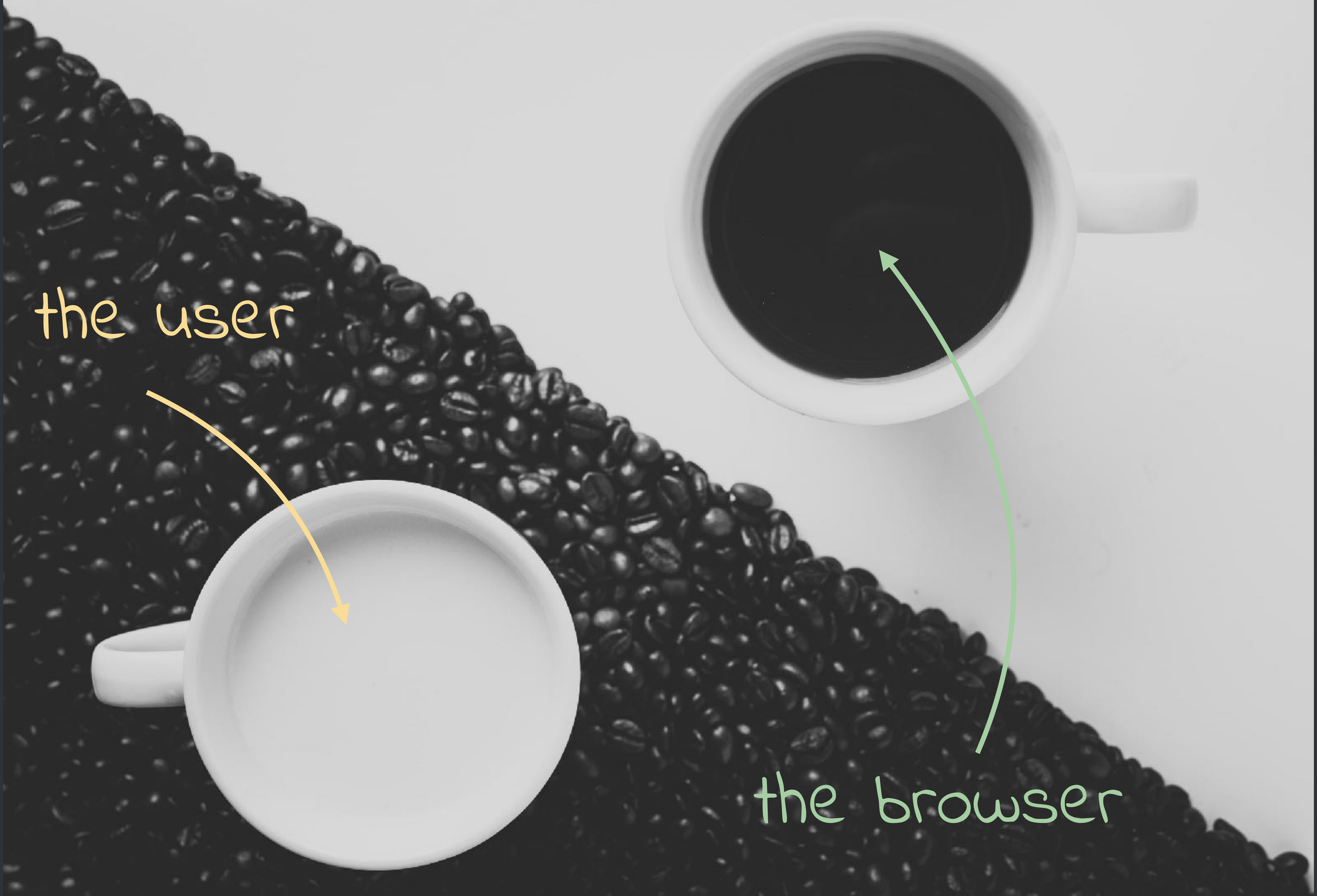
Practical Web Animation

Lisi Linhart

ölz
Linzer
Kelly

the user


the user
the browser

all kinds of experiences

FIL

Animation with the Browser

4 things a browser can animate cheaply

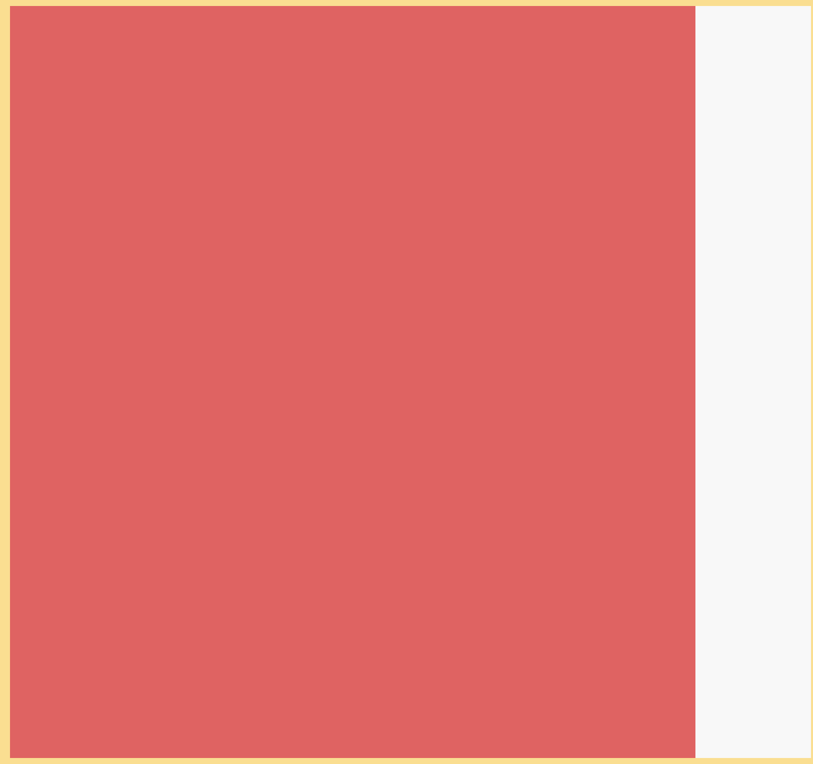
4 things a browser can animate cheaply

position

`translateX(-10px);`

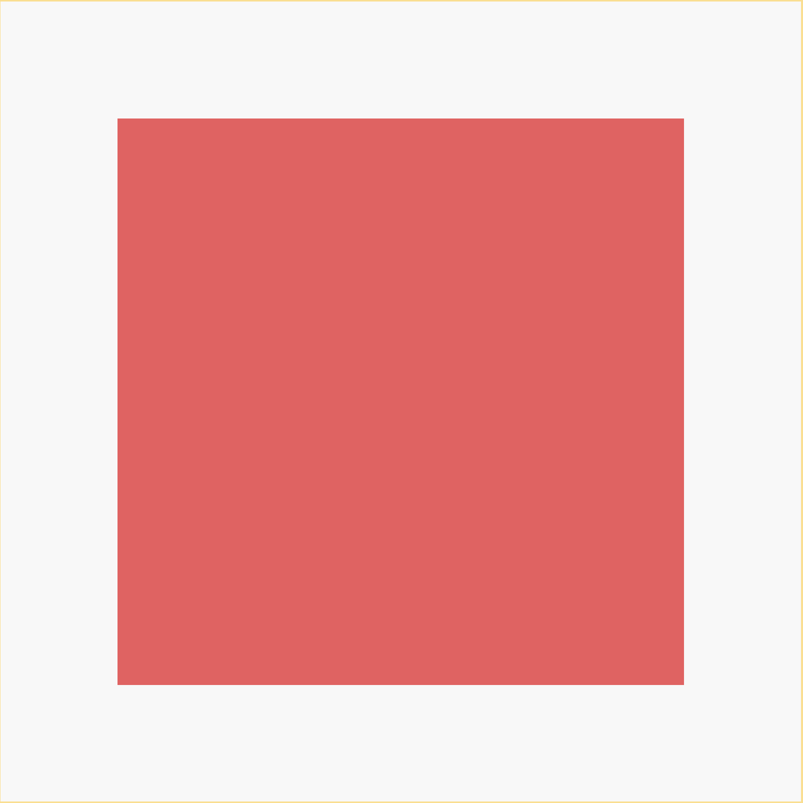
4 things a browser can animate cheaply

position



`translateX(-10px);`

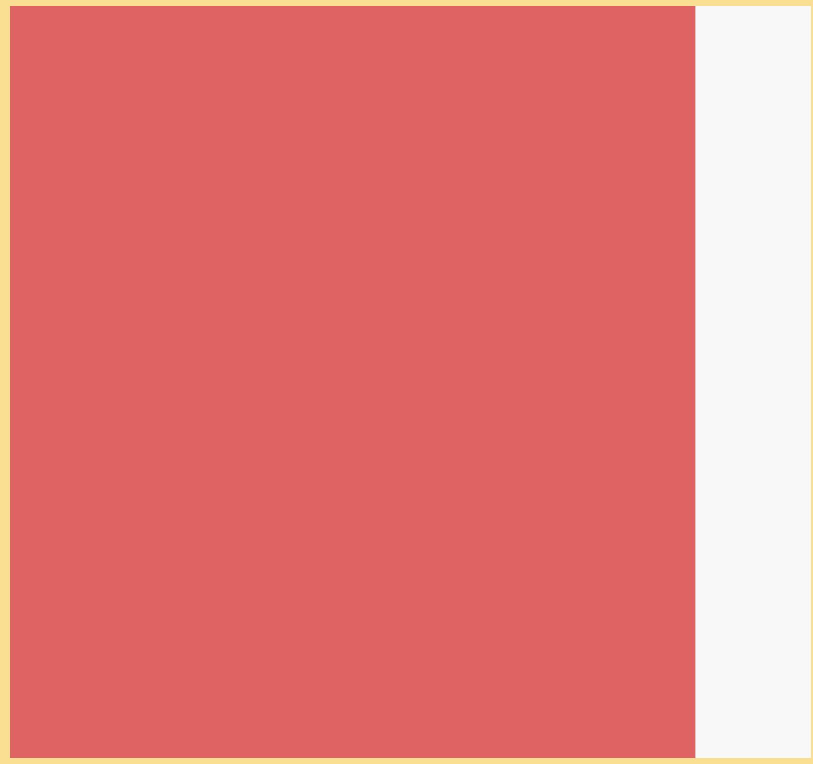
scale



`scale(0.5);`

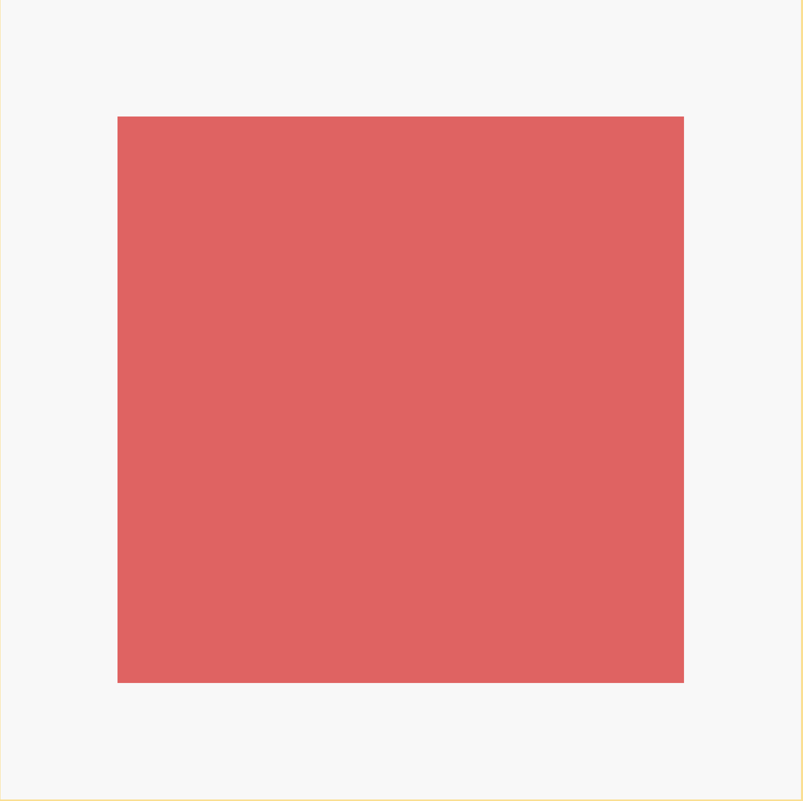
4 things a browser can animate cheaply

position



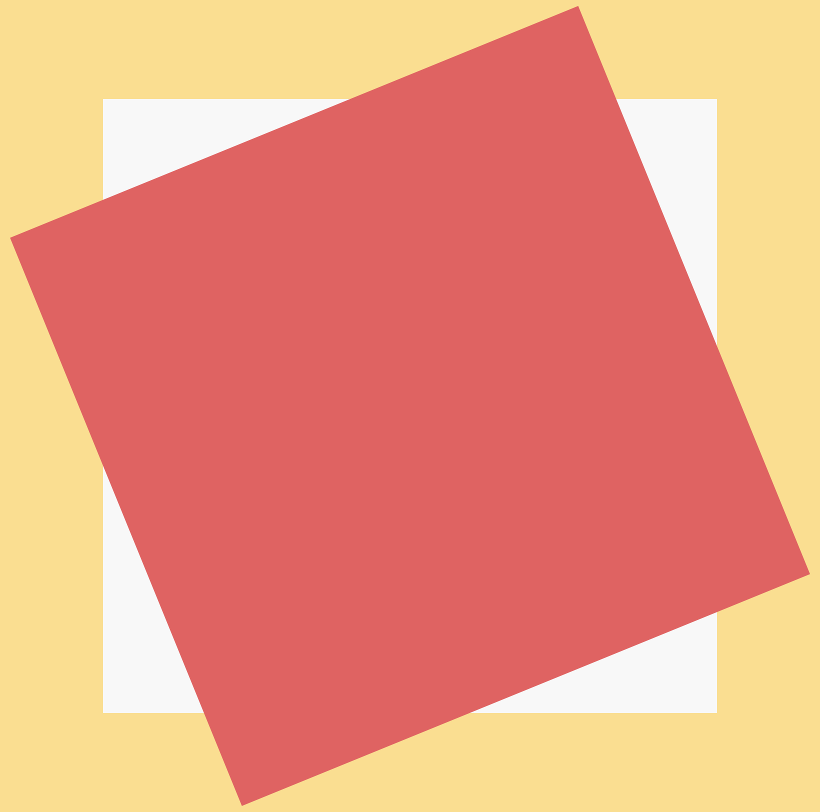
`translateX(-10px);`

scale



`scale(0.5);`

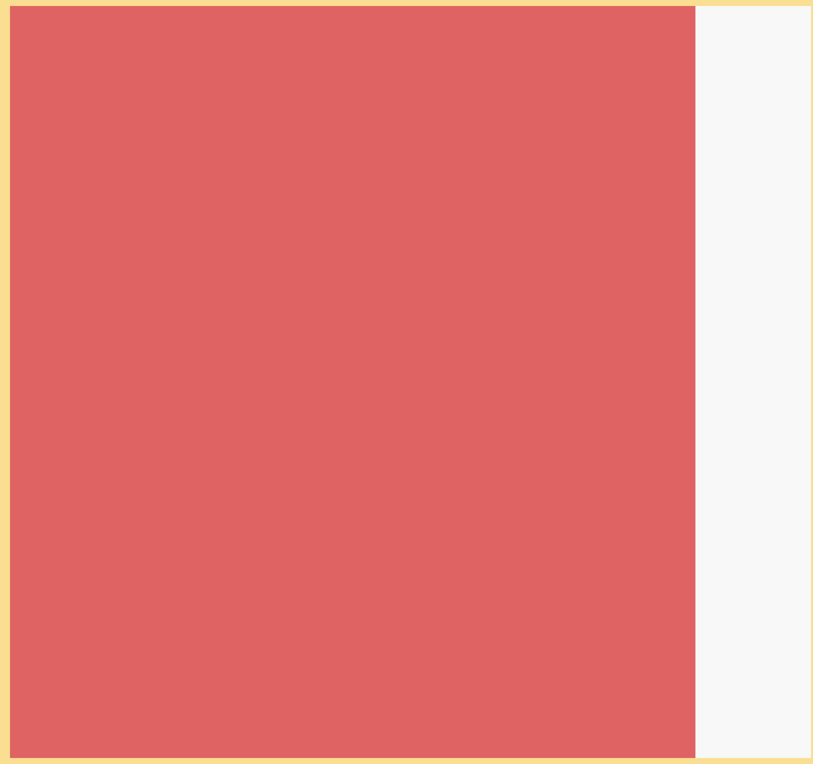
rotation



`rotate(-25deg);`

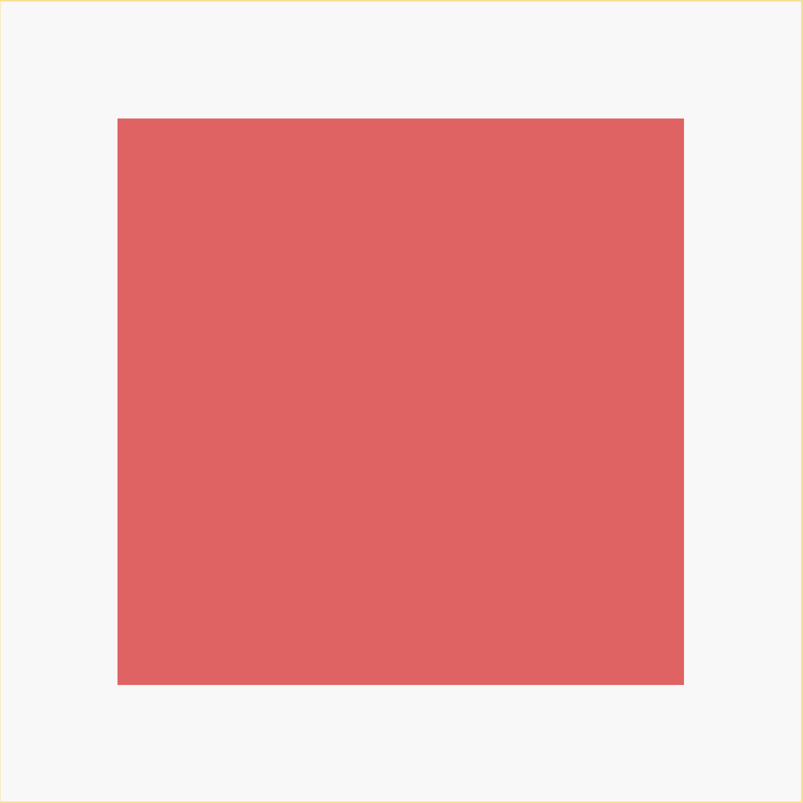
4 things a browser can animate cheaply

position



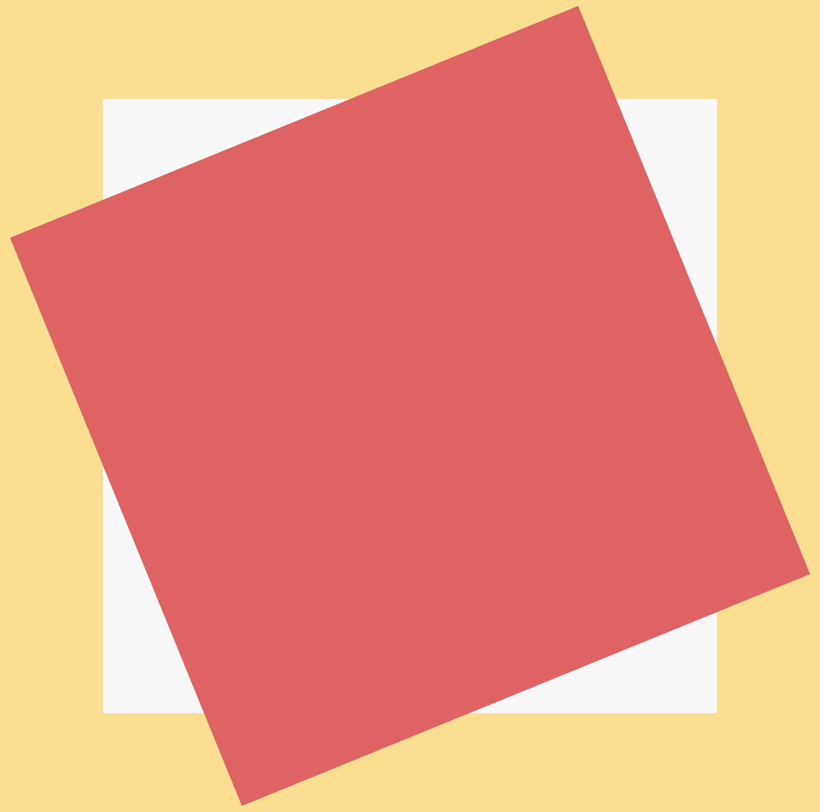
`translateX(-10px);`

scale



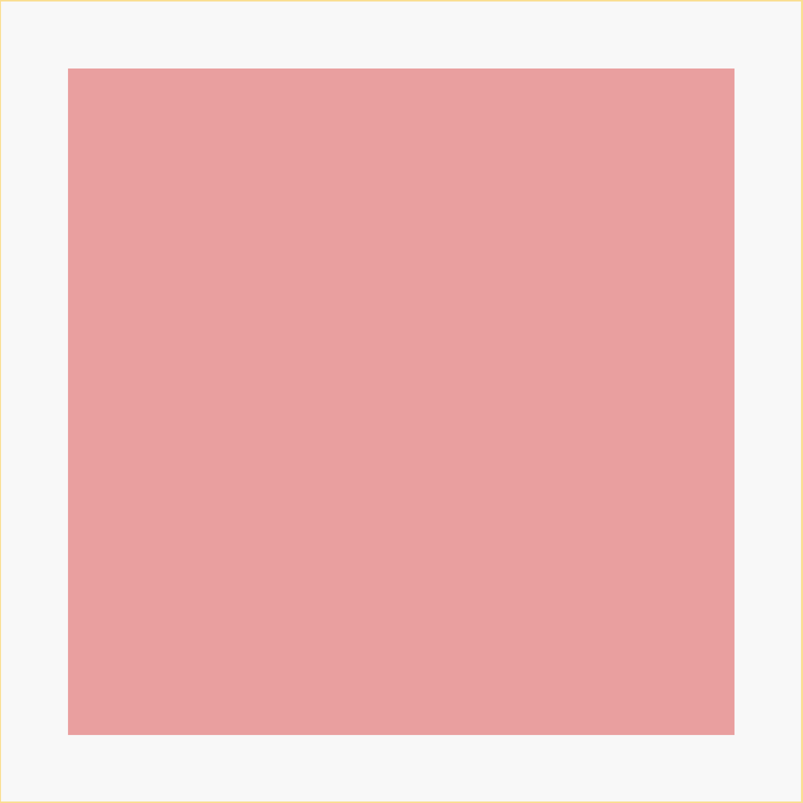
`scale(0.5);`

rotation



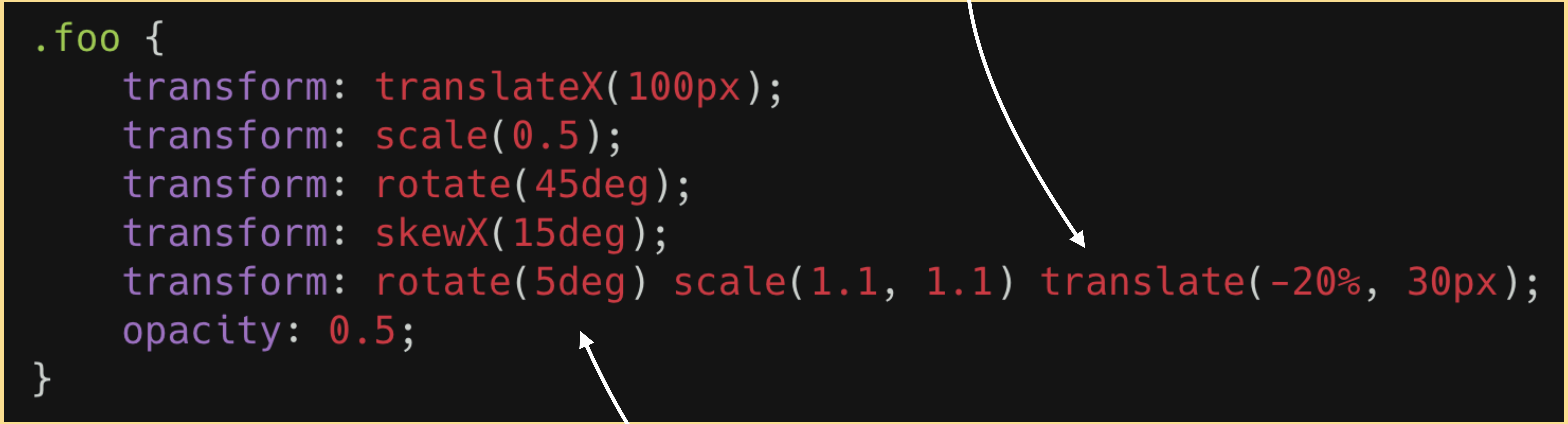
`rotate(-25deg);`

opacity



`opacity: 0.5;`

order matters



```css
.foo {
    transform: translateX(100px);
    transform: scale(0.5);
    transform: rotate(45deg);
    transform: skewX(15deg);
    transform: rotate(5deg) scale(1.1, 1.1) translate(-20%, 30px);
    opacity: 0.5;
}
```

transform properties can be chained

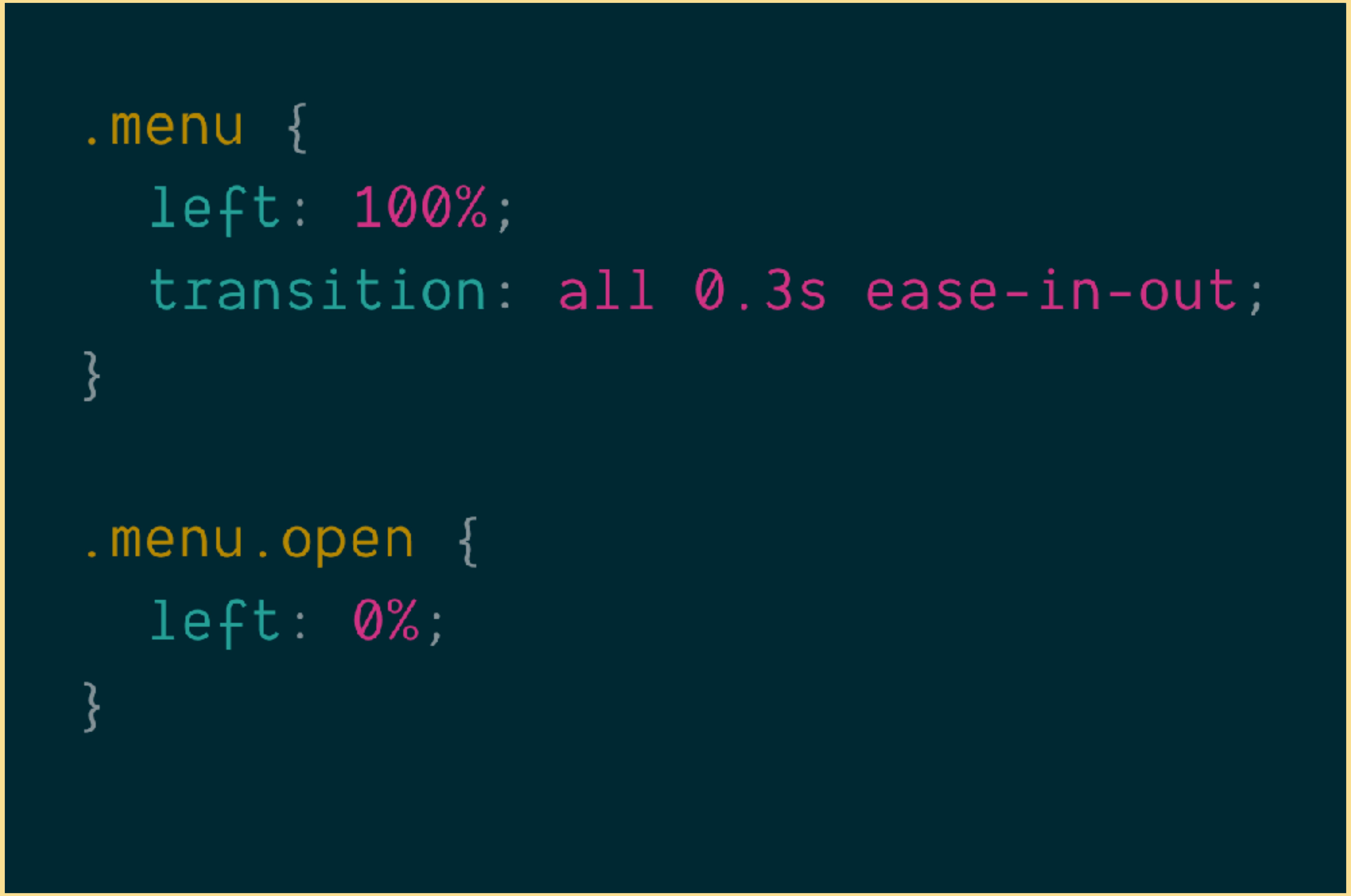
Visual Reference: Transform Coordinate Systems

A PEN BY Dan Wilson

```
transform:  translateX(66vmin) rotate(.125turn) scale(.5) translateY(66vmin)
```

codepen.io/danwilson/pen/eEYdgo

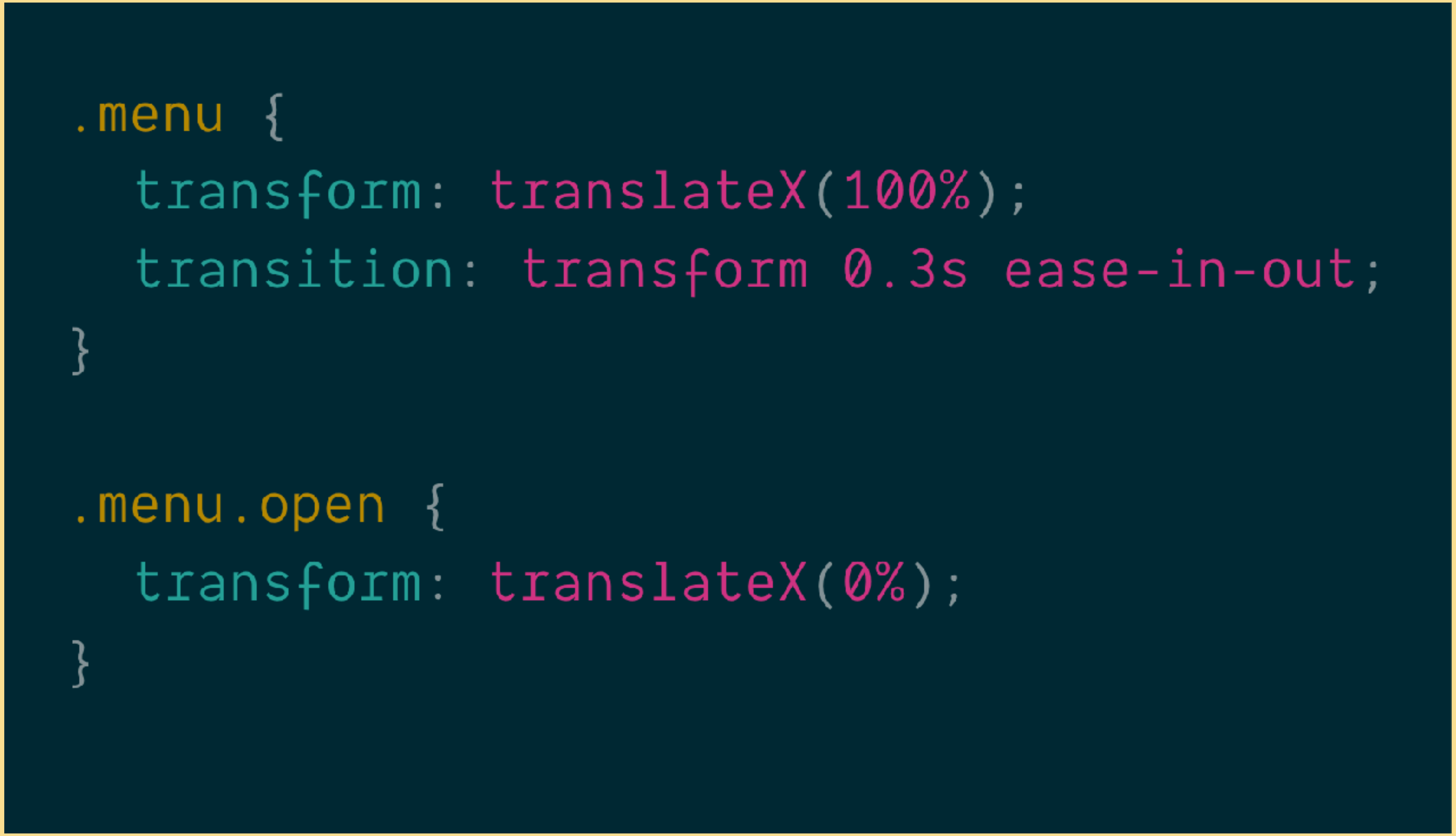
this is not performant



```
.menu {
  left: 100%;
  transition: all 0.3s ease-in-out;
}

.menu.open {
  left: 0%;
}
```

use the transform property 💪



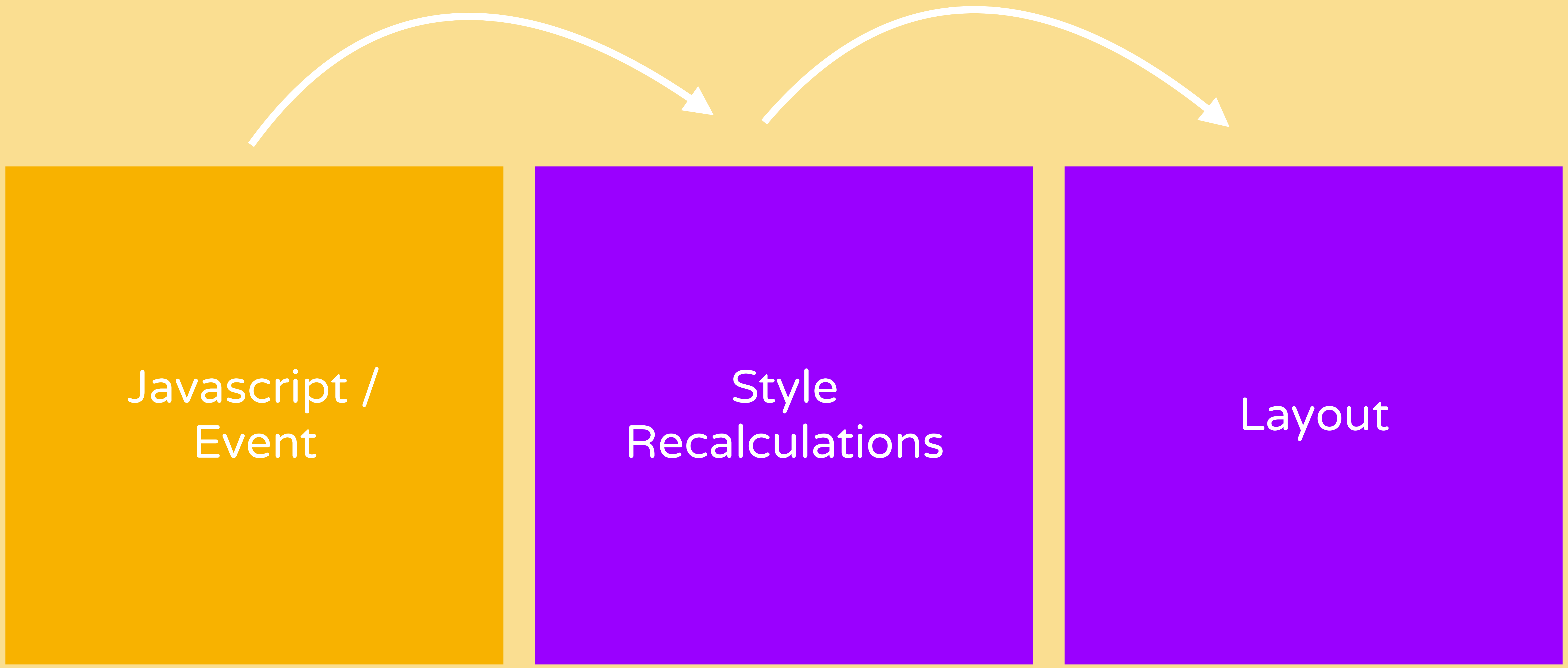
```css
.menu {
  transform: translateX(100%);
  transition: transform 0.3s ease-in-out;
}

.menu.open {
  transform: translateX(0%);
}
```

Rendering Performance

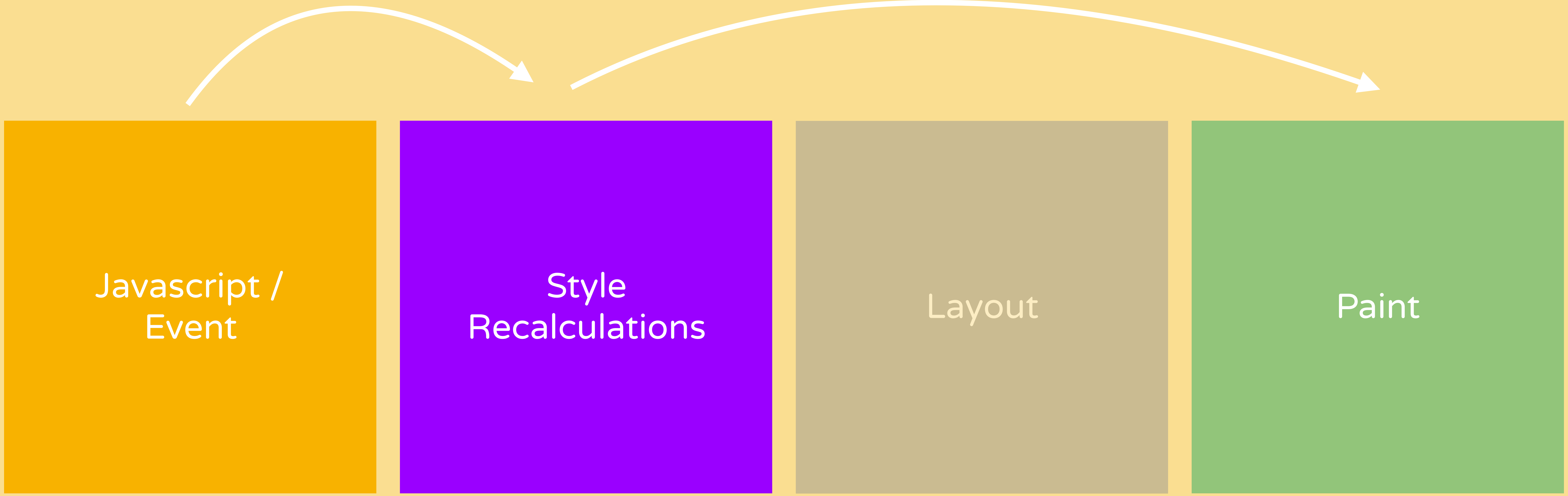
Javascript /
Event

Rendering Performance



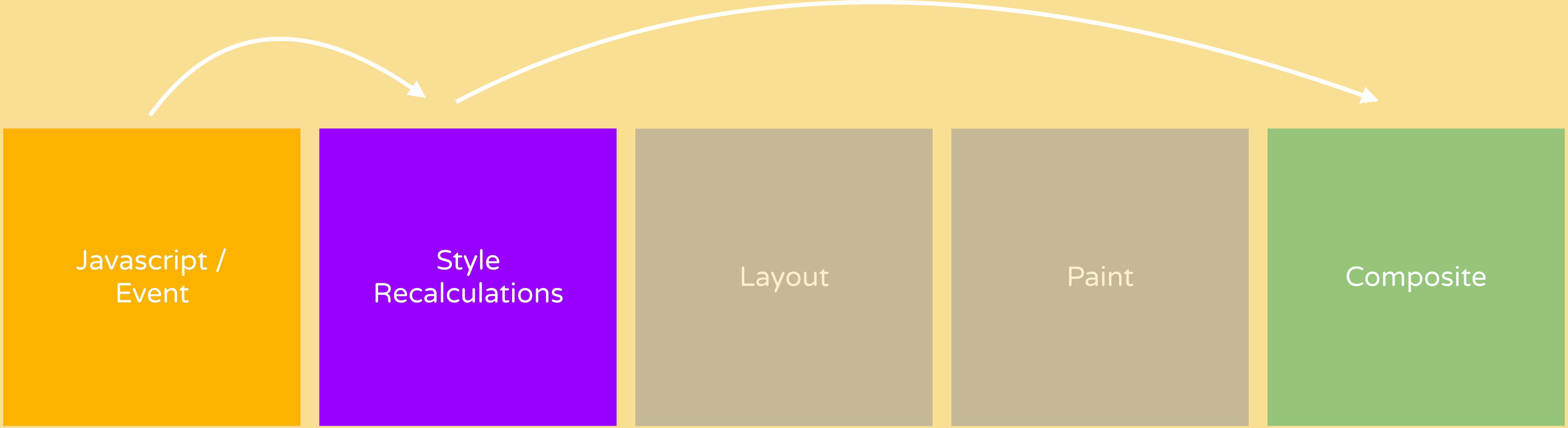
```
width,
margin,
left,
..
```

Rendering Performance



```
background,
box-shadow,
outline,
..
```

Rendering Performance



Javascript / Event

Style Recalculations

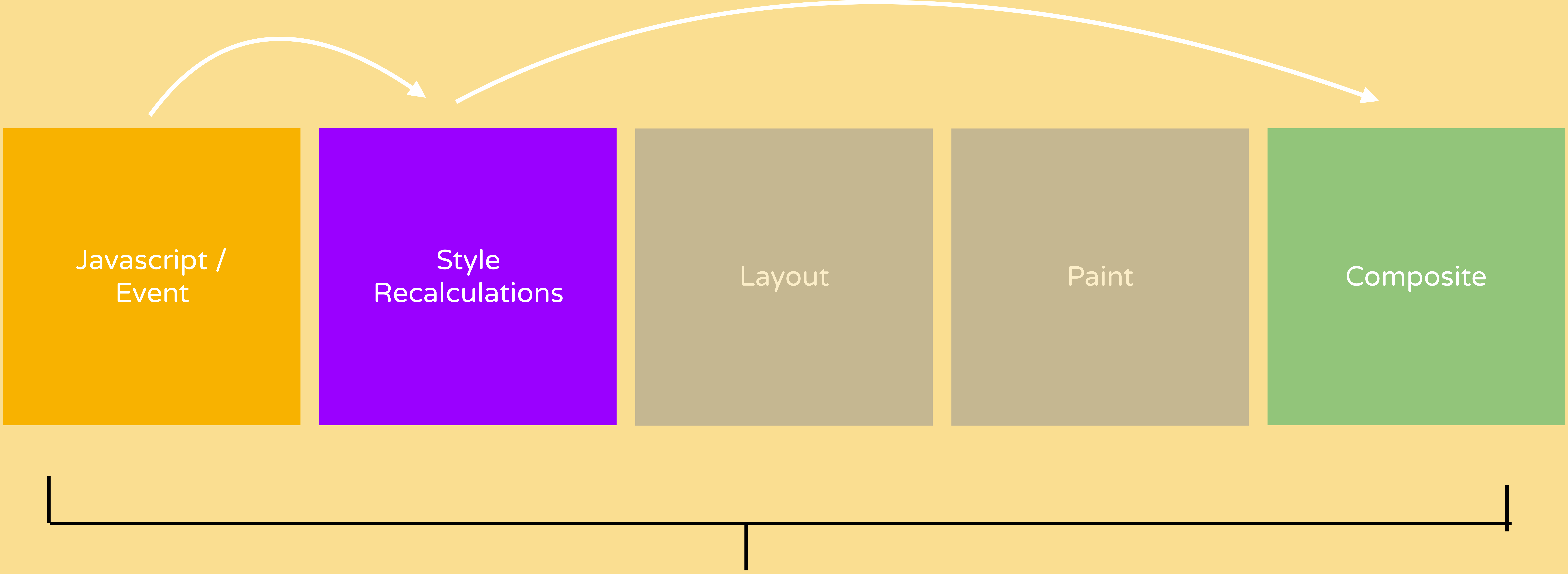
Layout

Paint

Composite

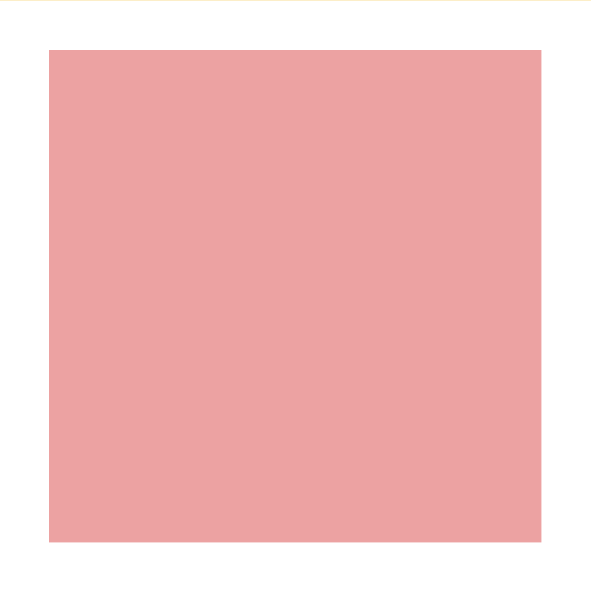
`transform,`
`opacity`
`..`

Rendering Performance



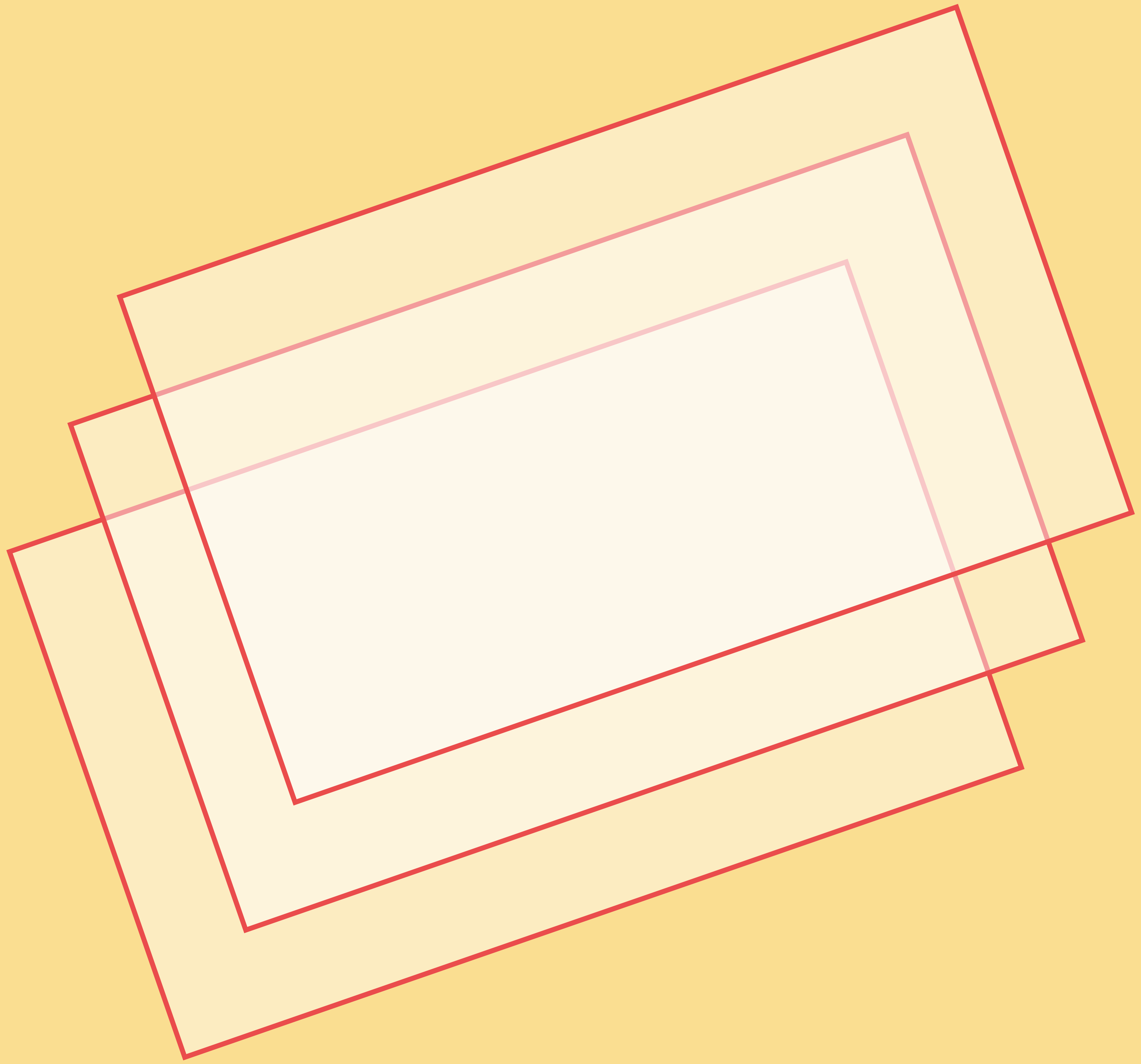
1 frame

`translateX(-10px);`



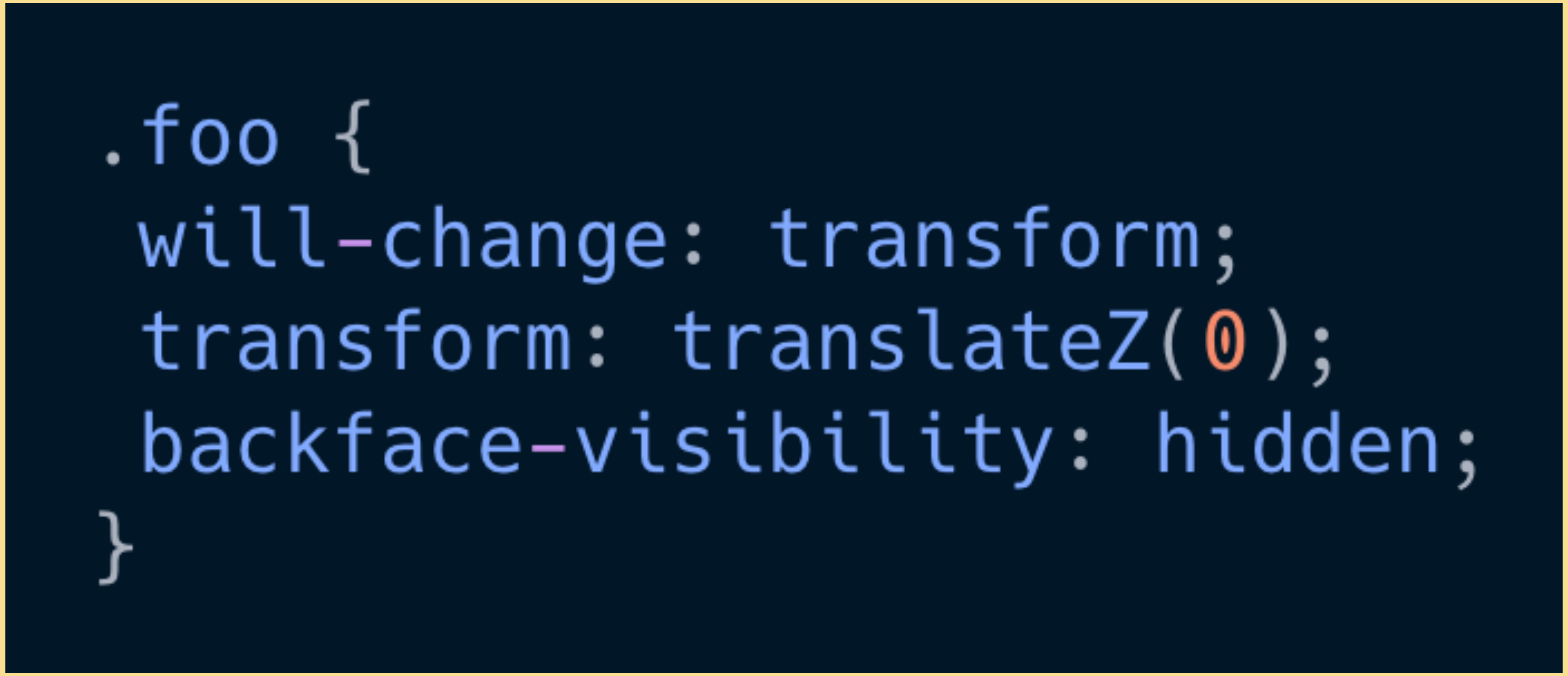
`opacity: 0.5;`

try to limit yourself to
CSS transform
& opacity for most
animations



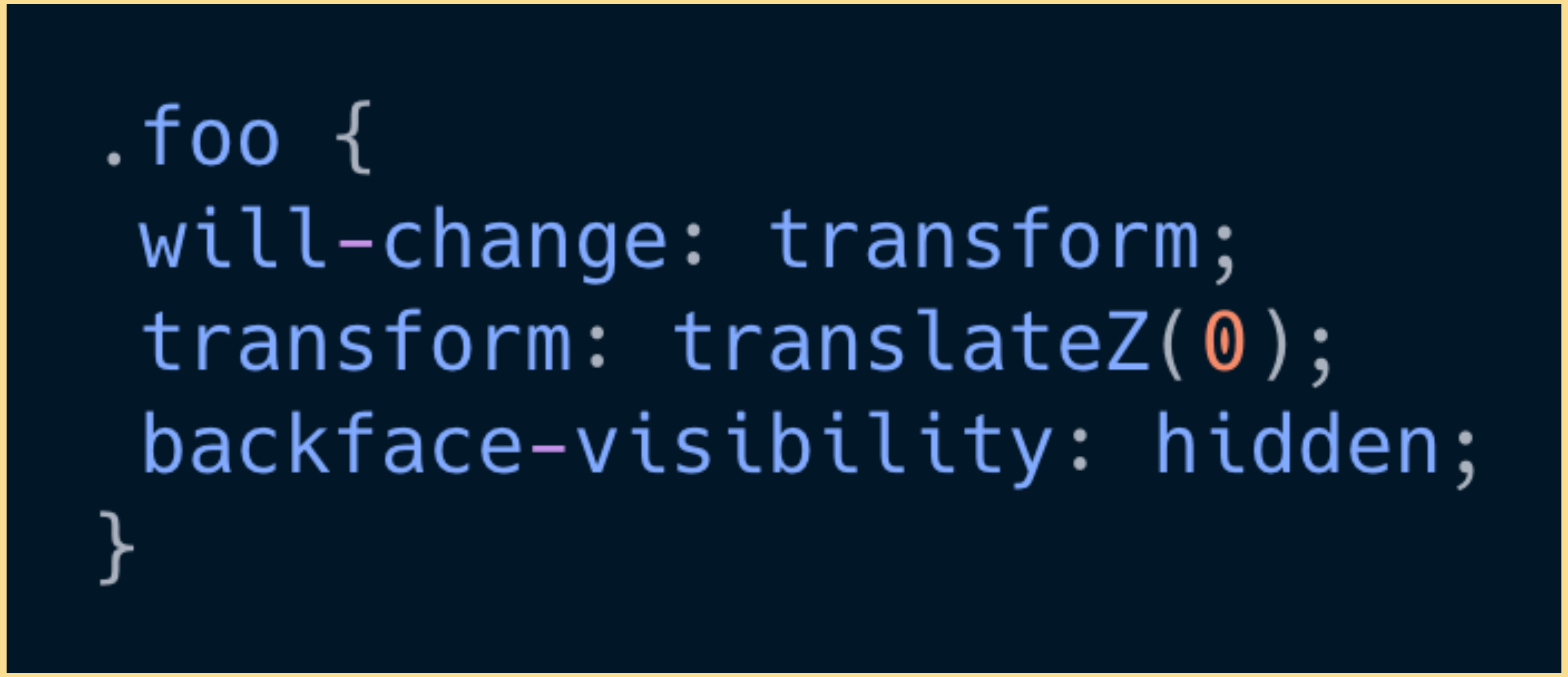
promote elements to
new layers if animated
often & constantly

Creating new layers



```css
.foo {
 will-change: transform;
 transform: translateZ(0);
 backface-visibility: hidden;
}
```

Creating new layers



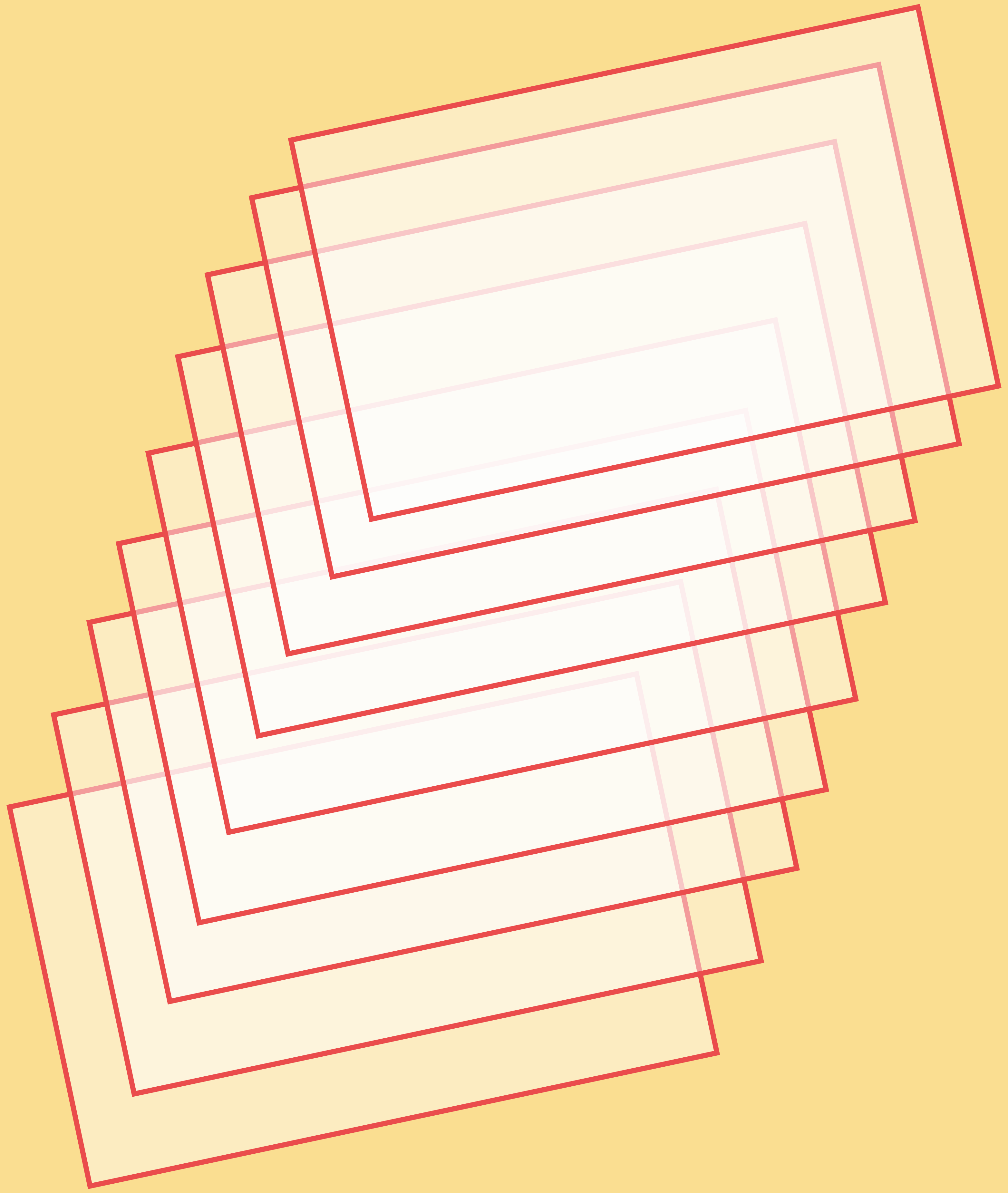
```css
.foo {
 will-change: transform;
 transform: translateZ(0);
 backface-visibility: hidden;
}
```

1. will-change property
2. 3D Transform
3. animated 2D transforms
4. being on top of a compositing layers
5. animated CSS filters

Elements
Console
Network
Layers
»
html
body
div.turtle
Styles
Event Listeners
DOM Breakpoints
Properties
Accessibility
»
Filter
:hov
.cls
+
Force element state
□ :active
□ :hover
□ :focus
□ :visited
□ :focus-within
position 0
margin 167.500
border -
padding -
696 × 332
30.500
30.500
167.500
0
Filter
☑ Show all
align-content normal
align-items normal

```
<!doctype html>
<html lang="en">
  ▶<head>…</head>
… ▼<body translate="no" cz-shortcut-listen="true"> == $0
    ▶<div class="turtle">…</div>
    ▶<div class="turtle">…</div>
    ▶<div class="turtle">…</div>
  </body>
</html>
```

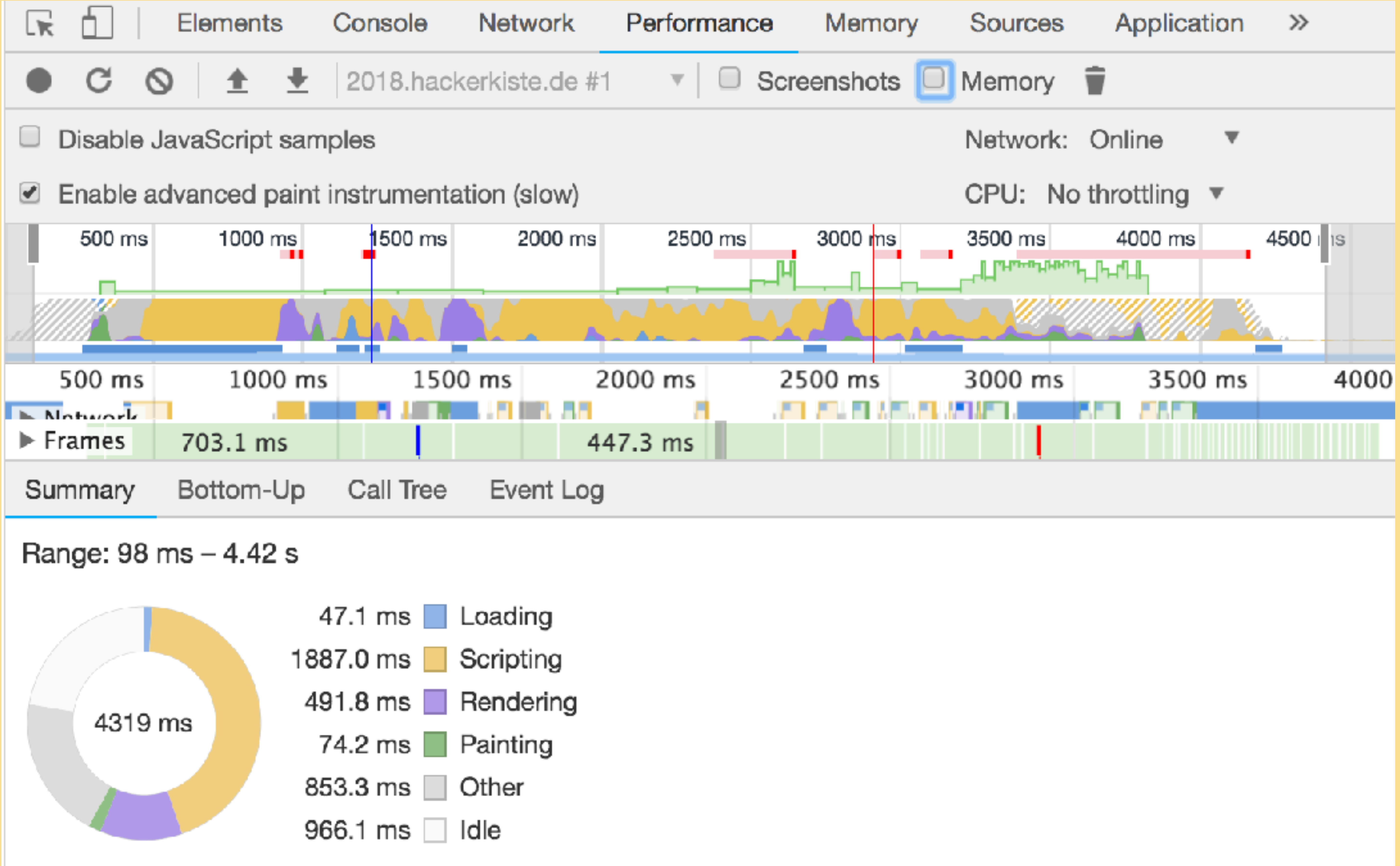
```
element.style {
}
body {                                    LDAmdPOYmJQr:53
  position: relative;
  margin: ▶ auto;
  background: ▶ □#efefef;
  display: flex;
}
body {                                    reset.min.css:1
```



don't create too many layers

remove them if the animation is finished

DevTools



□ Screenshots □ Memory

□ Disable JavaScript samples

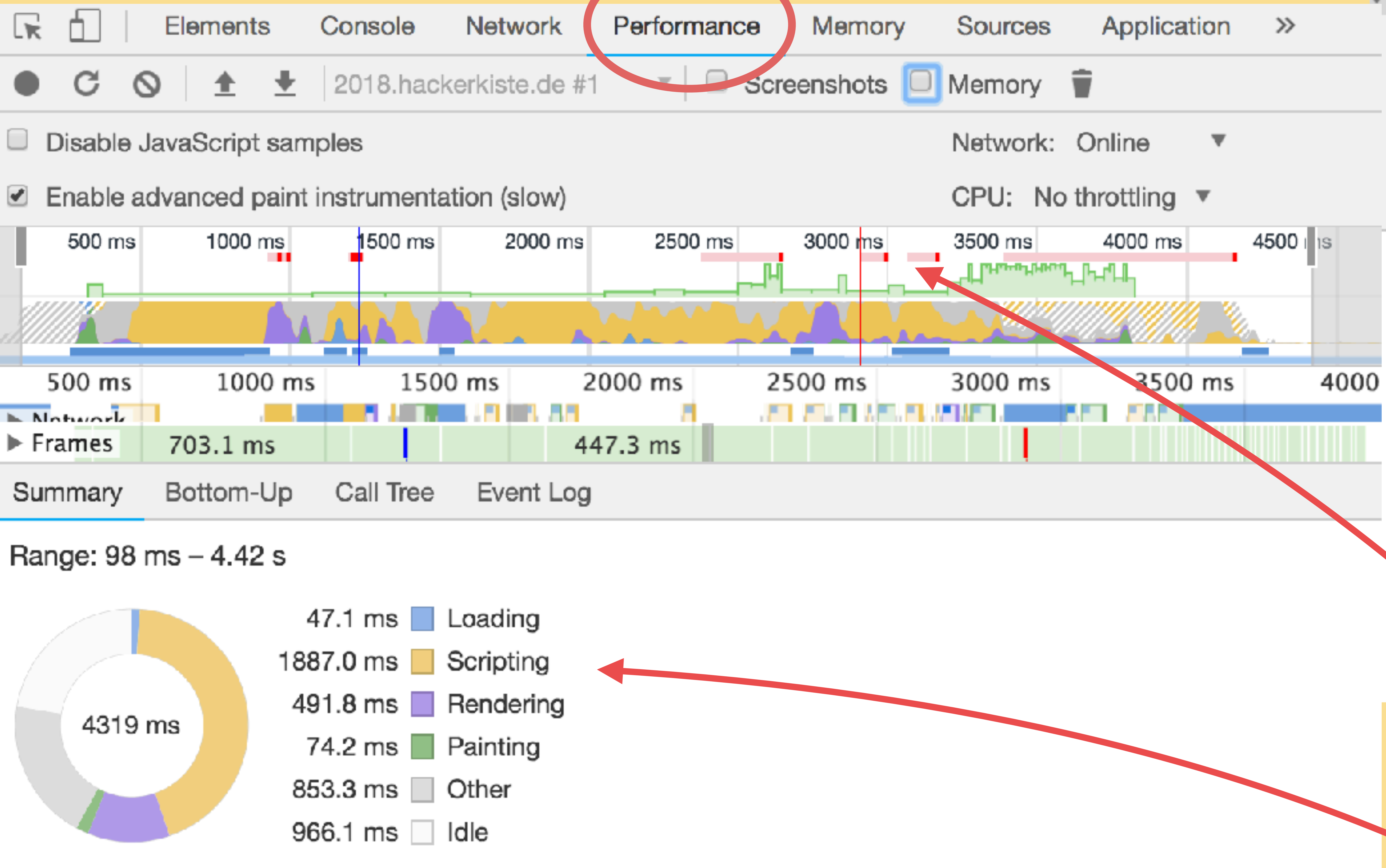
☑ Enable advanced paint instrumentation (slow)

Network: Online

CPU: No throttling

Range: 98 ms – 4.42 s

47.1 ms	🟦	Loading
1887.0 ms	🟨	Scripting
491.8 ms	🟪	Rendering
74.2 ms	🟩	Painting
853.3 ms	⬜	Other
966.1 ms	⬜	Idle



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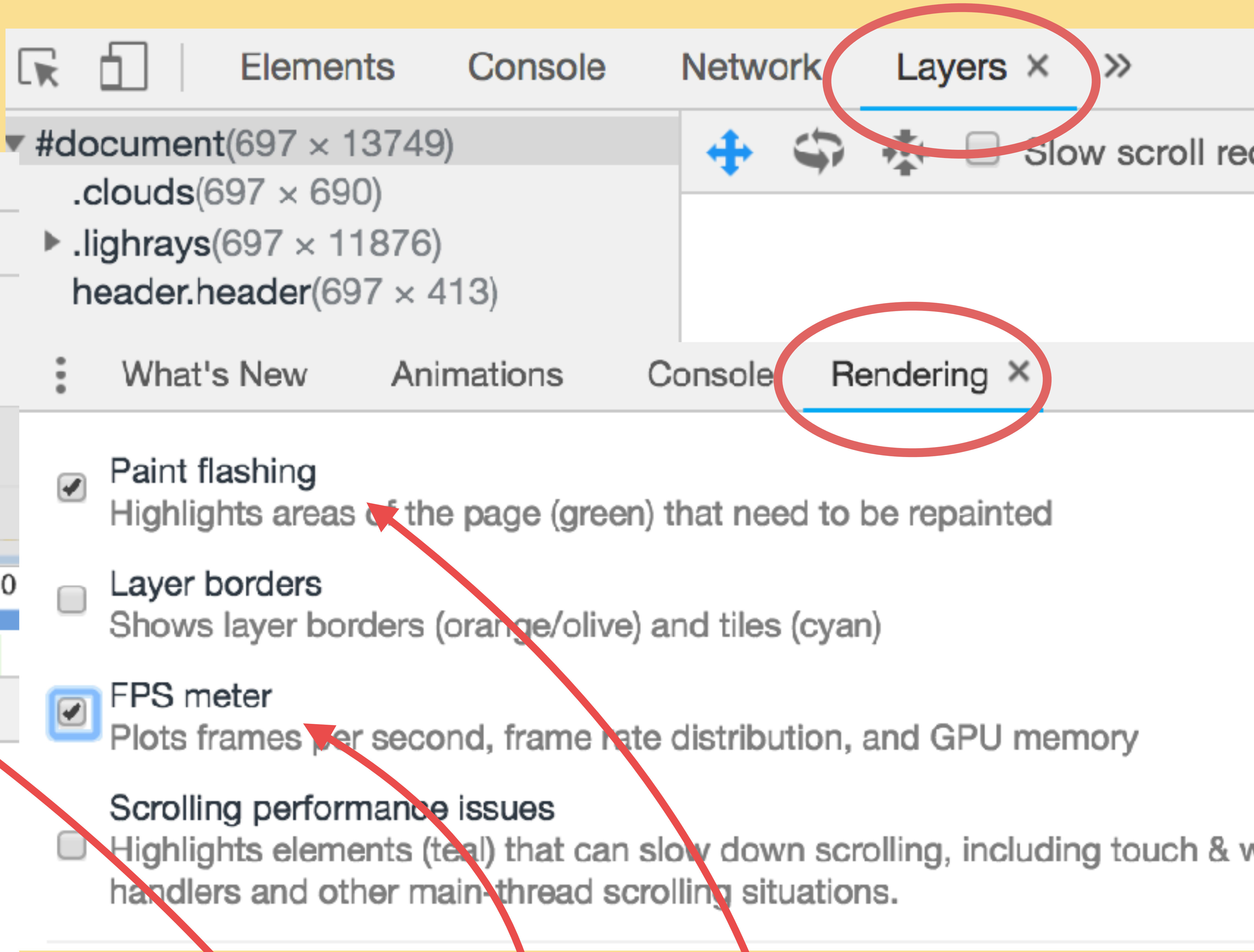


□ Slow scroll rec

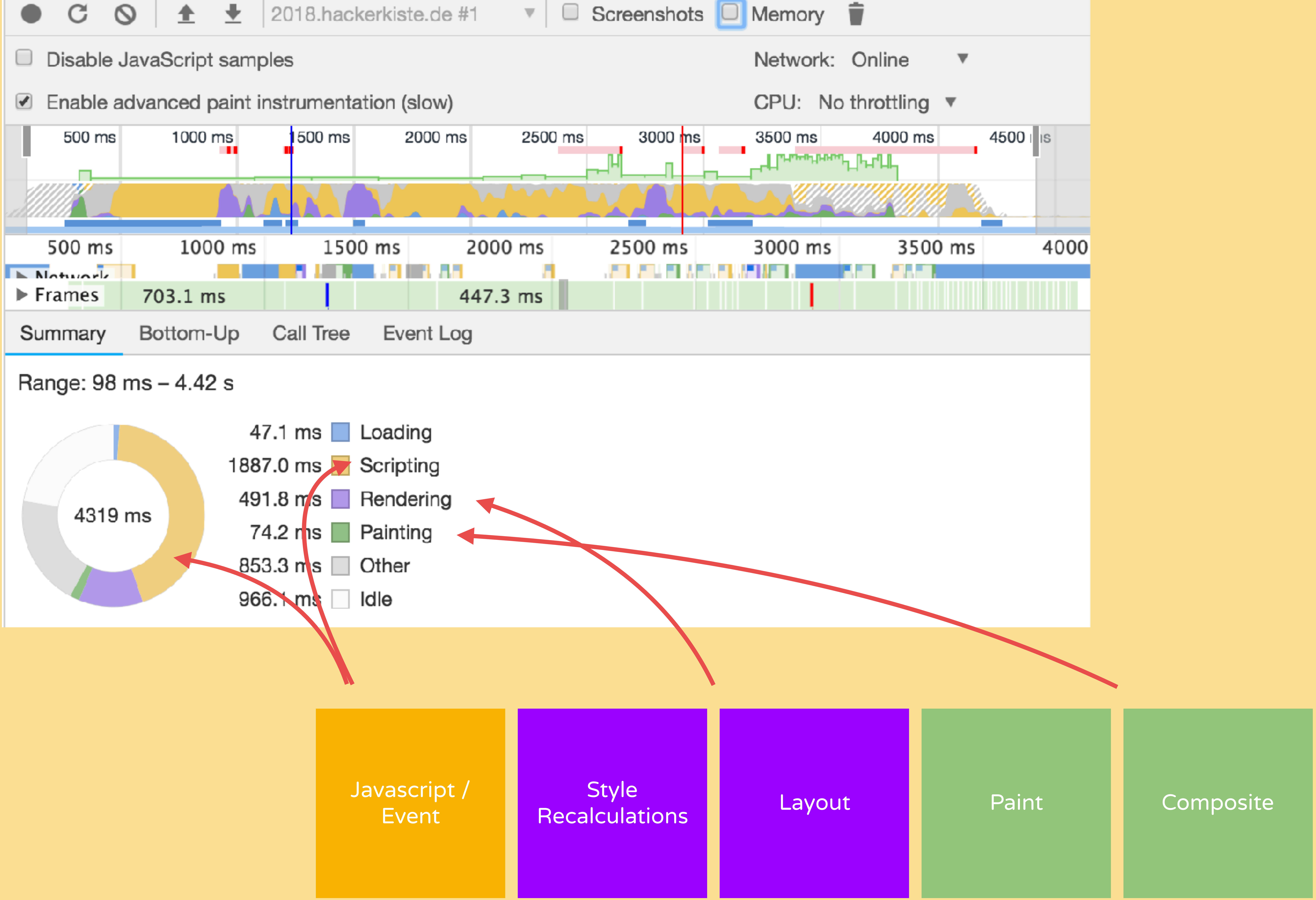
☑ Paint flashing
Highlights areas of the page (green) that need to be repainted

□ Layer borders
Shows layer borders (orange/olive) and tiles (cyan)

☑ FPS meter
Plots frames per second, frame rate distribution, and GPU memory

□ Scrolling performance issues
Highlights elements (teal) that can slow down scrolling, including touch & w
handlers and other main-thread scrolling situations.

inspect & test your
animations in your
devtools



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74.2 ms	🟩	Painting
853.3 ms	⬜	Other
966.1 ms	⬜	Idle

Animation for the User

ORIENTATION & TRANSITIONS

POIGNÉE
DE MAIN
VIRILE
Réalisations
Le studio
Contact
gel
Les
voir le projet
PRÉCÉDENT
SUIVANT
03

Xme Company

BOUTIQUE EN LIGNE

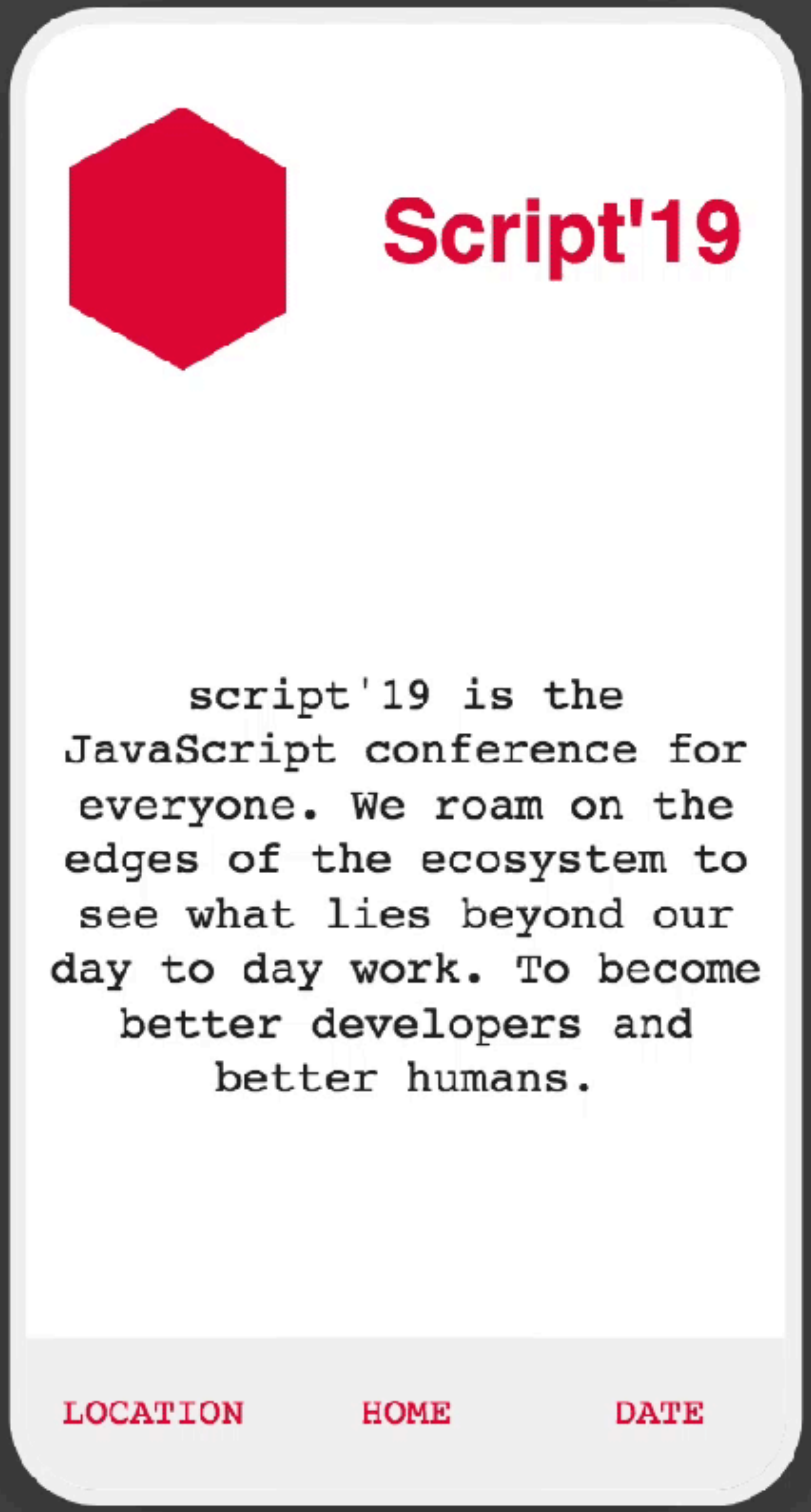
ORIENTATION & TRANSITIONS

1 help with reorientation in the user

2 explain relationships between different information spaces

ORIENTATION & TRANSITIONS

Example: WAAPi

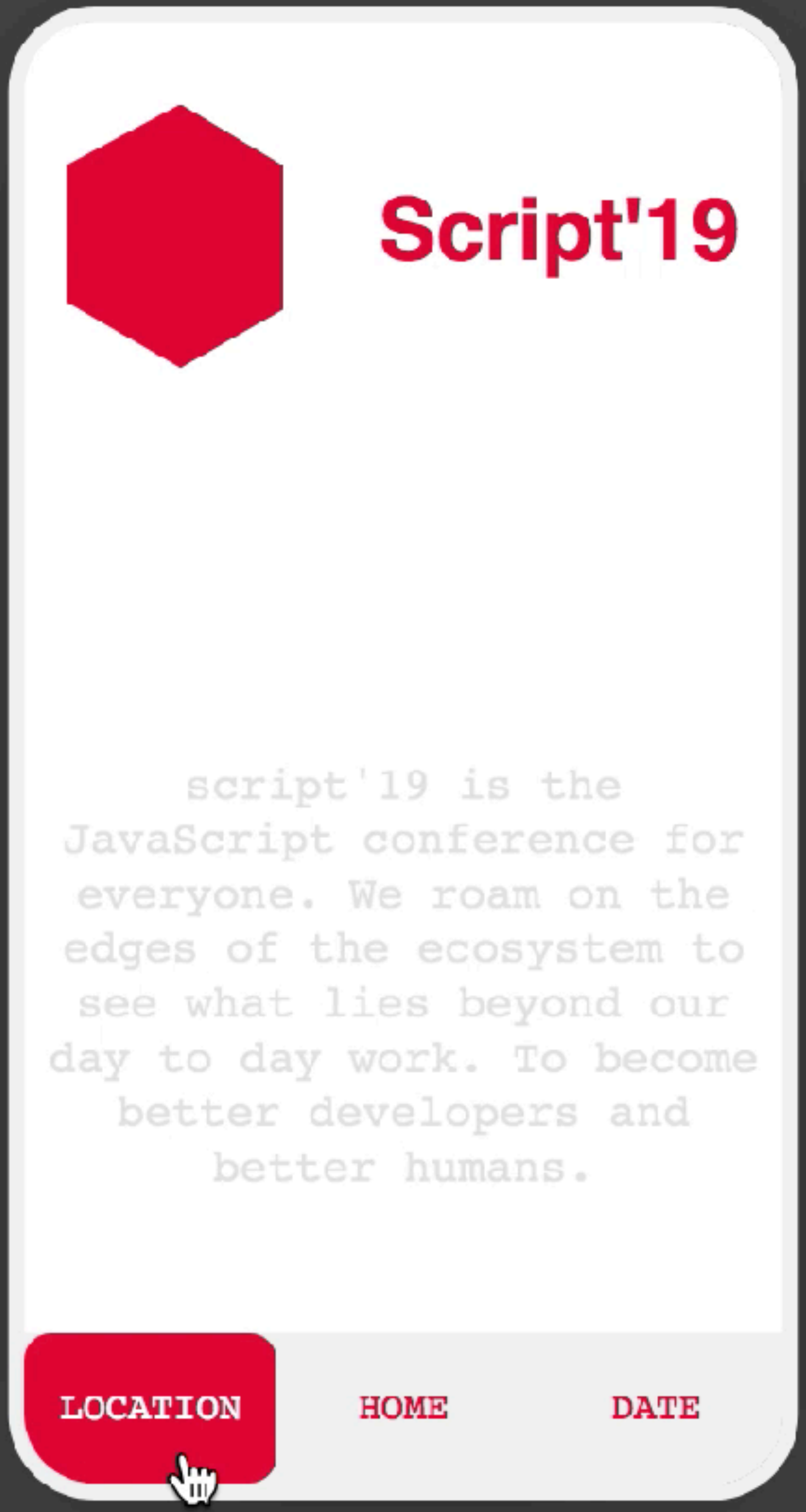


Script'19

script'19 is the JavaScript conference for everyone. We roam on the edges of the ecosystem to see what lies beyond our day to day work. To become better developers and better humans.

codepen.io/lisilinhart/pen/vYYLoQg

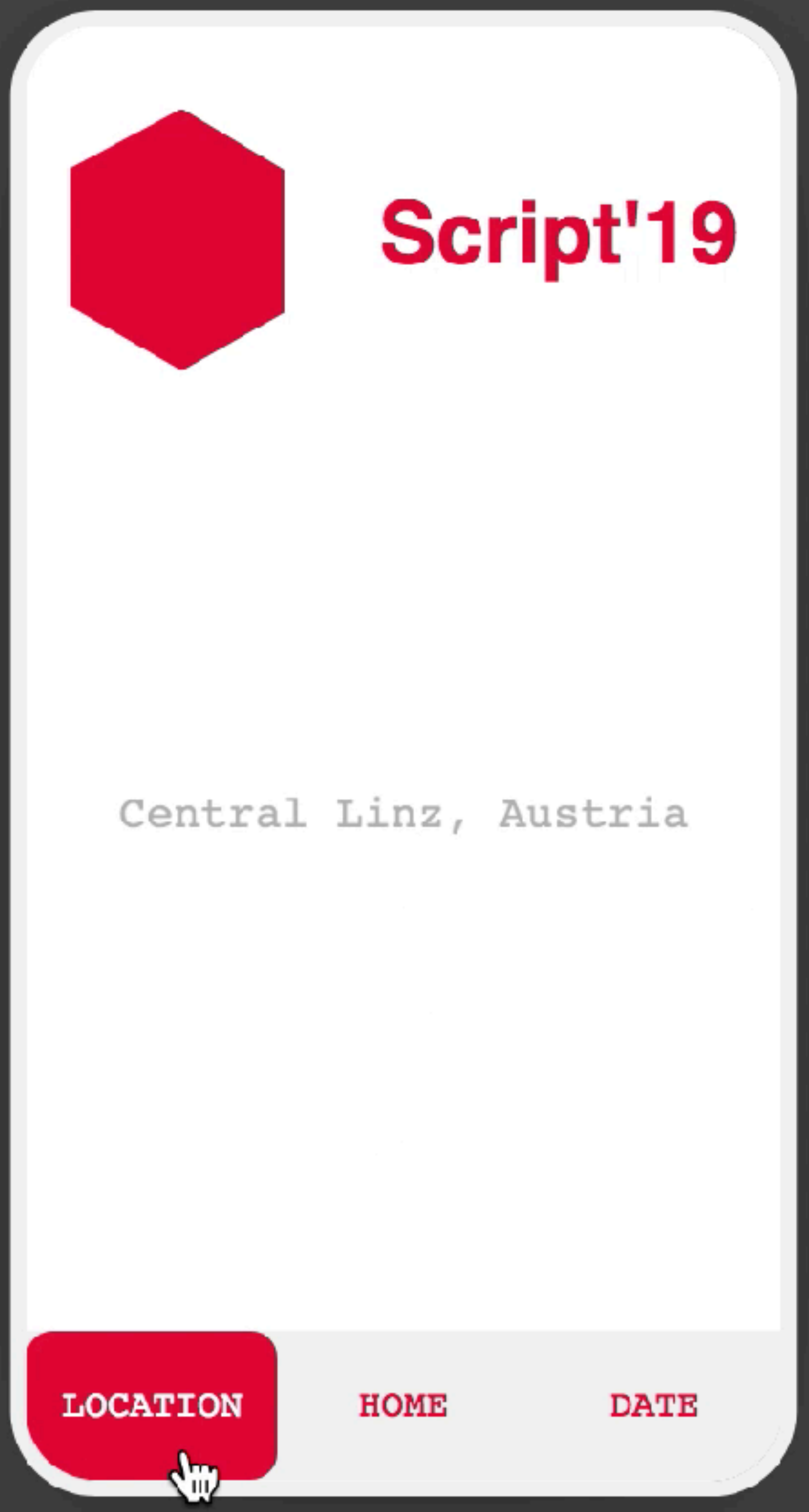
click button to start transition



script'19 is the JavaScript conference for everyone. We roam on the edges of the ecosystem to see what lies beyond our day to day work. To become better developers and better humans.

animate element out and wait for animation to finish

codepen.io/lisilinhart/full/pmYBva



animate new element in once the animation finished

codepen.io/lisilinhart/full/pmYBva

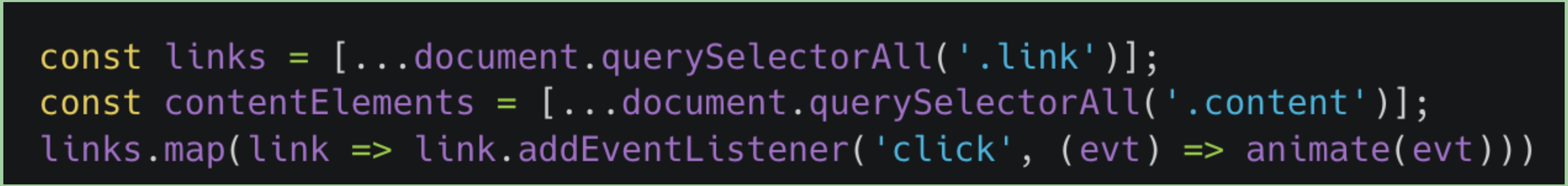
WAAPI Transitions

```
<main class="wrapper">
  <p id="home" class='content'>
    script'19 is the JavaScript conference for everyone.
    We roam on the edges of the ecosystem to see what
    lies beyond our day to day work. To become better
    developers and better humans.
   </p>
  <p id="location" class='content'>
      Central Linz, Austria
  </p>
  <p id="date" class='content' >
      October 25th
  </p>
</main>
```

elements become visible once we click the correct link

```
<a class="link" href="#location">Location</a>
```

WAAPI Transitions



```
const links = [...document.querySelectorAll('.link')];
const contentElements = [...document.querySelectorAll('.content')];
links.map(link => link.addEventListener('click', (evt) => animate(evt)))
```

call animation function
once a link is clicked

WAAPI Transitions

```
function animate(evt){
    const target = evt.currentTarget.getAttribute("href");
    const toShow = document.querySelector(target);

    contentElements.map(el => {
        if (el.classList.contains('visible')) {
                const animation = el.animate(leavingAnimation, timingIn)

                animation.onfinish = () => {
                    el.classList.remove('visible');
                    toShow.animate(enteringAnimation, timingOut);
                    toShow.classList.add('visible');
                };
        }
    })
}
```

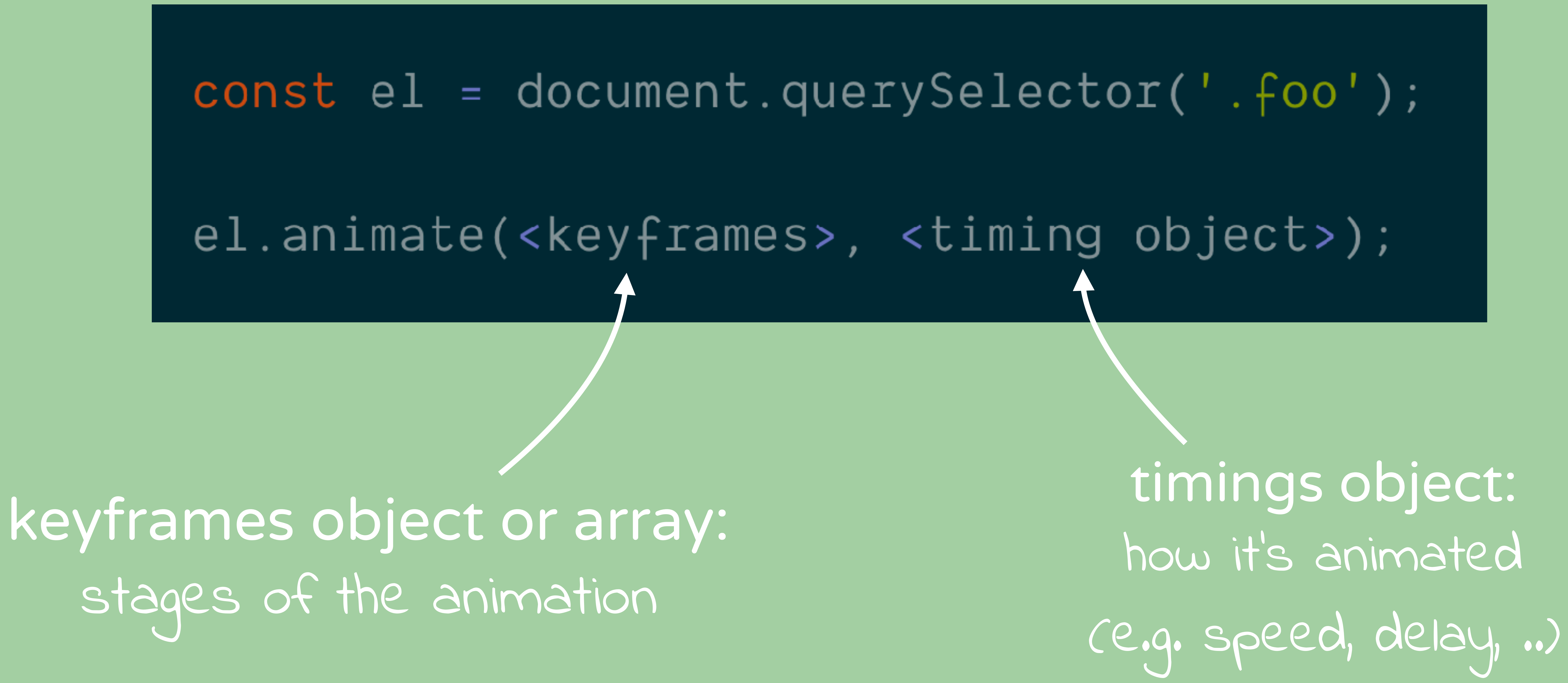
get the element that's currently visible

animate it out

wait for animation to finish

animate new element in

WEB ANIMATIONS **API**



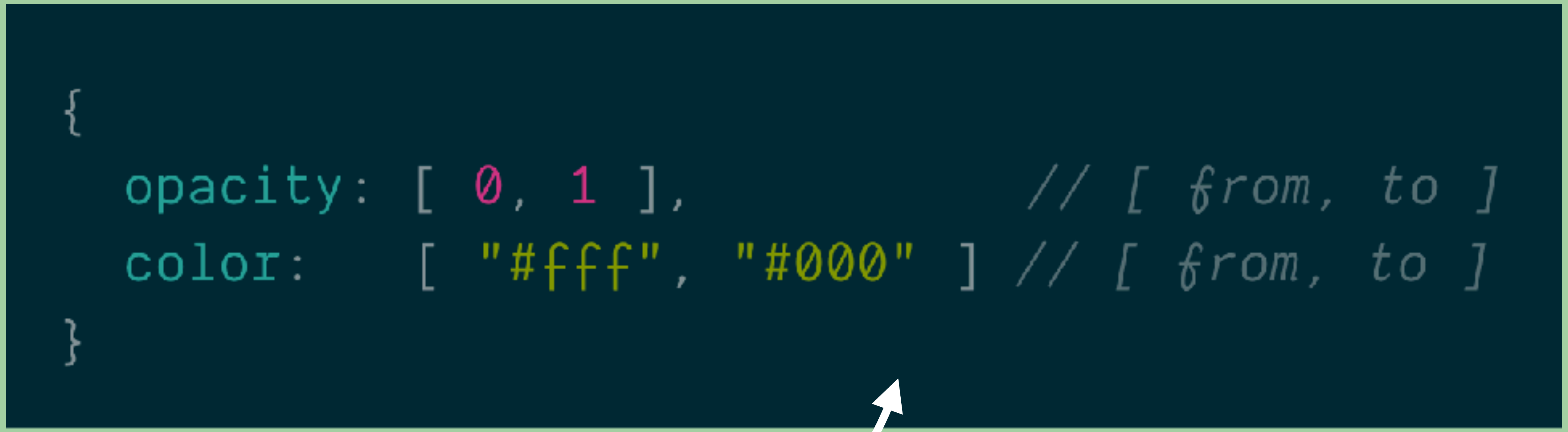
```
const el = document.querySelector('.foo');

el.animate(<keyframes>, <timing object>);
```

keyframes object or array:
stages of the animation

timings object:
how it's animated
(e.g. speed, delay, ..)

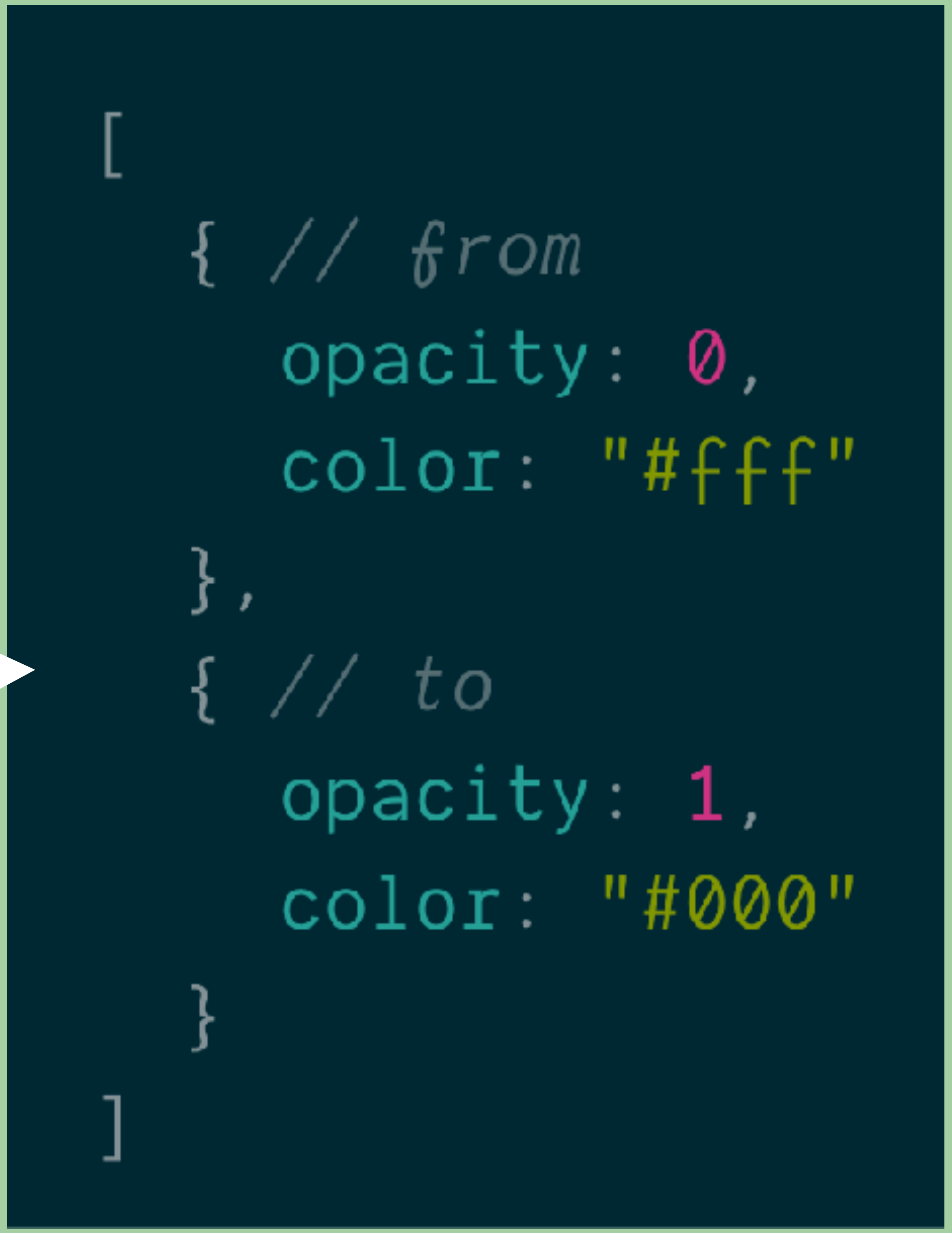
WAAPI KEYFRAMES



```
{
  opacity: [ 0, 1 ],           // [ from, to ]
  color:   [ "#fff", "#000" ] // [ from, to ]
}
```

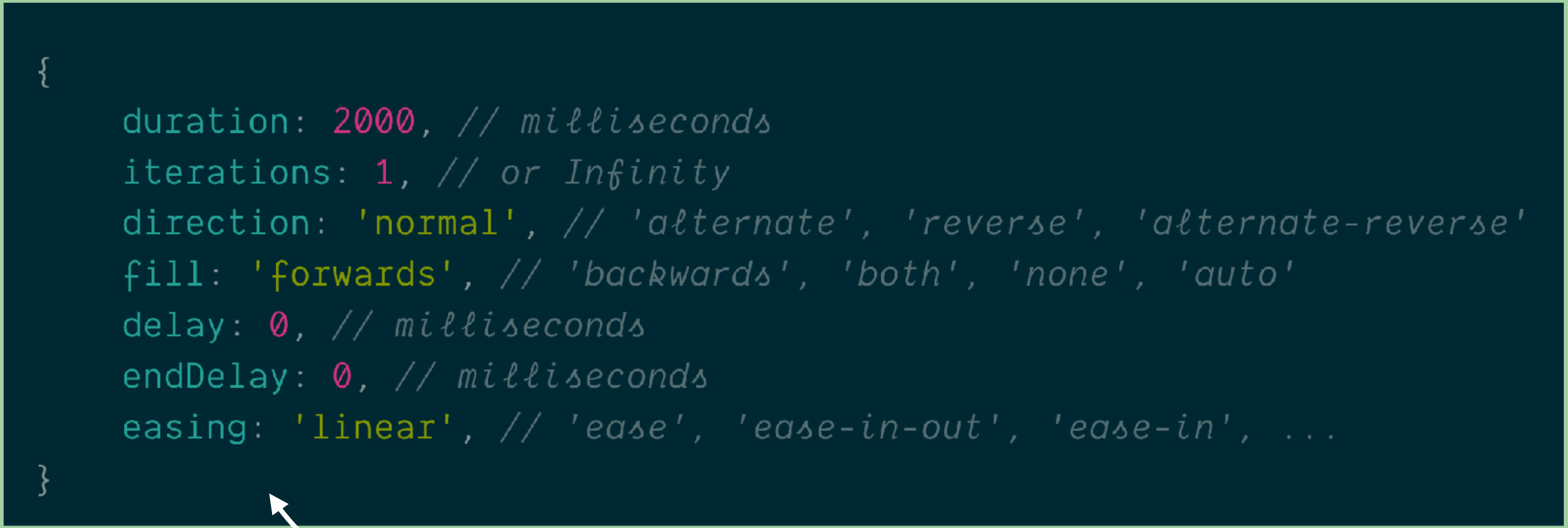
keyframes
object

keyframes
array



```
[
  { // from
    opacity: 0,
    color: "#fff"
  },
  { // to
    opacity: 1,
    color: "#000"
  }
]
```

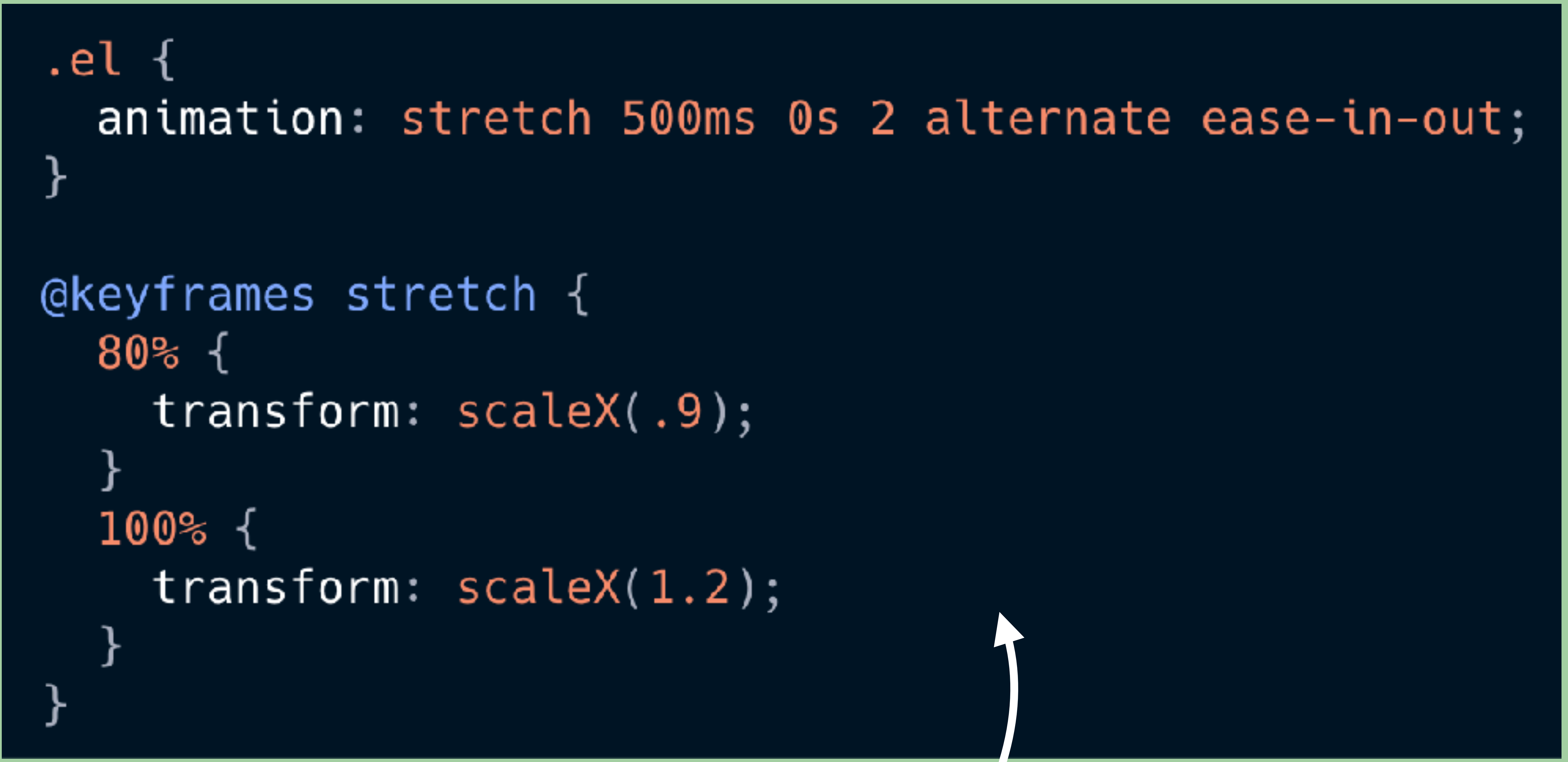
WAAPI TIMINGS OBJECT



```
{
    duration: 2000, // milliseconds
    iterations: 1, // or Infinity
    direction: 'normal', // 'alternate', 'reverse', 'alternate-reverse'
    fill: 'forwards', // 'backwards', 'both', 'none', 'auto'
    delay: 0, // milliseconds
    endDelay: 0, // milliseconds
    easing: 'linear', // 'ease', 'ease-in-out', 'ease-in', ...
}
```

how fast should my animation run, how often should it run, what should happen after it's finished?

CSS VS WAAPI

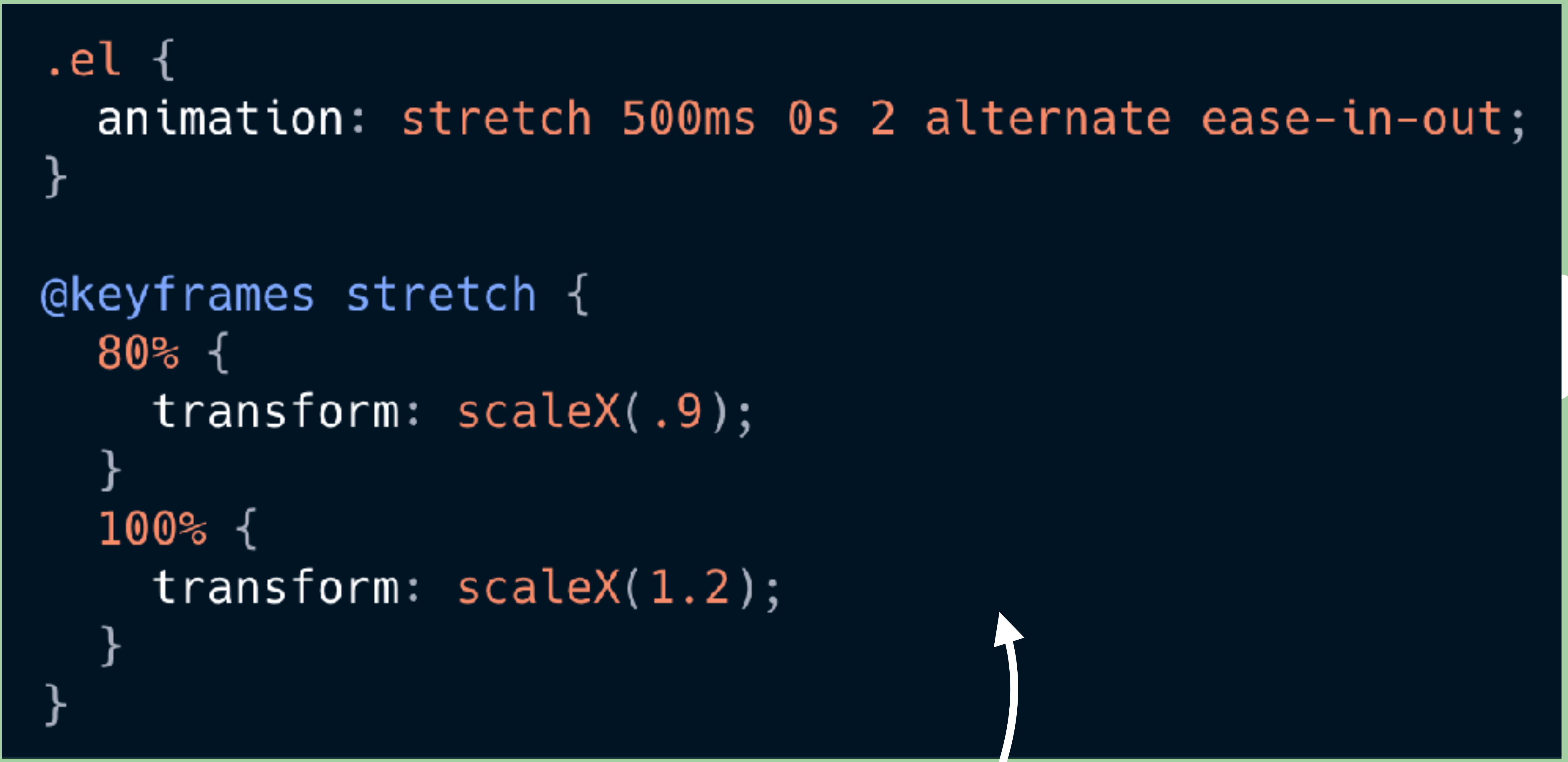


```
.el {
  animation: stretch 500ms 0s 2 alternate ease-in-out;
}

@keyframes stretch {
  80% {
    transform: scaleX(.9);
  }
  100% {
    transform: scaleX(1.2);
  }
}
```

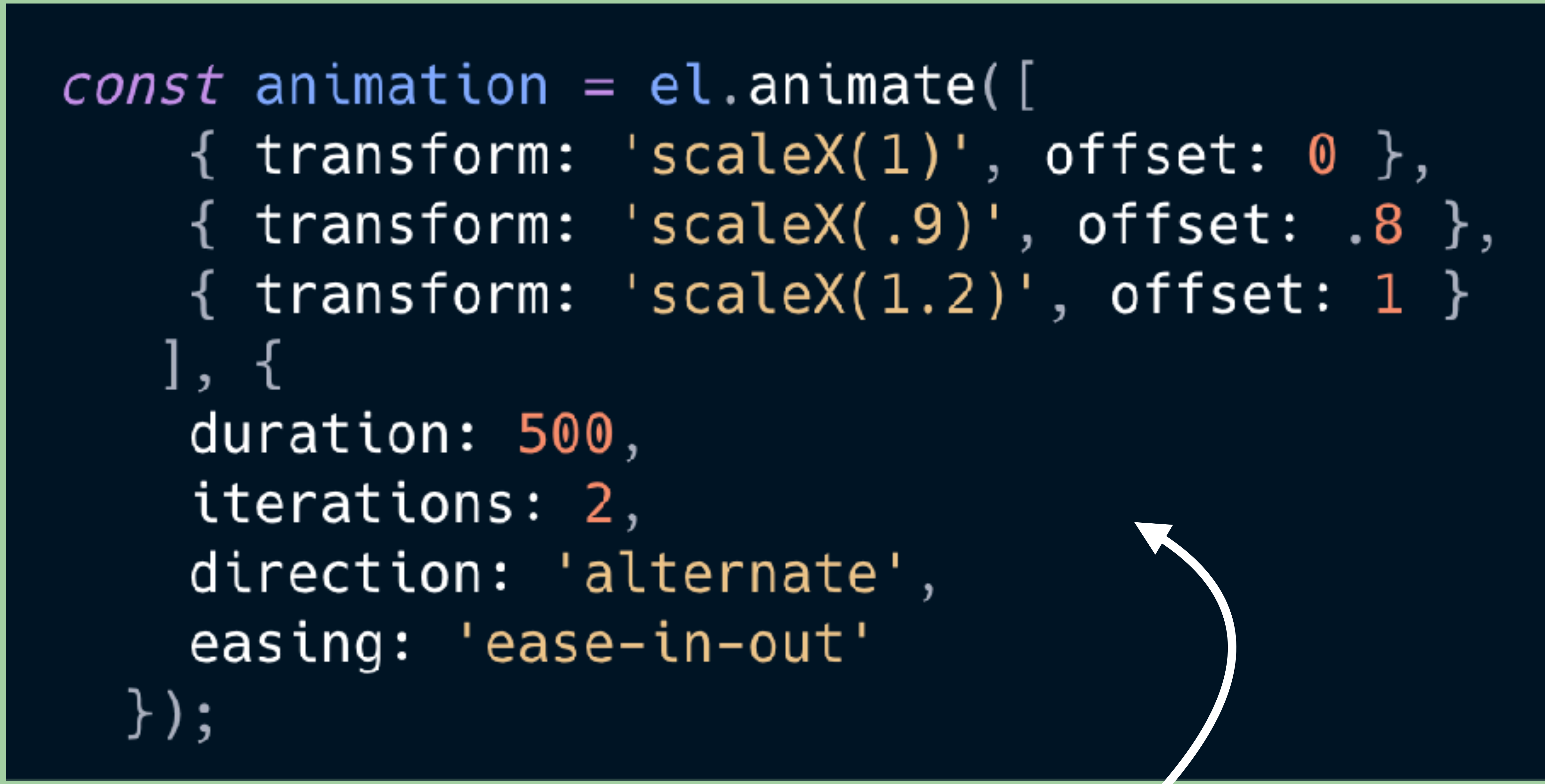
CSS Animation

CSS VS WAAPI



```css
.el {
  animation: stretch 500ms 0s 2 alternate ease-in-out;
}

@keyframes stretch {
  80% {
    transform: scaleX(.9);
  }
  100% {
    transform: scaleX(1.2);
  }
}
```

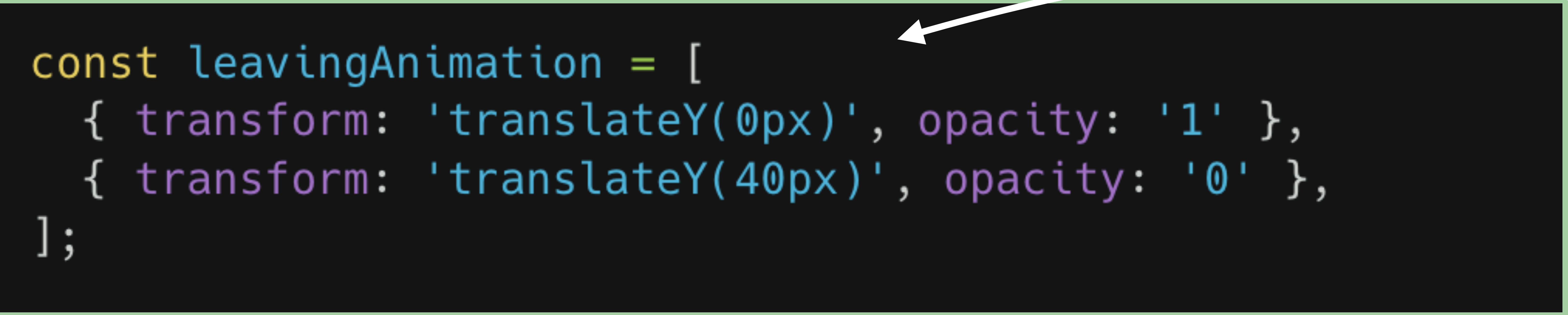


```js
const animation = el.animate([
    { transform: 'scaleX(1)', offset: 0 },
    { transform: 'scaleX(.9)', offset: .8 },
    { transform: 'scaleX(1.2)', offset: 1 }
  ], {
    duration: 500,
    iterations: 2,
    direction: 'alternate',
    easing: 'ease-in-out'
  });
```

CSS Animation

Waapi
Animation

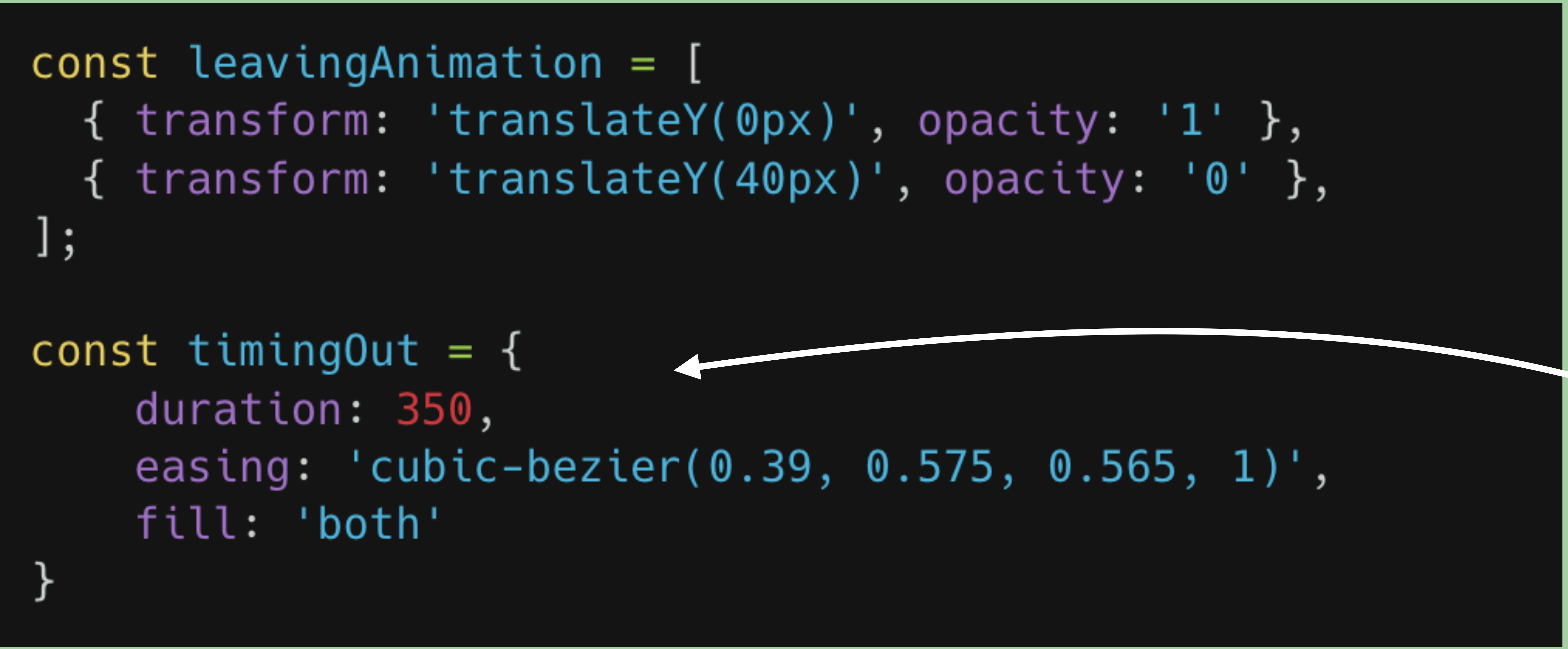
WAAPI EXAMPLE



```
const leavingAnimation = [
  { transform: 'translateY(0px)', opacity: '1' },
  { transform: 'translateY(40px)', opacity: '0' },
];
```

defining what should be animated

WAAPI EXAMPLE

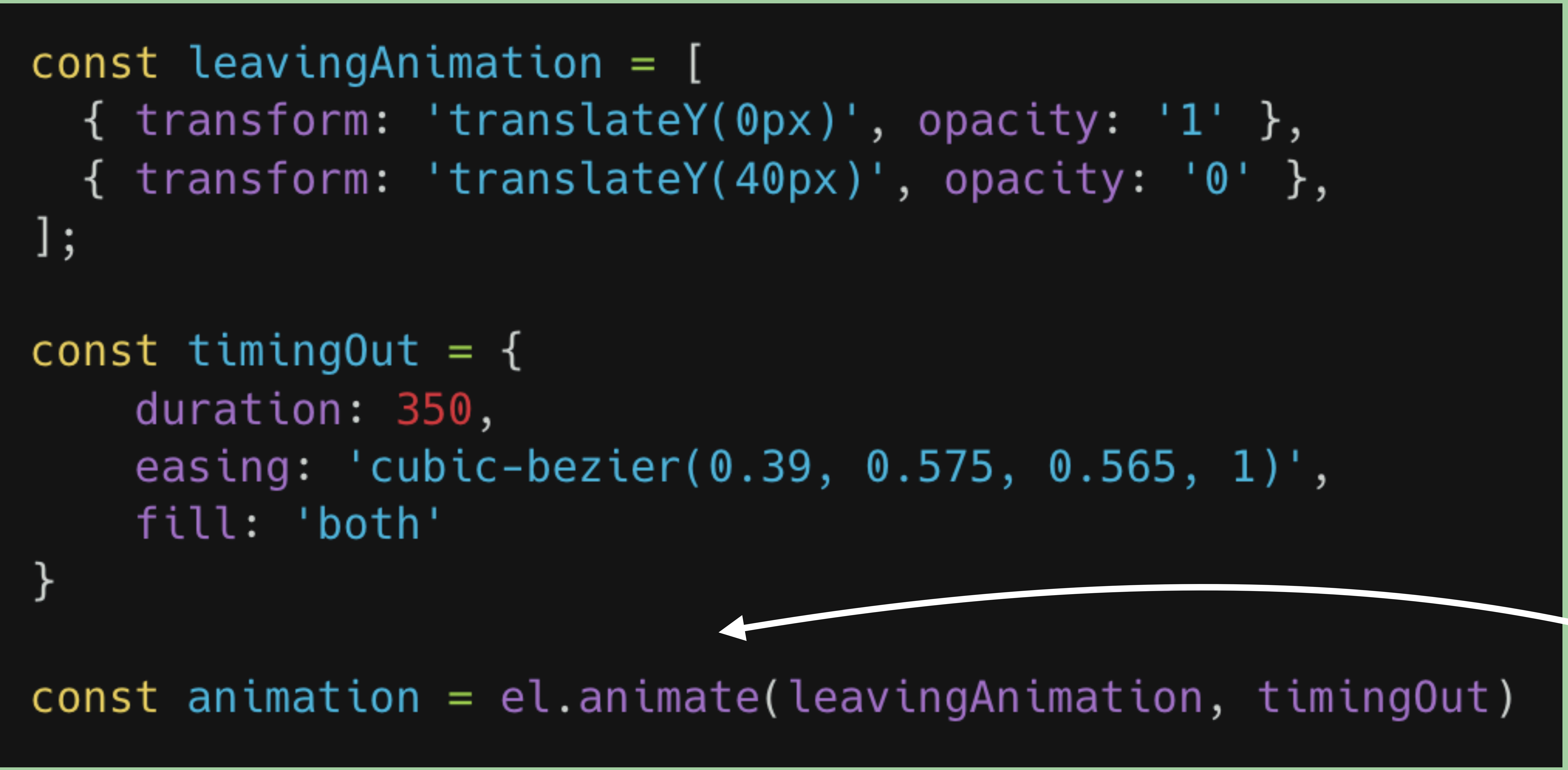


```
const leavingAnimation = [
  { transform: 'translateY(0px)', opacity: '1' },
  { transform: 'translateY(40px)', opacity: '0' },
];

const timingOut = {
    duration: 350,
    easing: 'cubic-bezier(0.39, 0.575, 0.565, 1)',
    fill: 'both'
}
```

defining timing of animation

WAAPI EXAMPLE



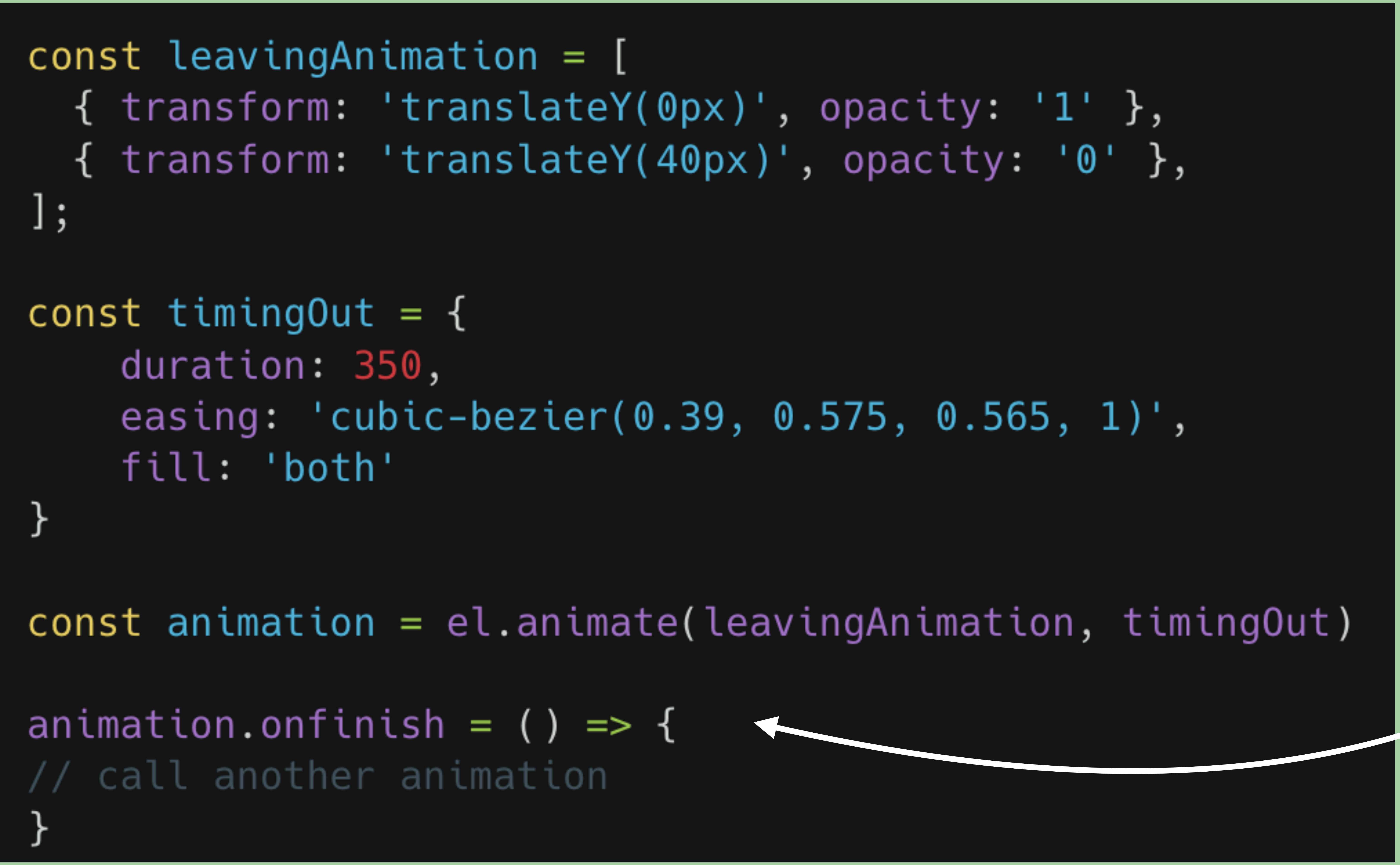
```
const leavingAnimation = [
  { transform: 'translateY(0px)', opacity: '1' },
  { transform: 'translateY(40px)', opacity: '0' },
];

const timingOut = {
    duration: 350,
    easing: 'cubic-bezier(0.39, 0.575, 0.565, 1)',
    fill: 'both'
}

const animation = el.animate(leavingAnimation, timingOut)
```

calling the animations

WAAPI EXAMPLE



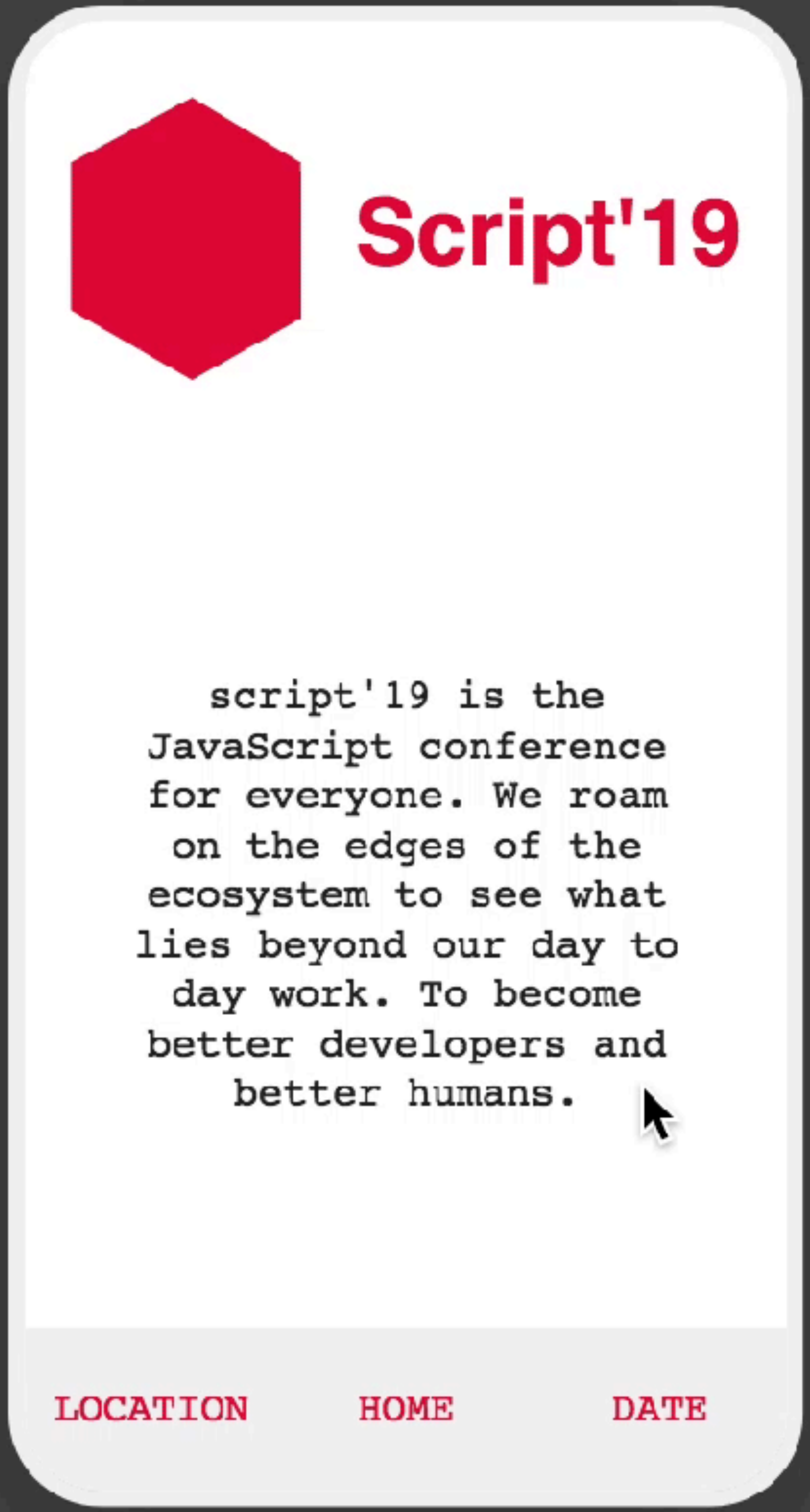
```
const leavingAnimation = [
  { transform: 'translateY(0px)', opacity: '1' },
  { transform: 'translateY(40px)', opacity: '0' },
];

const timingOut = {
    duration: 350,
    easing: 'cubic-bezier(0.39, 0.575, 0.565, 1)',
    fill: 'both'
}

const animation = el.animate(leavingAnimation, timingOut)

animation.onfinish = () => {
// call another animation
}
```

doing something else once
animation is finished



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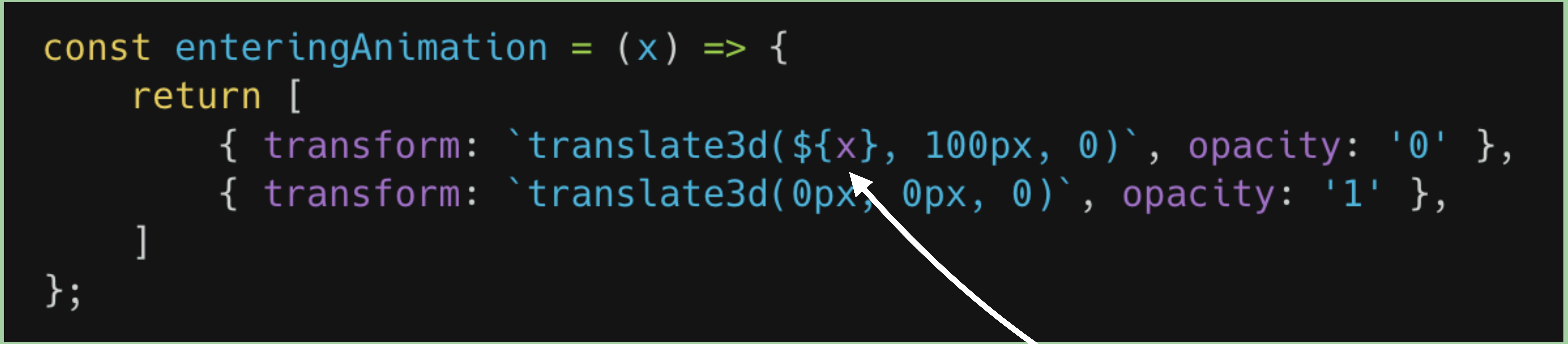
codepen.io/lisilinhart/pen/GRRrYLj

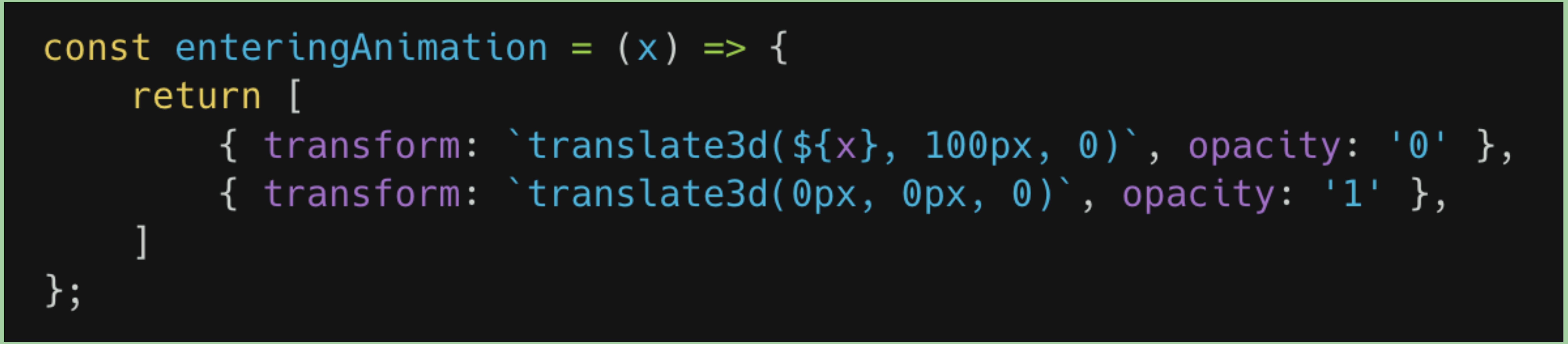
WAAPI EXAMPLE



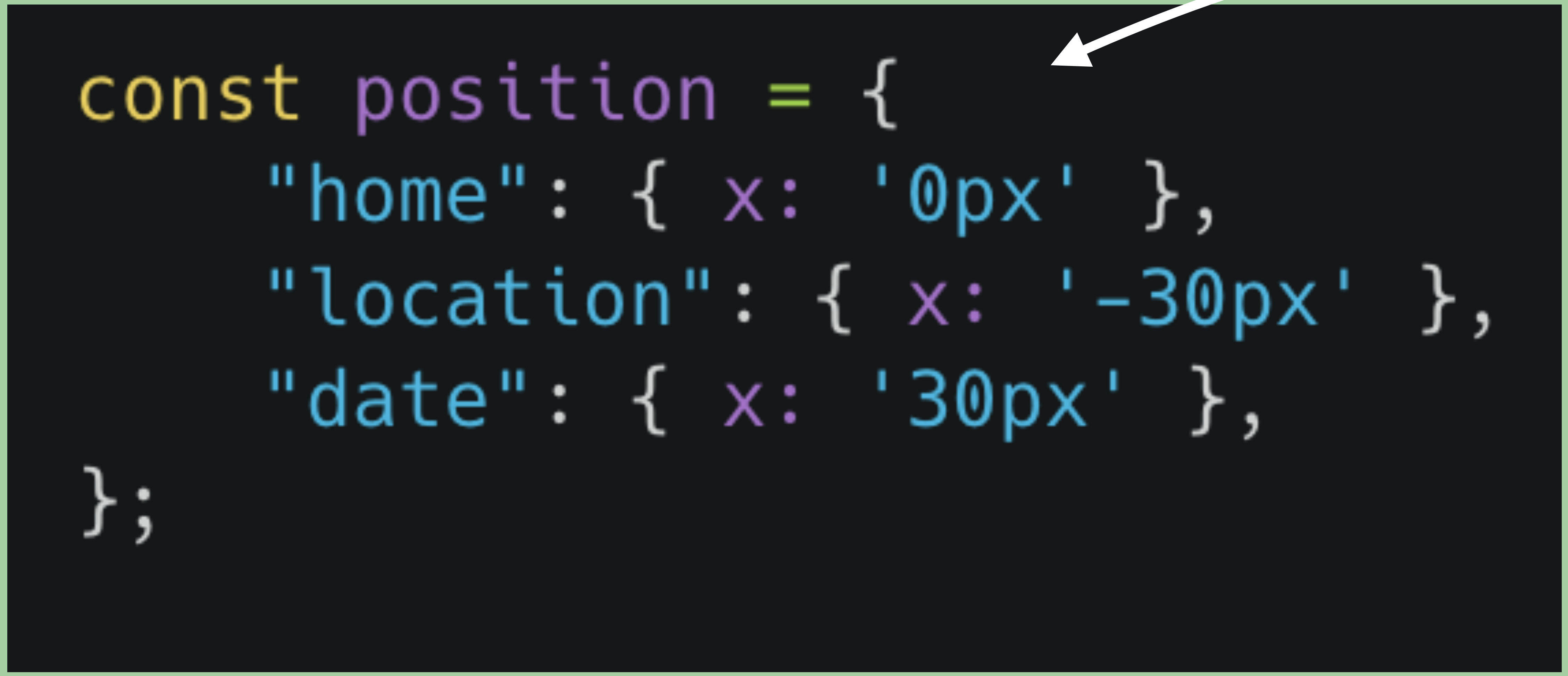
```
const enteringAnimation = (x) => {
    return [
        { transform: `translate3d(${x}, 100px, 0)`, opacity: '0' },
        { transform: `translate3d(0px, 0px, 0)`, opacity: '1' },
    ]
};
```

create a dynamic,
adapting animation via
a function

WAAPI EXAMPLE

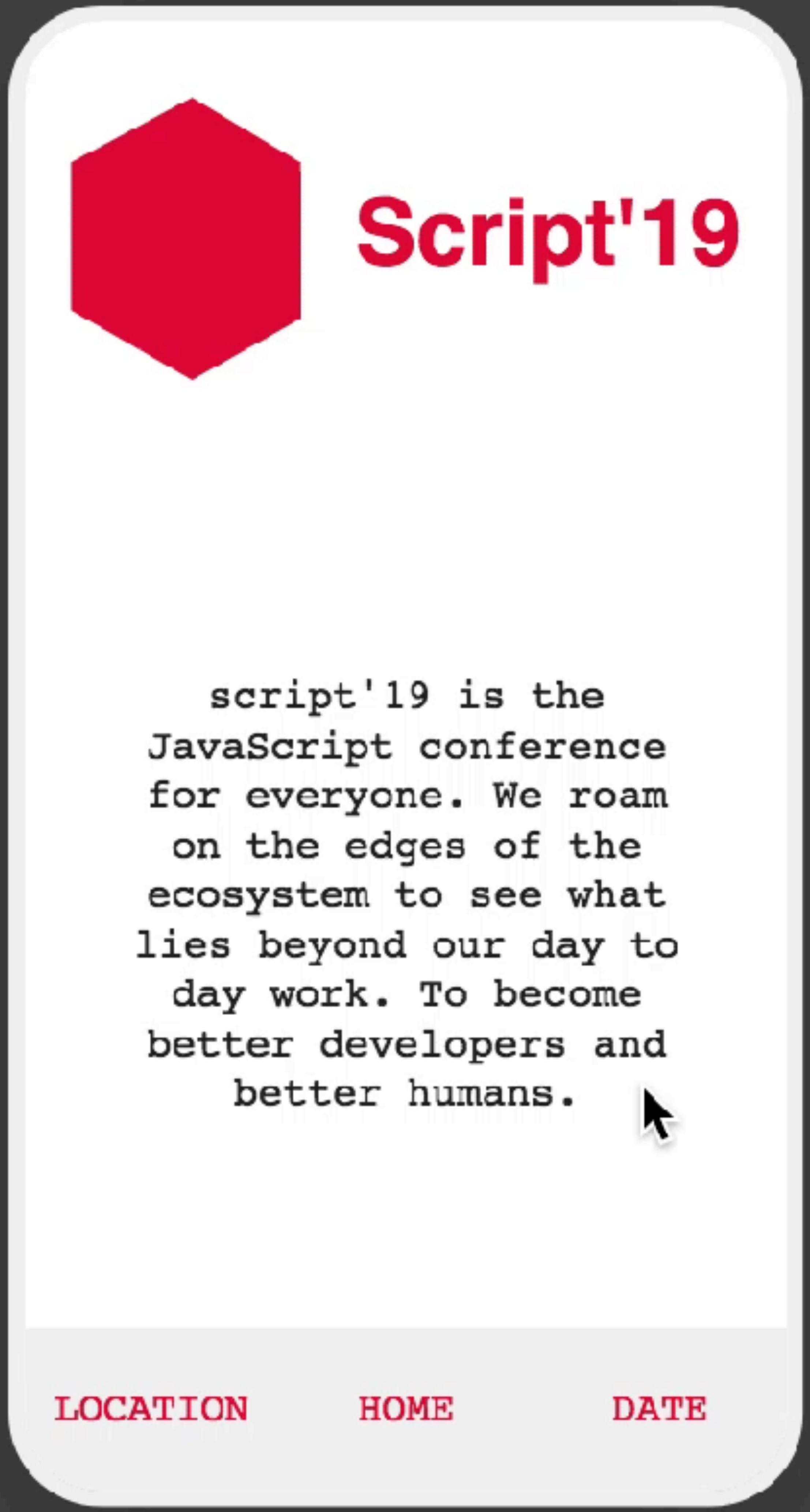


```
const enteringAnimation = (x) => {
    return [
        { transform: `translate3d(${x}, 100px, 0)`, opacity: '0' },
        { transform: `translate3d(0px, 0px, 0)`, opacity: '1' },
    ]
};
```



```
const position = {
    "home": { x: '0px' },
    "location": { x: '-30px' },
    "date": { x: '30px' },
};
```

hand some logical
parameters to the
animation function



Script'19

script'19 is the JavaScript conference for everyone. We roam on the edges of the ecosystem to see what lies beyond our day to day work. To become better developers and better humans.

codepen.io/lisilinhart/pen/GRRrYLj

WHY THE **WEB ANIMATIONS API?**

- API provided by the browser
- no extra Javascript code like for libraries
- can render animations over the compositor thread
- choreographed & chained animations
- a native & more powerful alternative to CSS animations

JUNE 2019

Web Animations API - WD

Usage % of all users ?

Global 0.2% + 85.59% = 85.79%

Lets you create animations that are run in the browser, as well as inspect and manipulate animations created through declarative means like CSS.

Current aligned
Usage relative
Date relative
Apply filters
Show all
?

IE	Edge *	Firefox	Chrome	Safari	Opera	iOS Safari *	Opera Mini *	Android Browser *	Blackberry Browser	Opera Mobile *	Chrome for Android	Firefox for Android	IE Mobile	UC for
		2-32												
		[3] 33-46	4-35		10-22									
		[3] 47-58	[1] 36-38	3.1-10.1	[1] 23-25	3.2-10.3								
6-10	12-17	[2] 59-66	[2] 39-73	[4] 11-12	[2] 26-57	[4] 11-12.1		2.1-4.4.4	7	12-12.1			10	
11	18	[2] 67	[2] 74	12.1	[2] 58	12.2	all	[2] 67	10	[2] 46	[2] 74	66	11	[2]
	[2] 75	[2] 68-69	[2] 75-77	13-TP		13								

OCTOBER 2019

Web Animations API - WD

Usage % of all users ?

Global 0.19% + 86.65% = 86.84%

Lets you create animations that are run in the browser, as well as inspect and manipulate animations created through declarative means like CSS.

Current aligned
Usage relative
Date relative
Apply filters
Show all
?

IE	Edge *	Firefox	Chrome	Safari	iOS Safari *	Opera Mini *	Chrome for Android	UC Browser for Android	Samsung Internet
			[2] 75	5.1	[4] 12.1 ⚑				
	17	[2] 68	[2] 76	[4] 12.1 ⚑	12.3				[2] 9.2
11	18	[2] 69	[2] 77	[4] 13 ⚑	13.1	all	[2] 76	[2] 12.12	[2] 10.1
	[2] 76	[2] 70	[2] 78	TP					
		[2] 71	[2] 79						
			[2] 80						

WPT.FYI/RESULTS/WEB-ANIMATIONS

web-platform-tests dashboard

Latest Run Recent Runs Insights Processor About GitHub Source

Test Results Interoperability

wpt / web-animations

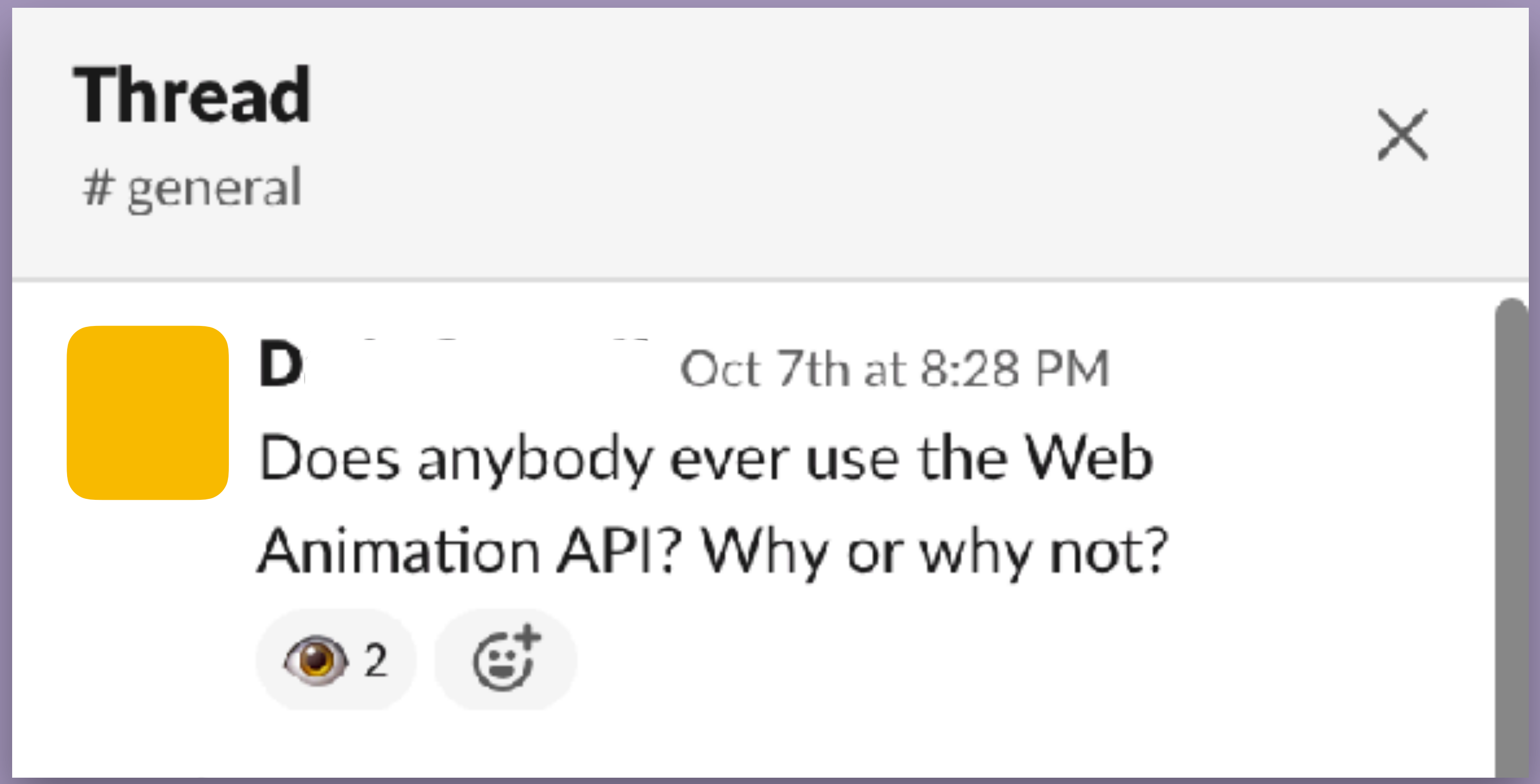
Search test files, like 'cors/allow-headers.htm', then press <Enter>

For information on the search syntax, view the search documentation

Showing 78 tests (3405 subtests) in web-animations from the latest master test runs for chrome[experimental], edge[experimental], firefox[experimental], safari[experimental] LINK EDIT

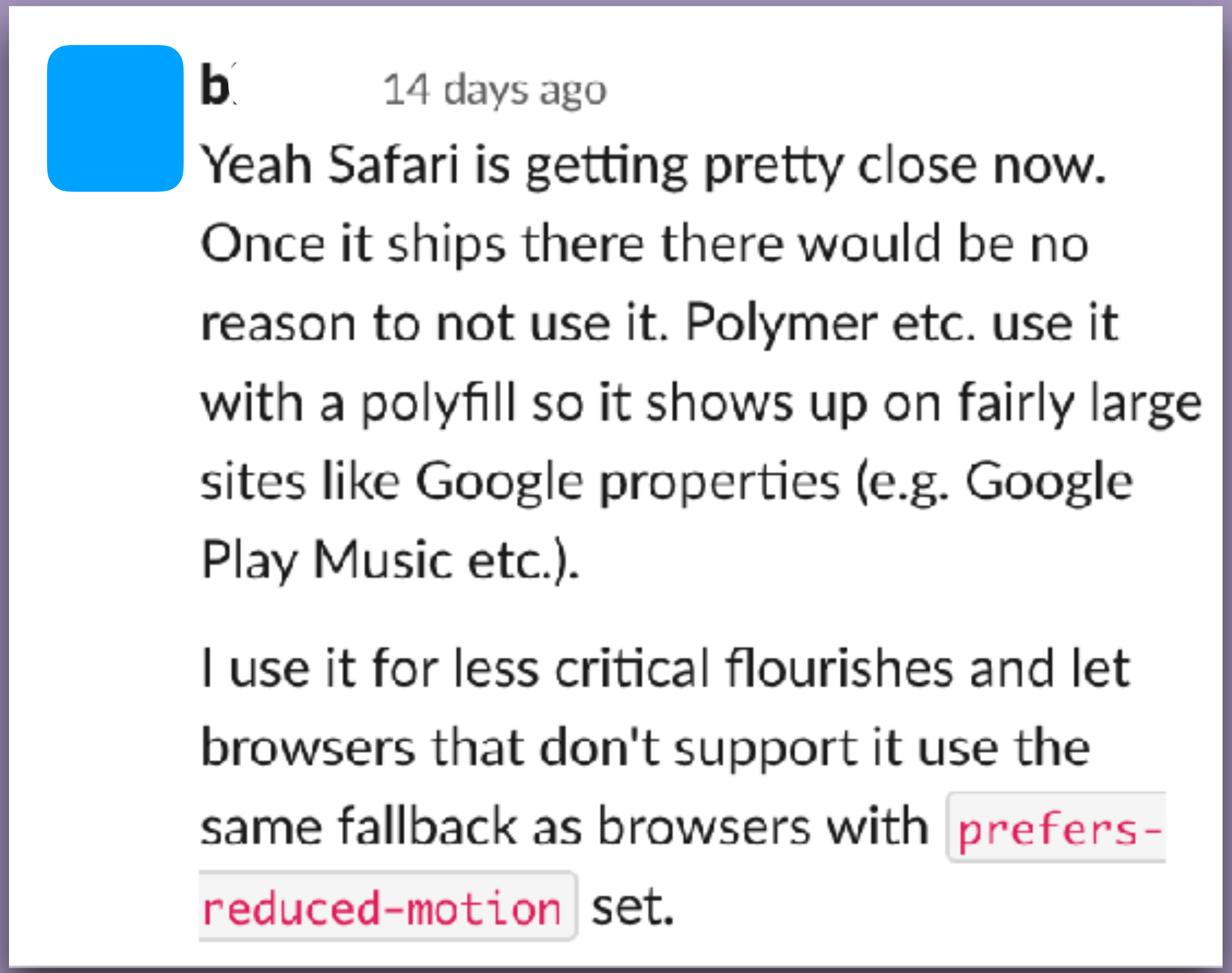
Path	Chrome 78 Linux 18.04 42b683c Oct 19, 2019	Edge 79 Windows 10.0 42b683c Oct 19, 2019	Firefox 71 Linux 18.04 42b683c Oct 19, 2019	Safari 94 preview macOS 10.14 42b683c Oct 19, 2019
animation-model/	1661 / 1924	1813 / 1924	2125 / 2125	401 / 820
interfaces/	818 / 879	835 / 879	871 / 884	835 / 884
timing-model/	325 / 396	325 / 396	396 / 396	374 / 396

SHOW HISTORY



D Oct 7th at 8:28 PM

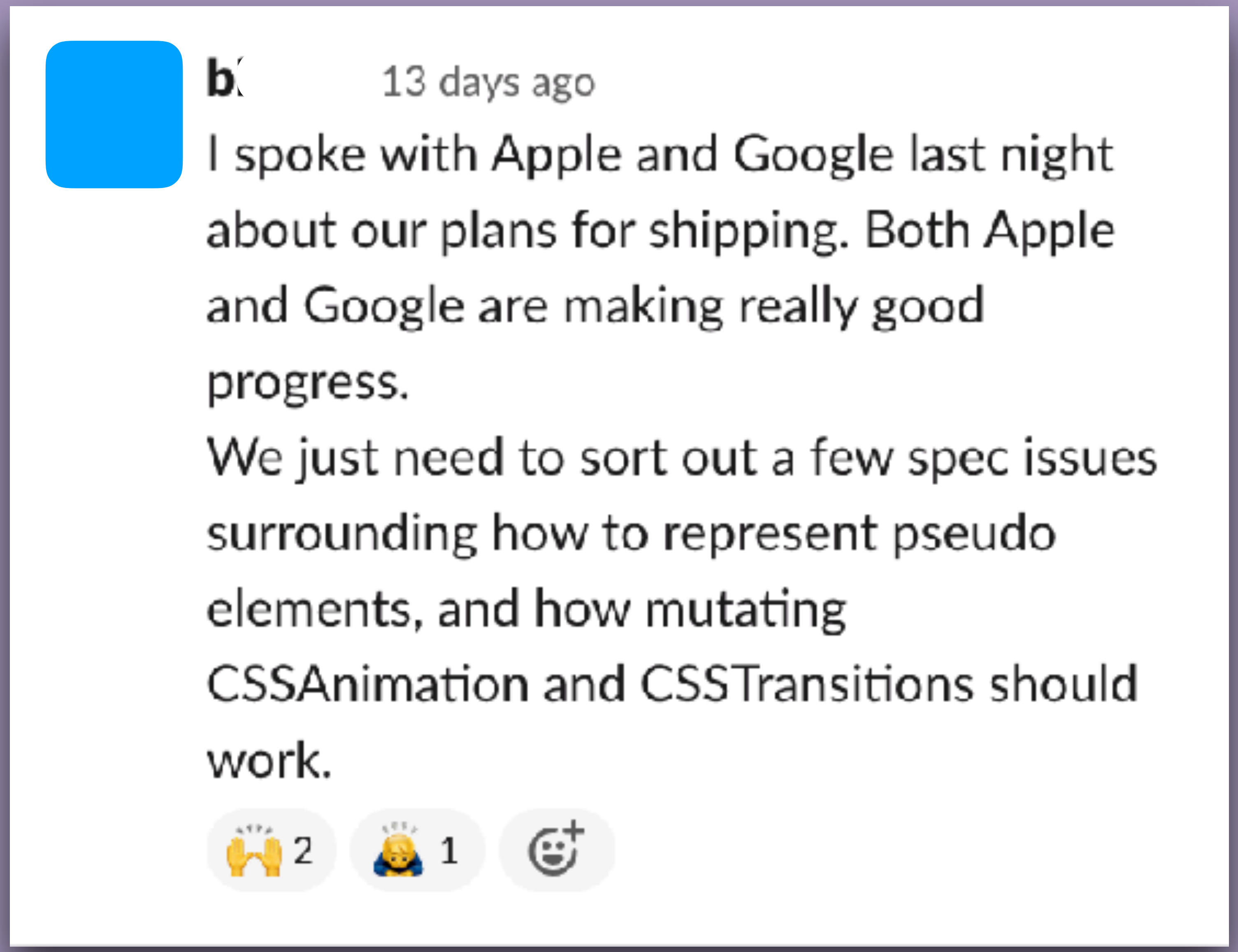
Does anybody ever use the Web Animation API? Why or why not?



b 14 days ago

Yeah Safari is getting pretty close now. Once it ships there there would be no reason to not use it. Polymer etc. use it with a polyfill so it shows up on fairly large sites like Google properties (e.g. Google Play Music etc.).

I use it for less critical flourishes and let browsers that don't support it use the same fallback as browsers with `prefers-reduced-motion` set.



b 13 days ago

I spoke with Apple and Google last night about our plans for shipping. Both Apple and Google are making really good progress.
We just need to sort out a few spec issues surrounding how to represent pseudo elements, and how mutating CSSAnimation and CSSTransitions should work.

ATTENTION & FEEDBACK

FEEDBACK

“Feedback indicates causation between two or more events, often used to connect a user’s interaction with the interface’s reaction”

Rachel Nabors - Animation at Work

FEEDBACK

I recognised that you clicked this button

giving a reaction
to user input

FEEDBACK

I recognised that you clicked this button

You entered some information, but it’s not correct

giving a reaction to user input

cause & effect of the users input

FEEDBACK

I recognised that you clicked this button

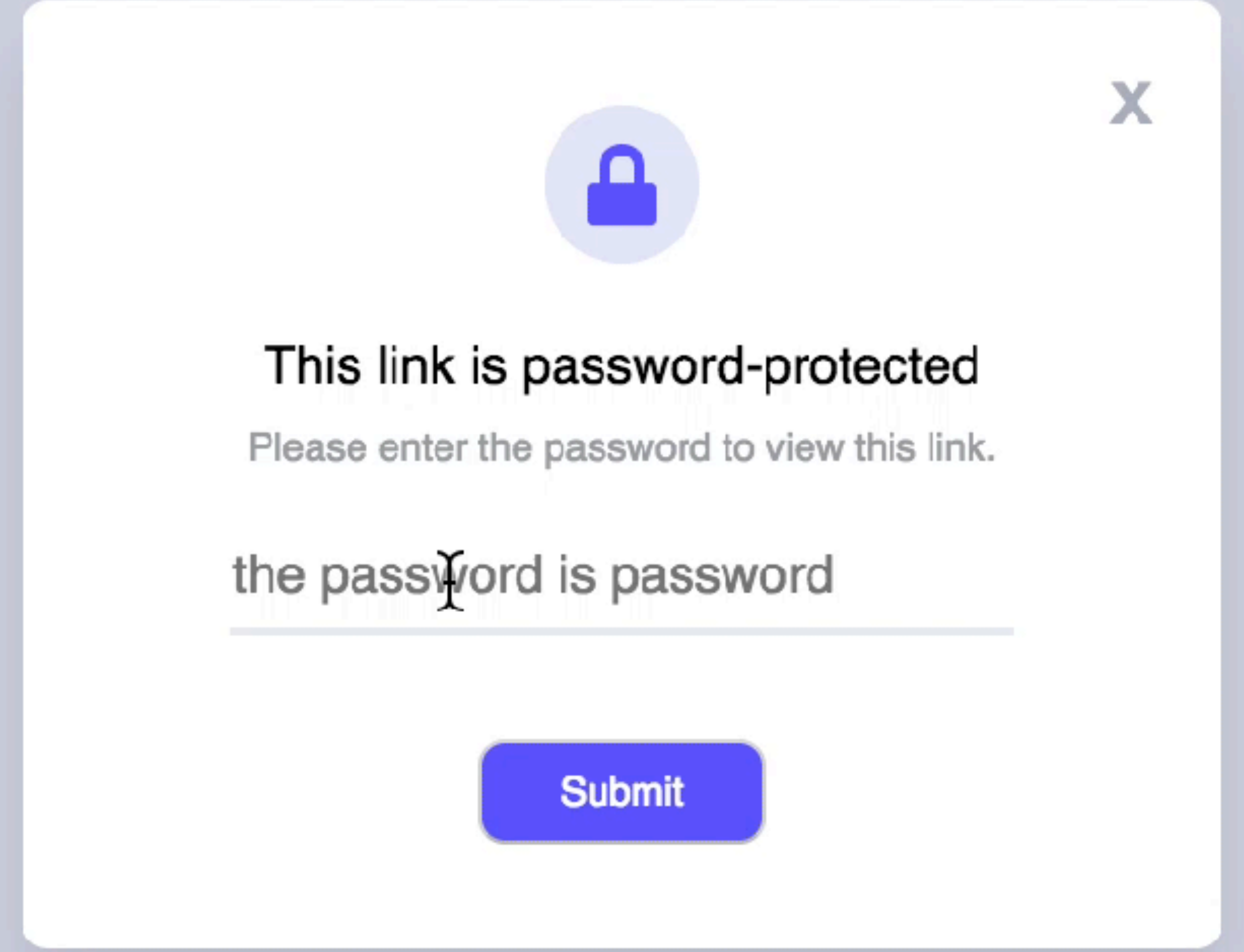
You entered some information, but it's not correct

You submitted the form, but our system is still processing it

giving a reaction to user input

cause & effect of the users input

making system activity visible



This link is password-protected

Please enter the password to view this link.

the password is password

codepen.io/davidkpiano/full/WKvPBP/

ATTENTION

ATTENTION

To get to the next step, click this prominent item

showing possible actions

ATTENTION

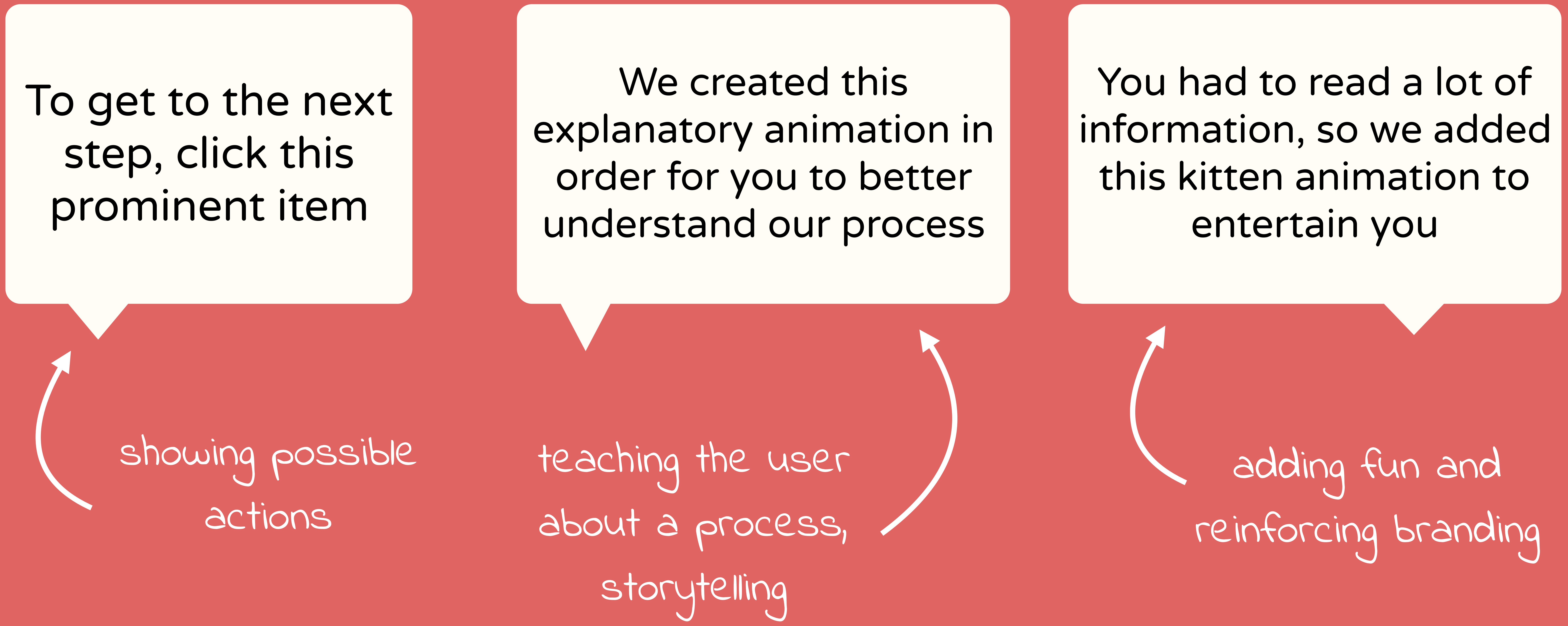
To get to the next step, click this prominent item

We created this explanatory animation in order for you to better understand our process

showing possible actions

teaching the user about a process, storytelling

ATTENTION



To get to the next step, click this prominent item

showing possible actions

We created this explanatory animation in order for you to better understand our process

teaching the user about a process, storytelling

You had to read a lot of information, so we added this kitten animation to entertain you

adding fun and reinforcing branding

PAYMENTS

OVERVIEW FEATURES DOCS →

A complete payments platform engineered for growth

Whether you're looking to bill customers on a recurring basis, set up a marketplace, or simply accept payments, do it all with a fully integrated, global platform that can support online and in-person payments.

CREATE ACCOUNT EXPLORE FEATURES

KICKSTARTER
€25
Pay
Pay with Face ID
DigitalOcean
Billing Info
Credit / Debit Card
CARD DETAILS
4242 8224 6310 8210
VISA
09 / 20
BILLING ADDRESS
Jenny
Rosen
185 Berry St
San Franci

stripe.com/us/payments

ATTENTION & FEEDBACK

Reactive Animation

> “A reactive animation is one involving discrete changes, due to events.”

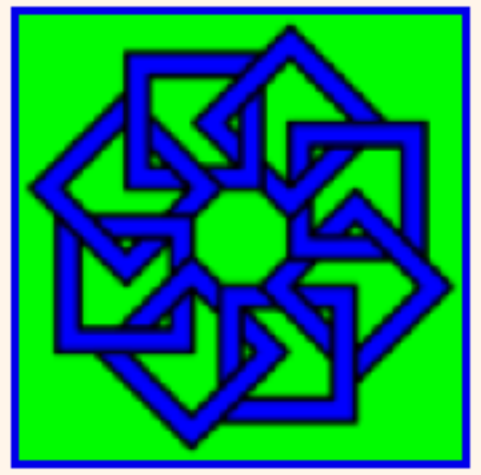
Conal Elliott

Conal Elliott

Recent

read here

March 2018	Paper: *The simple essence of automatic differentiation*
February 2017	Paper: *Compiling to categories*
February 2017	Paper: *Generic parallel functional programming*
June 2016	Joined Target, working in data sciences and optimization, continuing to explore elegant and principled techniques from math and programming language theory for building fast, correct, and beautiful software.
January 2015	Sadly, Tabula closed down.
October 2011	I'm working at Tabula and having a great time. I'm helping with chip specification and working out how to compile Haskell to hardware.
May 2009	Paper: *Push-pull functional reactive programming*
March 2009	Paper: *Beautiful differentiation*
March 2009	Paper: *Denotational design with type class morphisms*
January 2008	New technical blog
November 2007	Google tech talk: Tangible Functional Programming: a modern marriage of usability and composability
October 2007	The paper *Functional Reactive Animation*, co-authored with Paul Hudak, was awarded as the most influential paper of ICFP '97.



Conal Elliott

Recent

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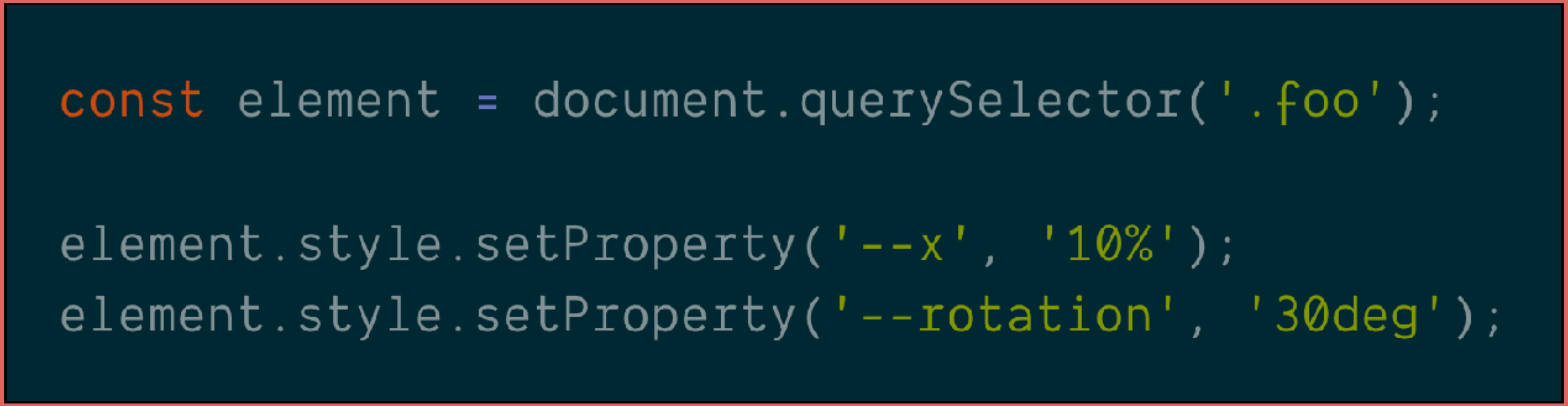
JS + CSS VARIABLES

the final demo

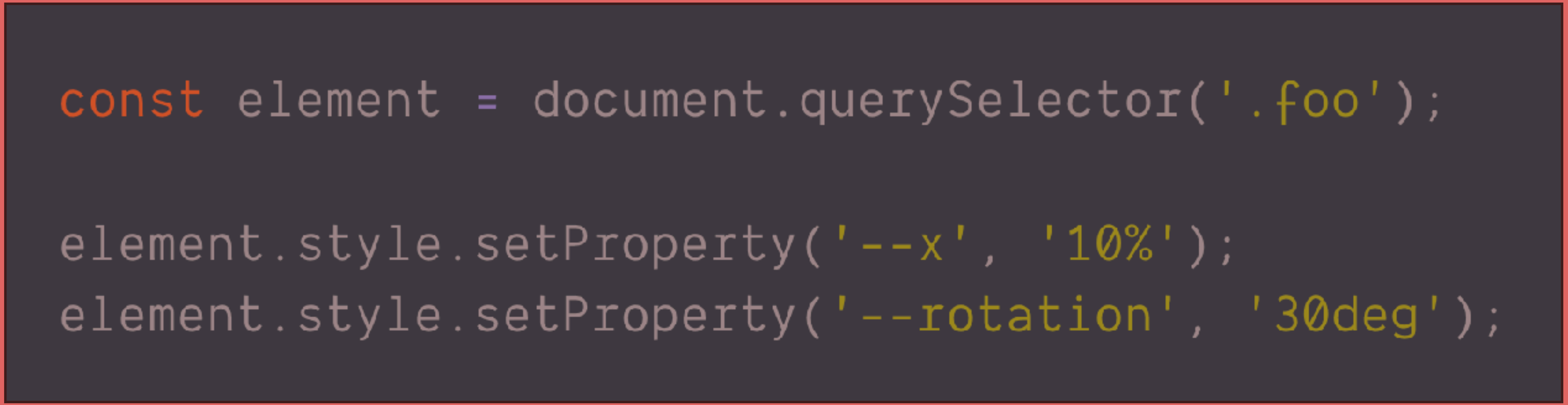
JS + CSS VARIABLES



```
const element = document.querySelector('.foo');

element.style.setProperty('--x', '10%');
element.style.setProperty('--rotation', '30deg');
```

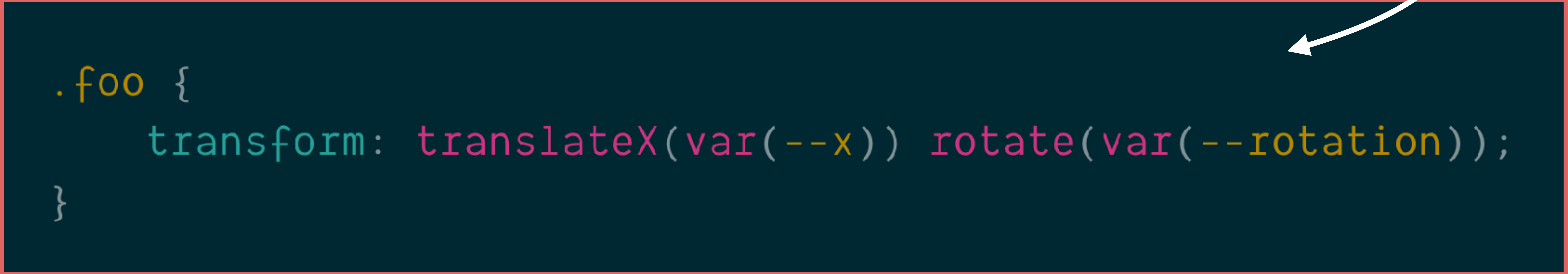
setting a CSS
variable via JS

JS + CSS VARIABLES



```
const element = document.querySelector('.foo');

element.style.setProperty('--x', '10%');
element.style.setProperty('--rotation', '30deg');
```

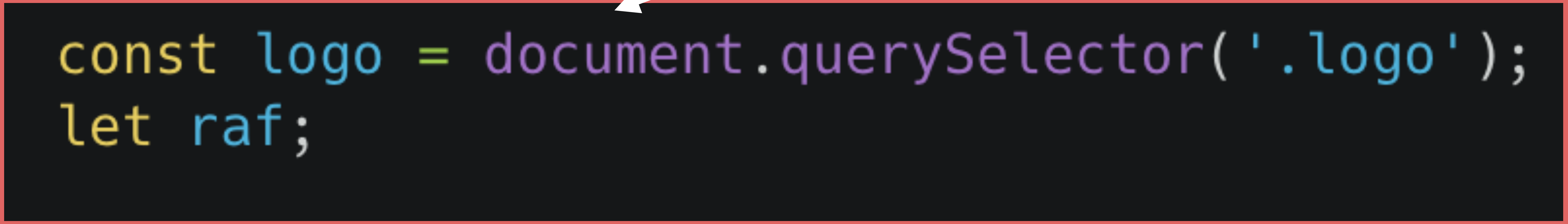
using the set
variables in your CSS



```
.foo {
    transform: translateX(var(--x)) rotate(var(--rotation));
}
```

codepen.io/lisilinhart/pen/YzzqGNX

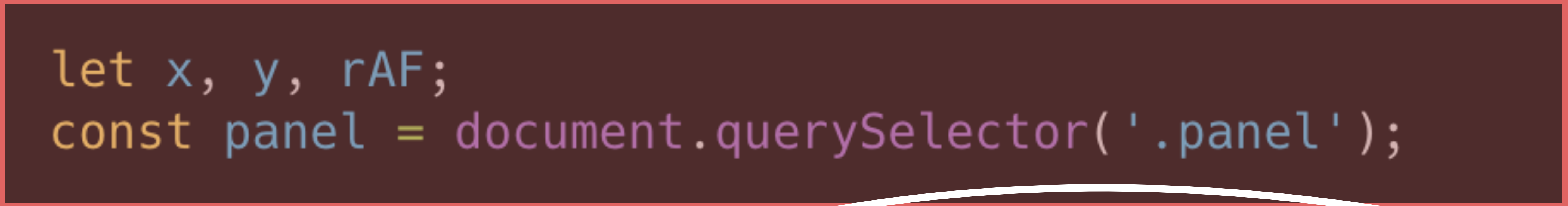
JS + CSS VARIABLES



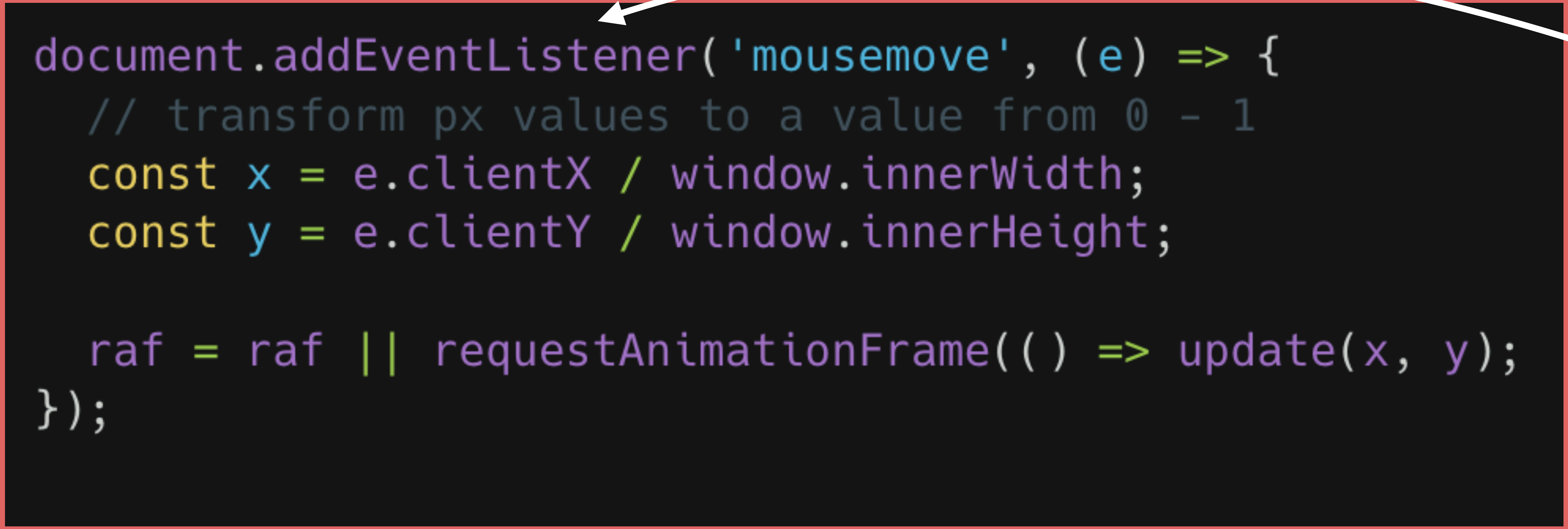
```
const logo = document.querySelector('.logo');
let raf;
```

get the elements for setting the variables on and define a variable for the requestAnimationFrame

JS + CSS VARIABLES



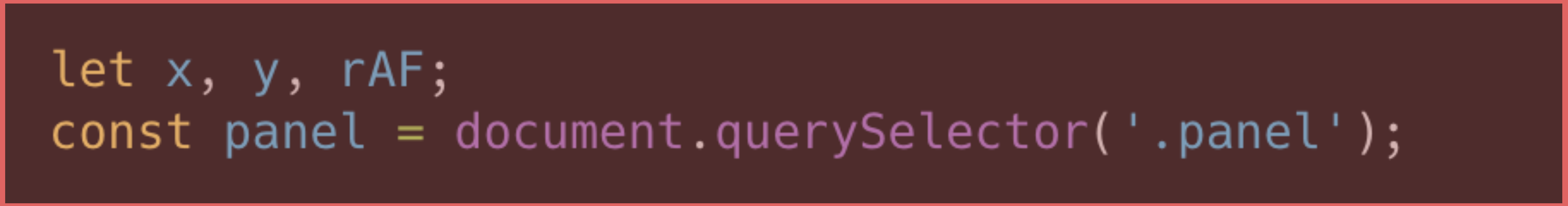
```
let x, y, rAF;
const panel = document.querySelector('.panel');
```



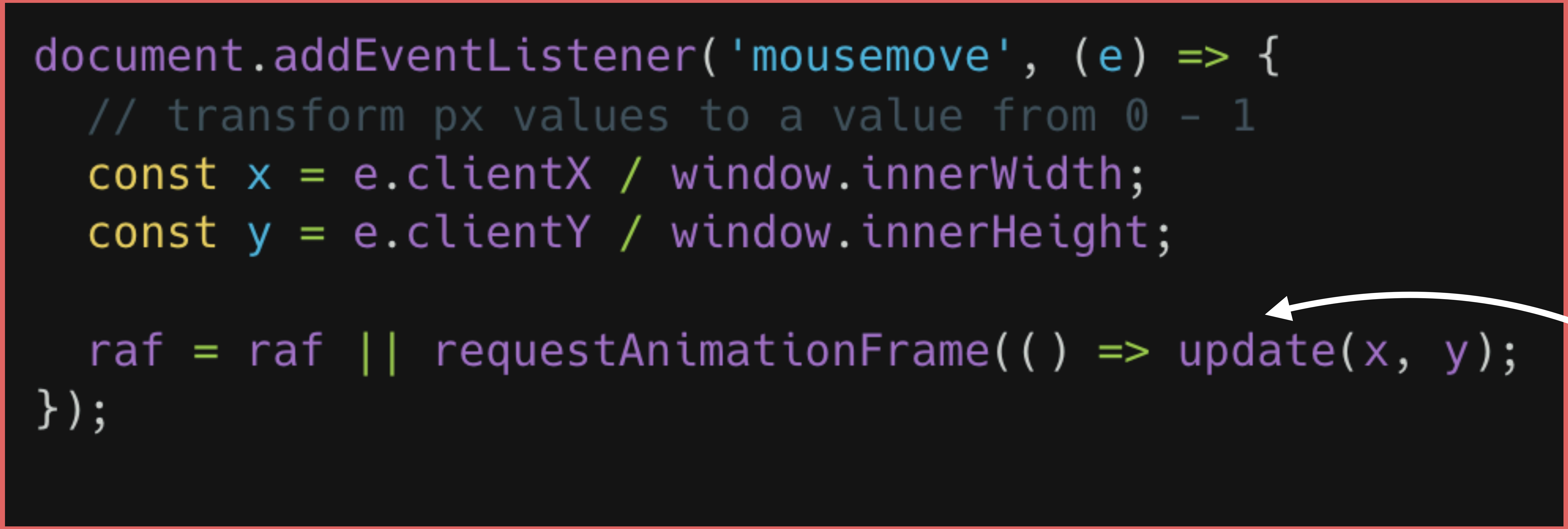
```
document.addEventListener('mousemove', (e) => {
  // transform px values to a value from 0 - 1
  const x = e.clientX / window.innerWidth;
  const y = e.clientY / window.innerHeight;

  raf = raf || requestAnimationFrame(() => update(x, y));
});
```

define EventListener and calculate X & Y from event values that are pixels

JS + CSS VARIABLES



```
let x, y, rAF;
const panel = document.querySelector('.panel');
```



```
document.addEventListener('mousemove', (e) => {
  // transform px values to a value from 0 - 1
  const x = e.clientX / window.innerWidth;
  const y = e.clientY / window.innerHeight;

  raf = raf || requestAnimationFrame(() => update(x, y);
});
```

update DOM inside
requestAnimationFrame

REQUESTANIMATIONFRAME

FRAME

FRAME

FRAME

FRAME

FRAME

we continuously want to update
the screen and get as many
frames as possible

REQUESTANIMATIONFRAME

FRAME FRAME FRAME FRAME FRAME

rAF(update) rAF(update) rAF(update) rAF(update)

so we update once before each new frame

REQUESTANIMATIONFRAME

mousemove
FRAME
FRAME
FRAME
FRAME
FRAME
rAF(update)
rAF(update)
rAF(update)
rAF(update)

REQUESTANIMATIONFRAME

mousemove
mousemove
FRAME
FRAME
FRAME
FRAME
FRAME
rAF(update)
rAF(update)
rAF(update)
rAF(update)

REQUESTANIMATIONFRAME

mousemove

mousemove

mousemove

mousemove

mousemove

FRAME

FRAME

FRAME

FRAME

FRAME

rAF(update)

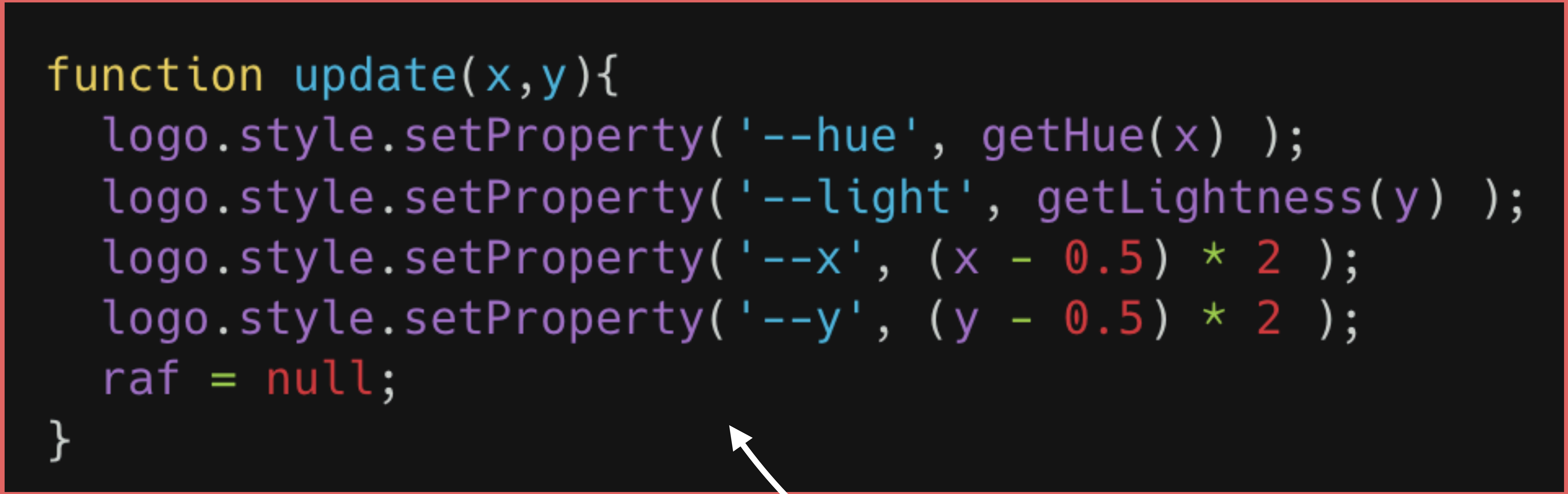
rAF(update)

rAF(update)

rAF(update)

we update the next frame
only with the latest value

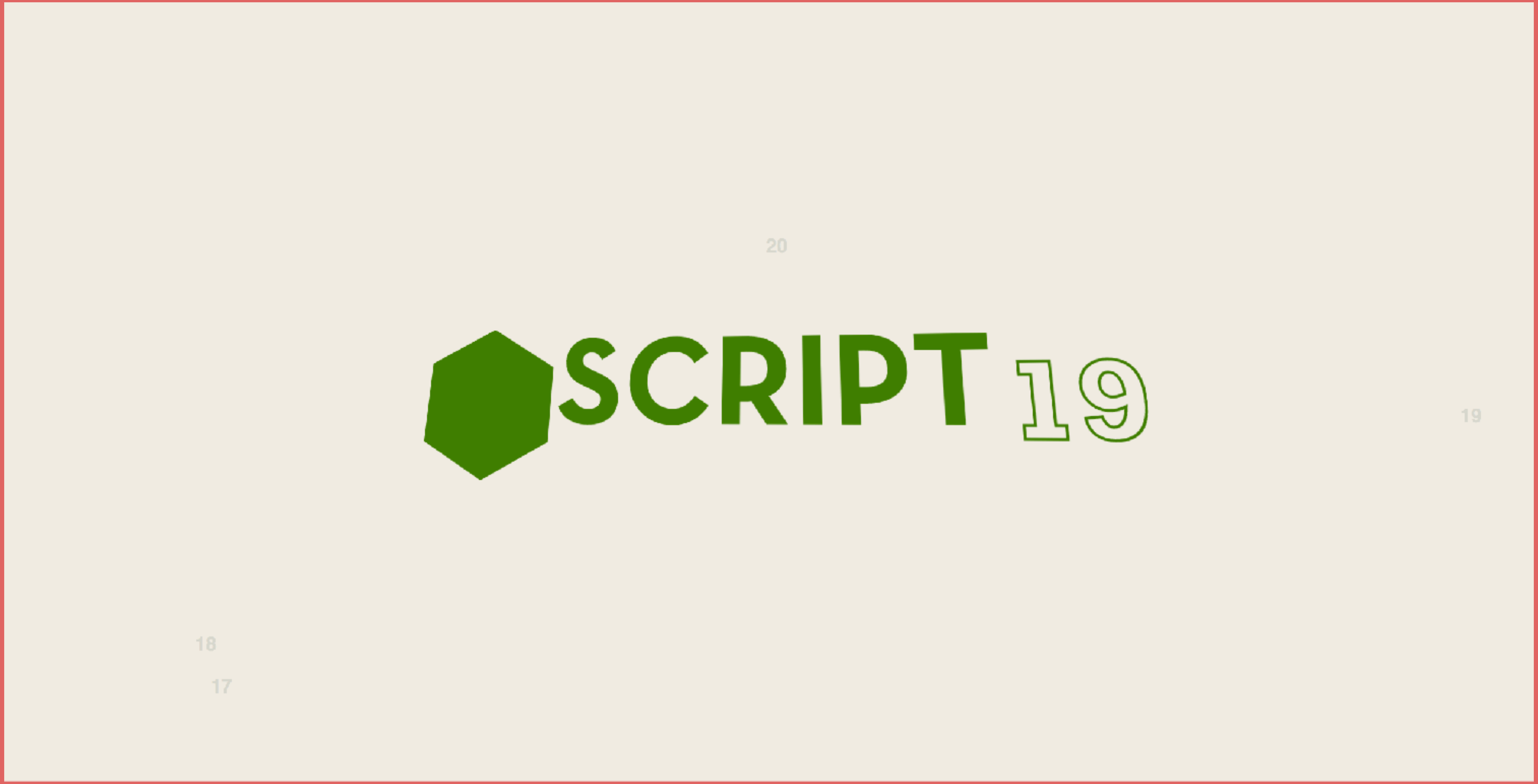
JS + CSS VARIABLES



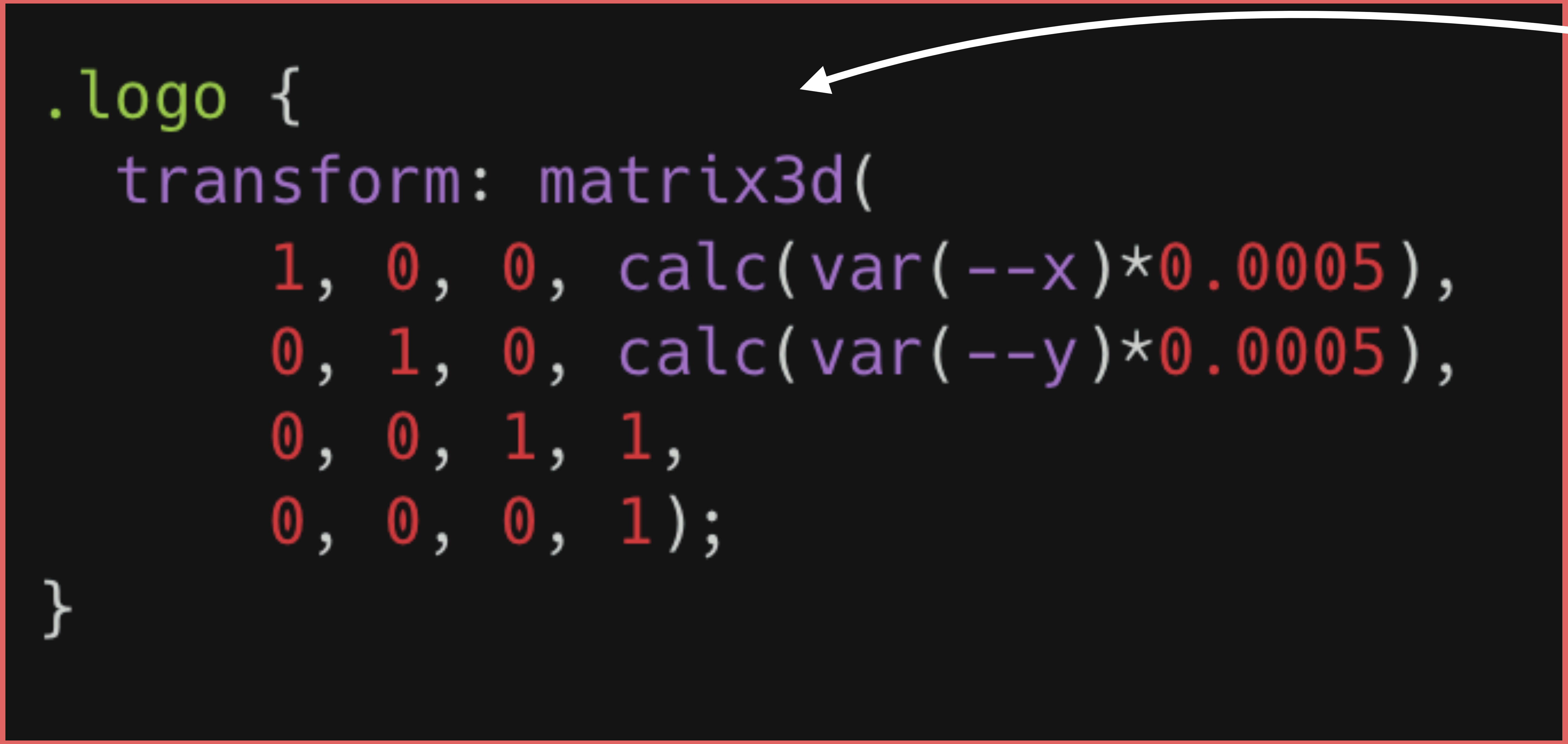
```
function update(x,y){
  logo.style.setProperty('--hue', getHue(x) );
  logo.style.setProperty('--light', getLightness(y) );
  logo.style.setProperty('--x', (x - 0.5) * 2 );
  logo.style.setProperty('--y', (y - 0.5) * 2 );
  raf = null;
}
```

set CSS variables and reset requestAnimationFrame when done

JS + CSS VARIABLES



JS + CSS VARIABLES



```
.logo {
  transform: matrix3d(
      1, 0, 0, calc(var(--x)*0.0005),
      0, 1, 0, calc(var(--y)*0.0005),
      0, 0, 1, 1,
      0, 0, 0, 1);
}
```

rotate panel
according to
the variables

MATRIX 3D ????

I got you

MATRIX 3D ????

THE MATRIX RESOLUTIONS

I imagine that right now, you're feeling a bit like Alice. Hmm? Transforming down the rabbit hole?

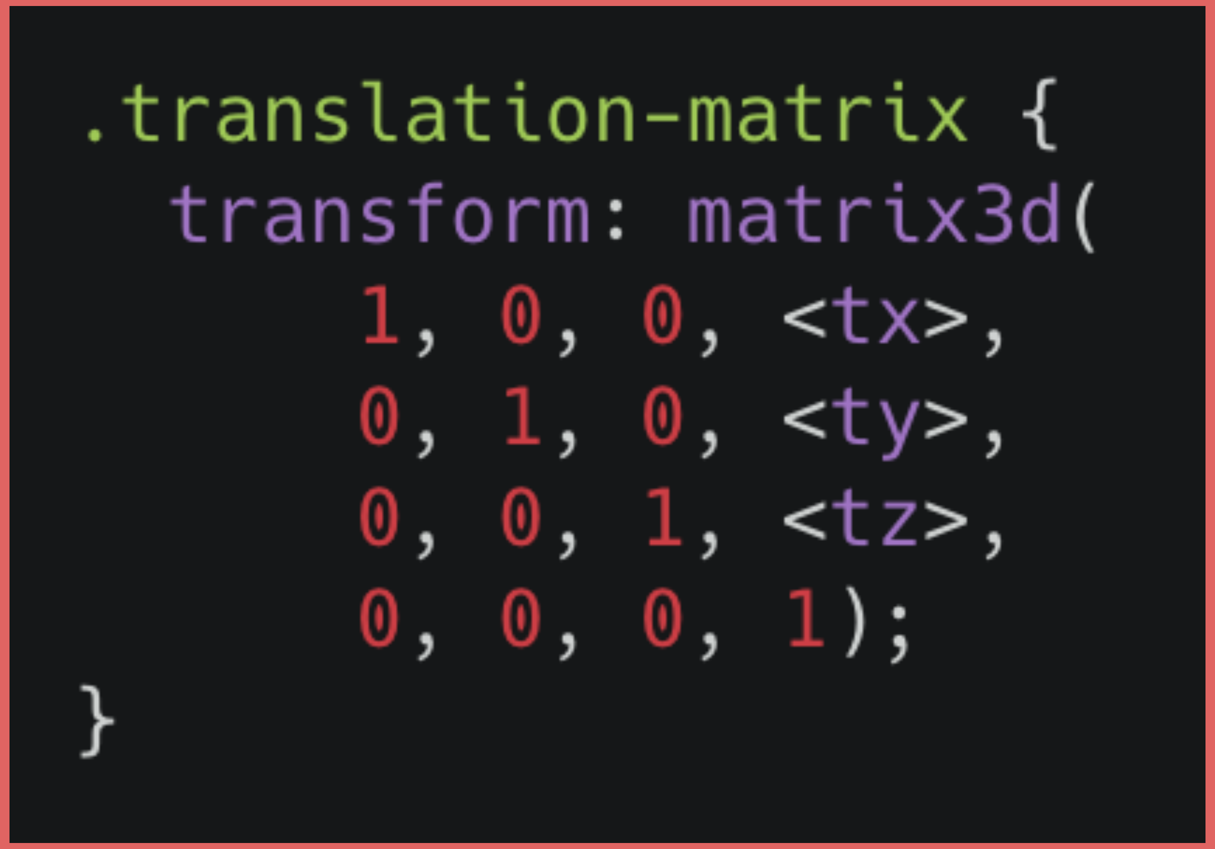
This is your last chance. After this, there is no turning back. You take the blue pill—the story ends, you wake up in your bed and believe whatever you want to believe. You take the red pill—you stay in Wonderland and I show you how deep the rabbit-hole goes.

The Red Pill
The Blue Pill

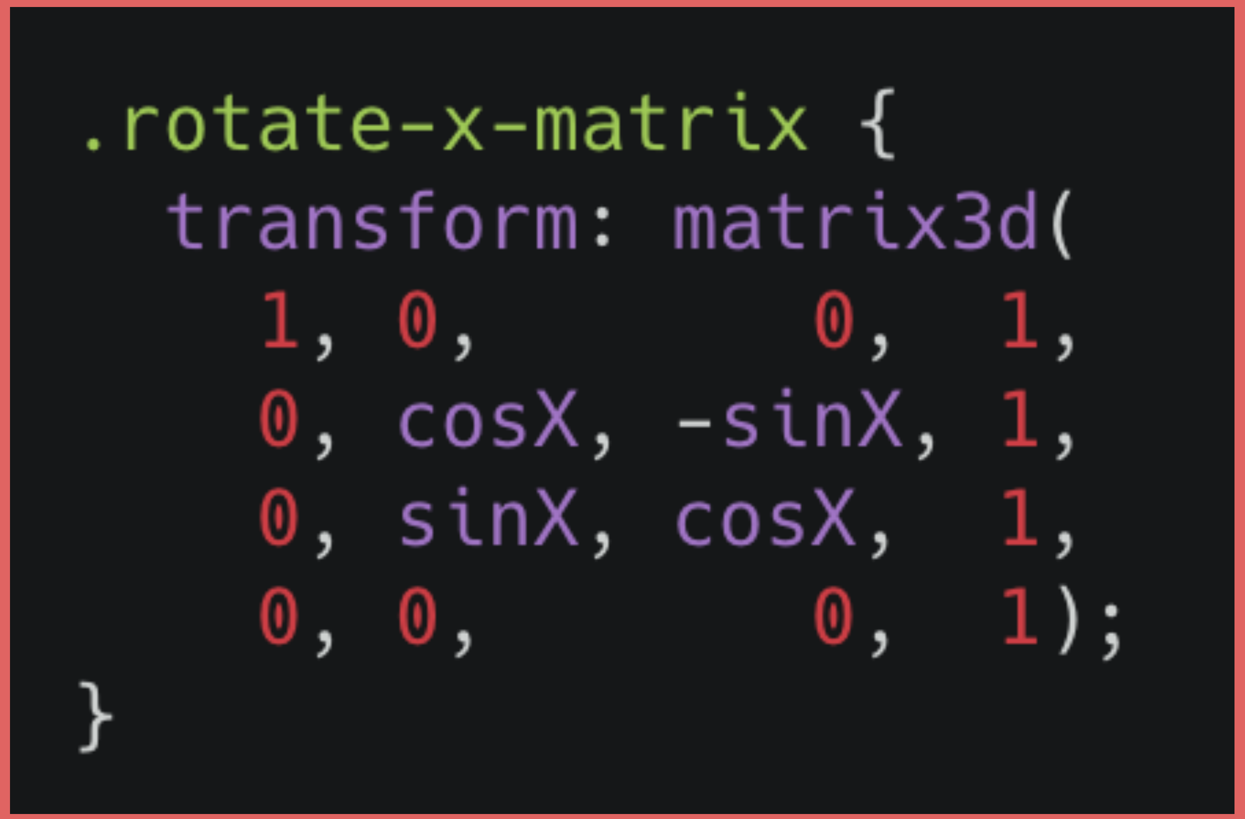
A helpful tool from the addled minds of Eric Meyer and Aaron Gustafson

meyerweb.com/eric/tools/matrix/

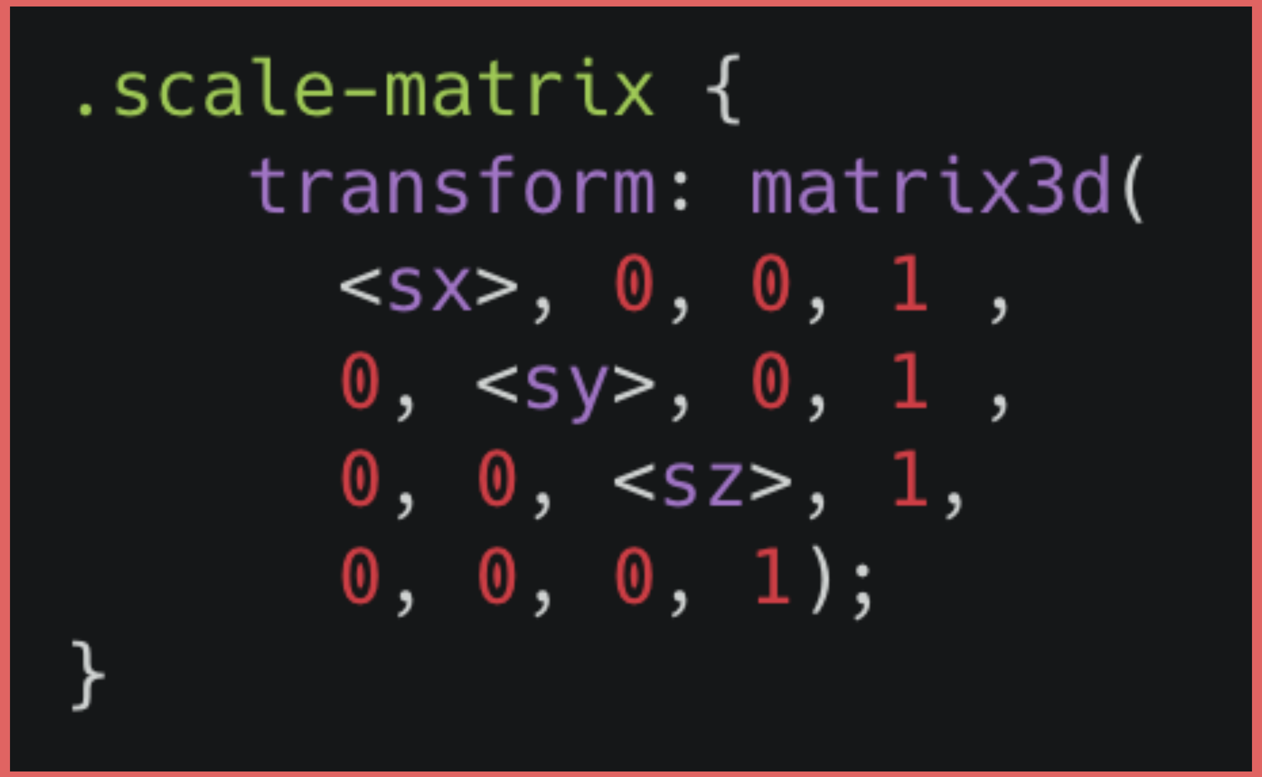
MATRIX 3D



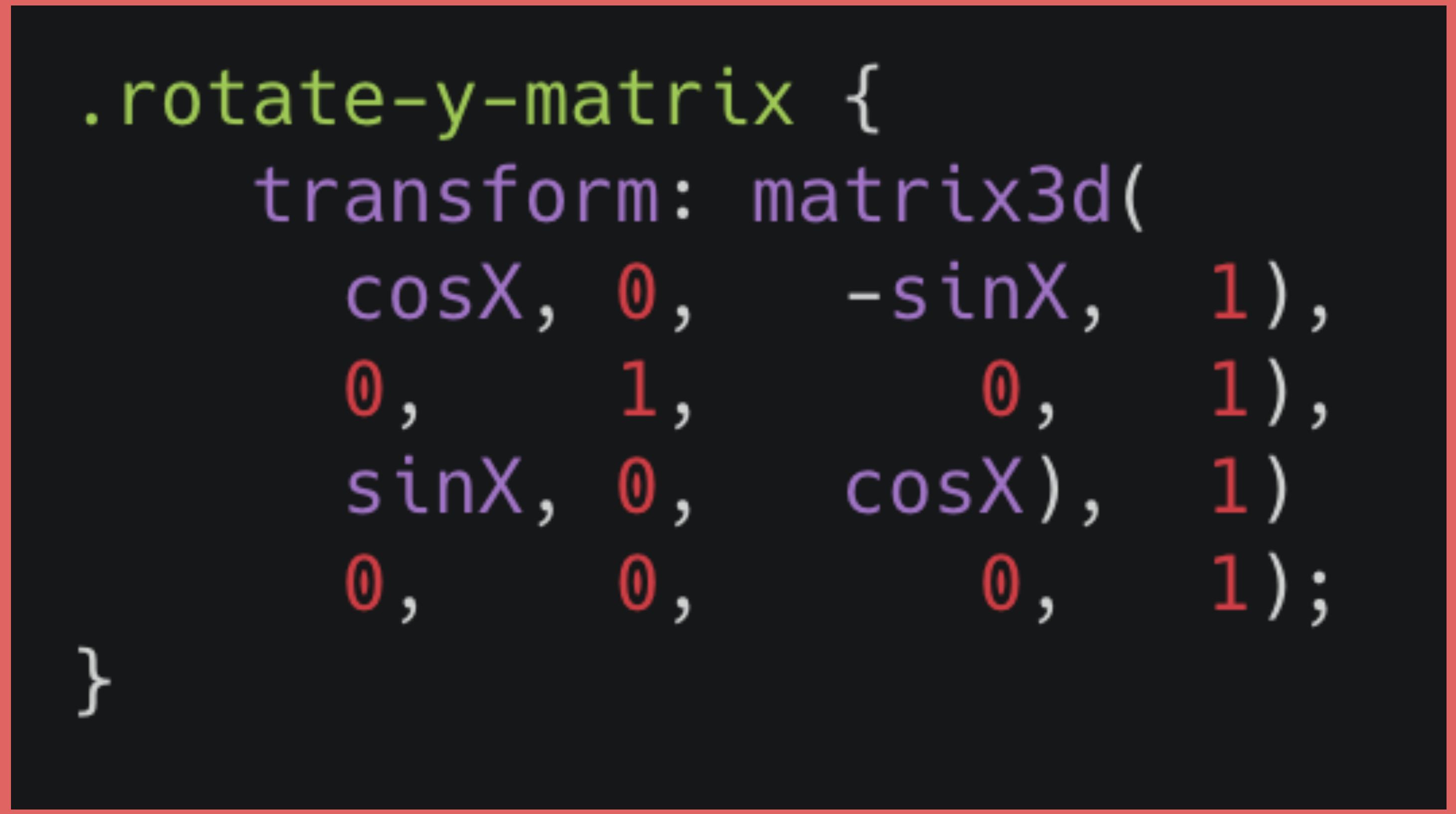
```
.translation-matrix {
  transform: matrix3d(
      1, 0, 0, <tx>,
      0, 1, 0, <ty>,
      0, 0, 1, <tz>,
      0, 0, 0, 1);
}
```



```
.rotate-x-matrix {
  transform: matrix3d(
    1, 0,       0,  1,
    0, cosX, -sinX, 1,
    0, sinX, cosX,  1,
    0, 0,       0,  1);
}
```



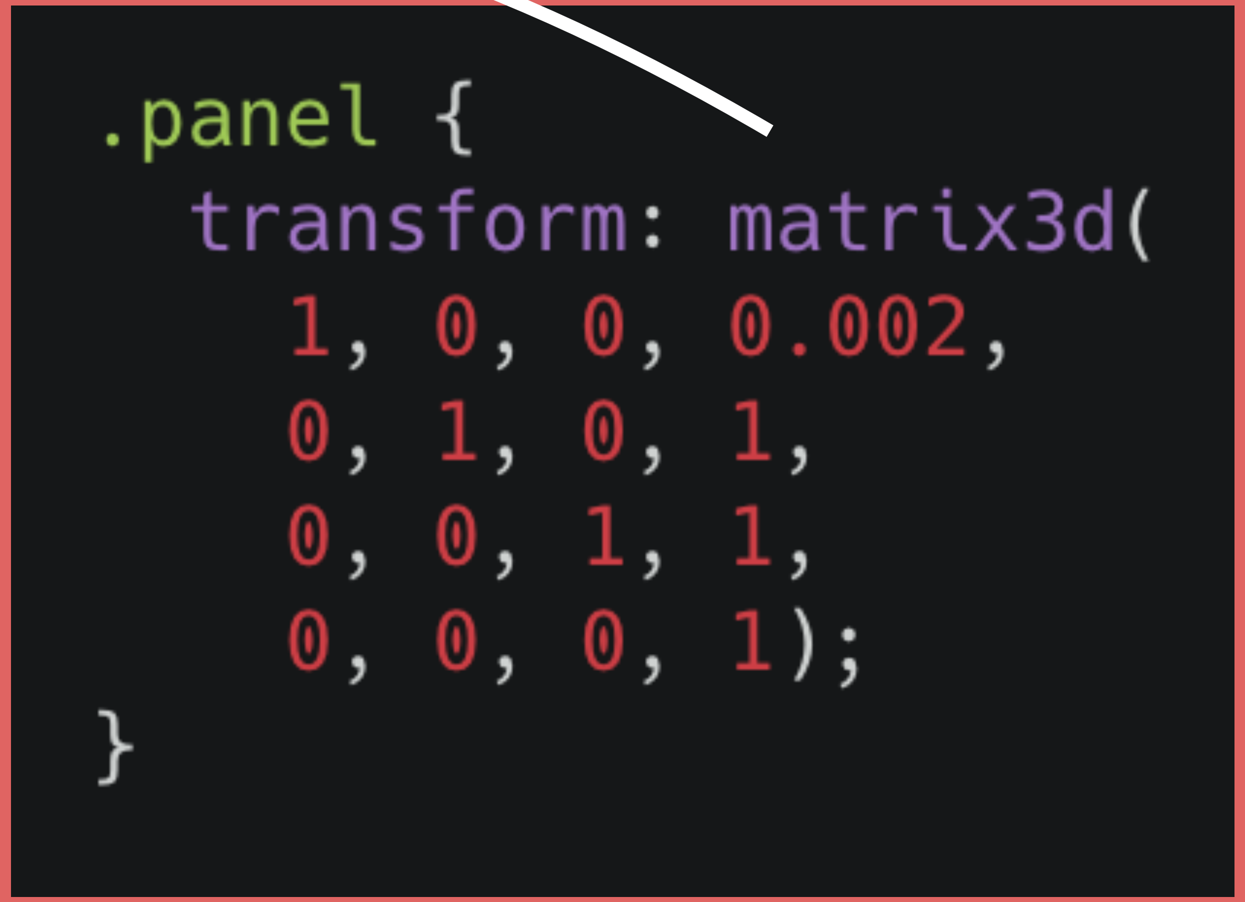
```
.scale-matrix {
    transform: matrix3d(
      <sx>, 0, 0, 1 ,
      0, <sy>, 0, 1 ,
      0, 0, <sz>, 1,
      0, 0, 0, 1);
}
```



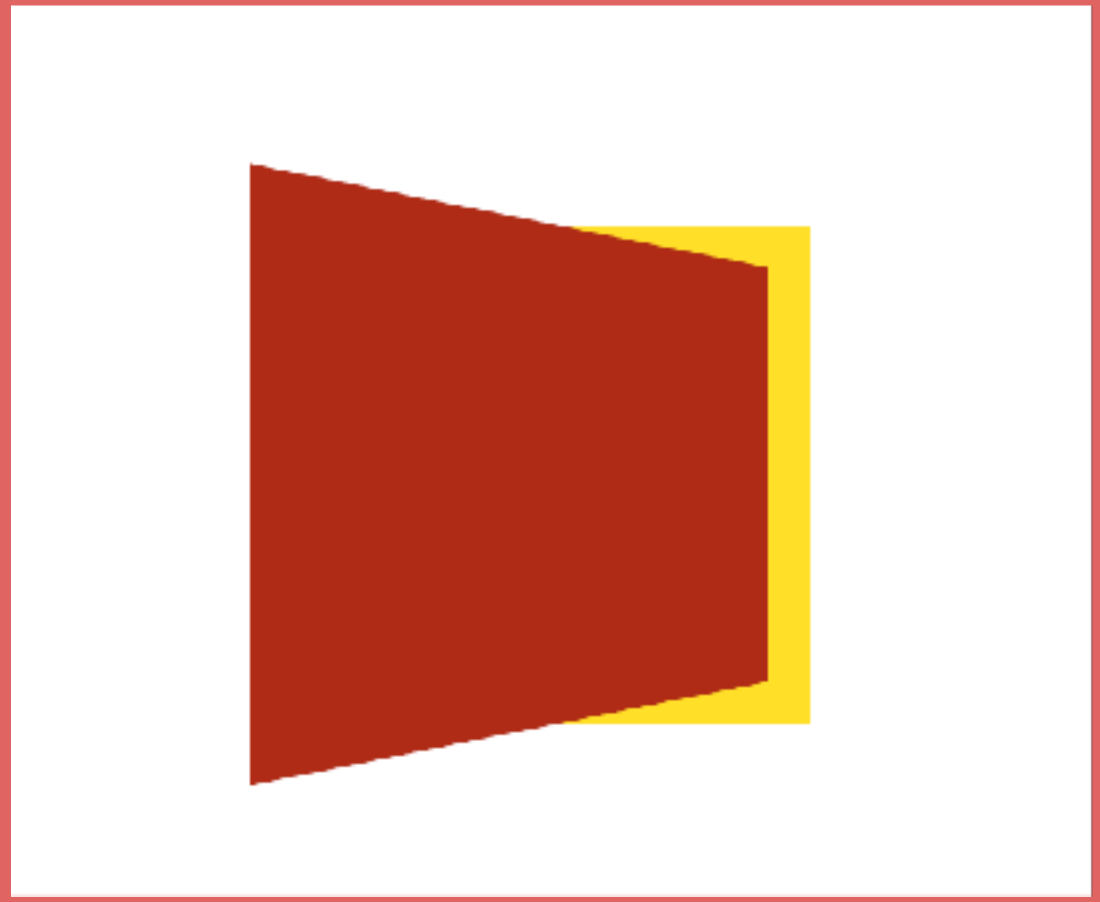
```
.rotate-y-matrix {
    transform: matrix3d(
      cosX, 0,   -sinX,  1),
      0,    1,      0,   1),
      sinX, 0,   cosX),  1)
      0,    0,      0,   1);
}
```

The matrix3d() function is an alternative to the three dimensional transform functions rotate3d(), rotateX(), rotateY(), rotateZ(), translate3d(), translateZ(), scale3d(), scaleZ(), and perspective().

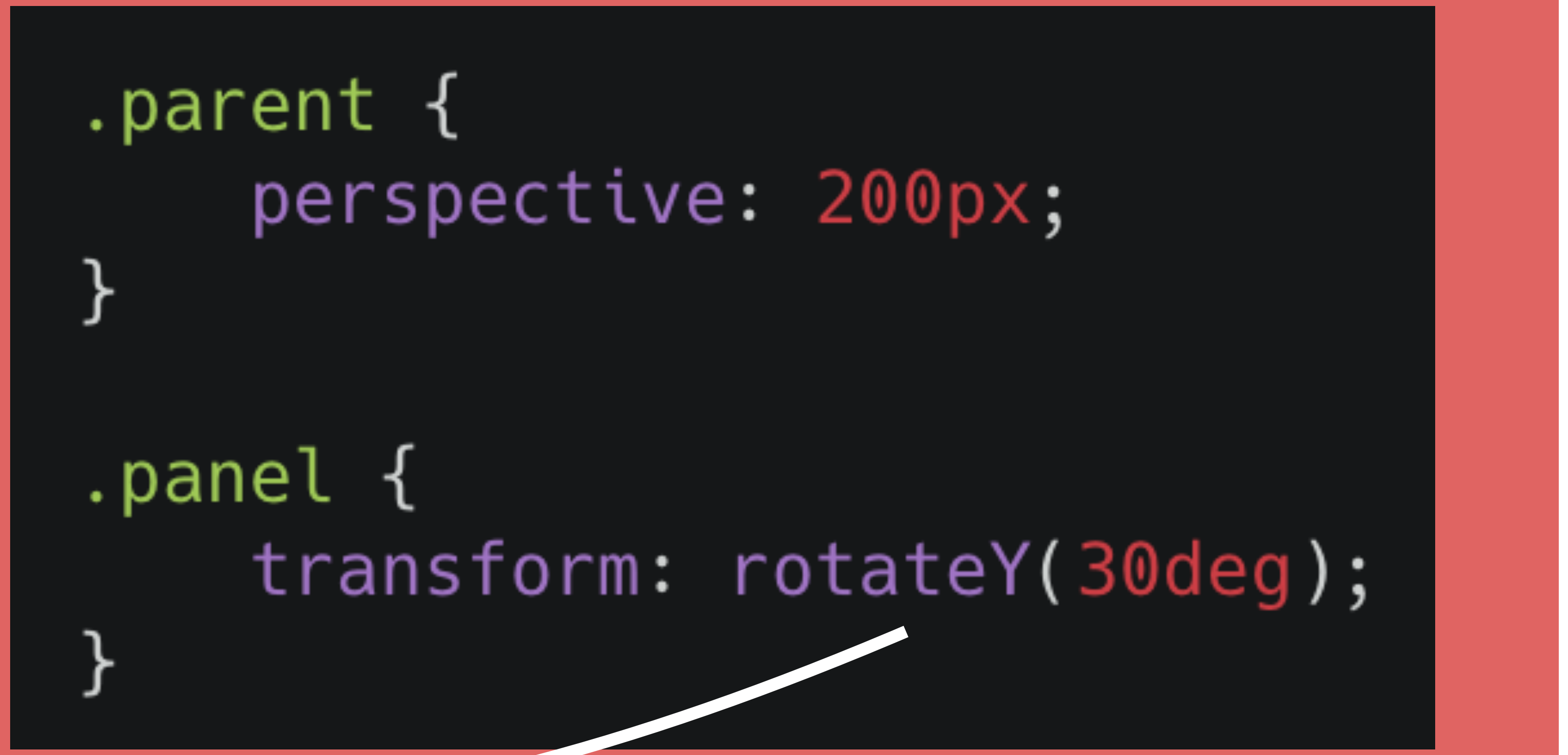
MATRIX 3D



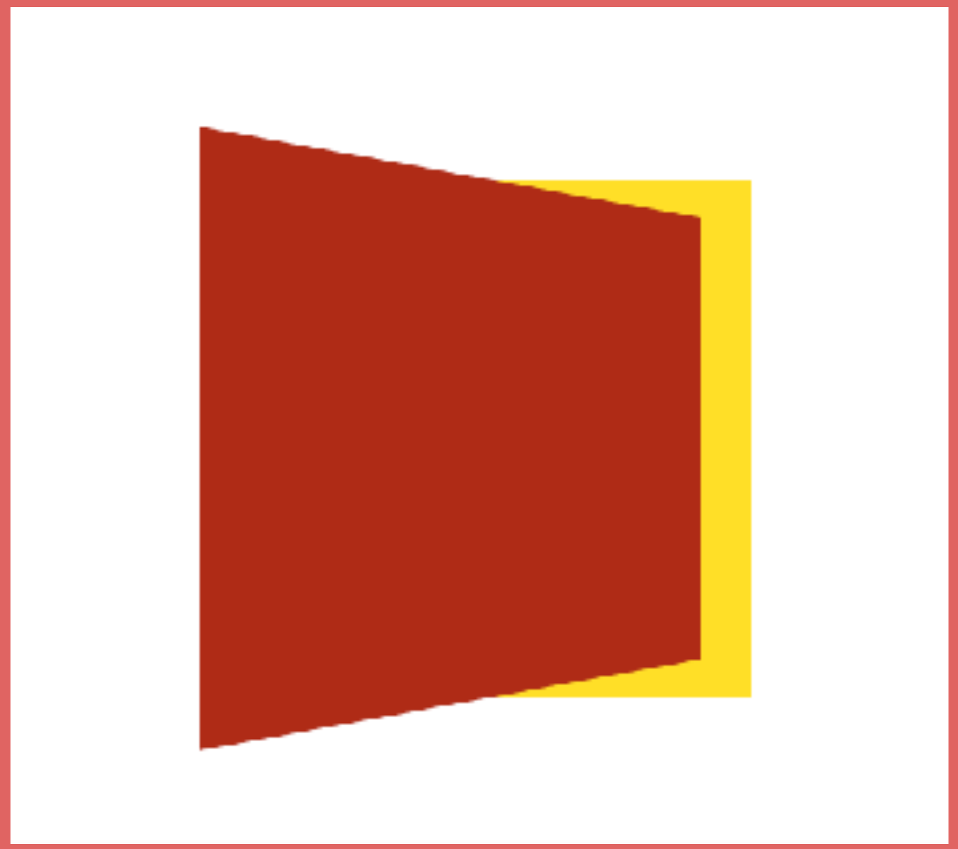
```
.panel {
  transform: matrix3d(
    1, 0, 0, 0.002,
    0, 1, 0, 1,
    0, 0, 1, 1,
    0, 0, 0, 1);
}
```



doesn't need
perspective on parent



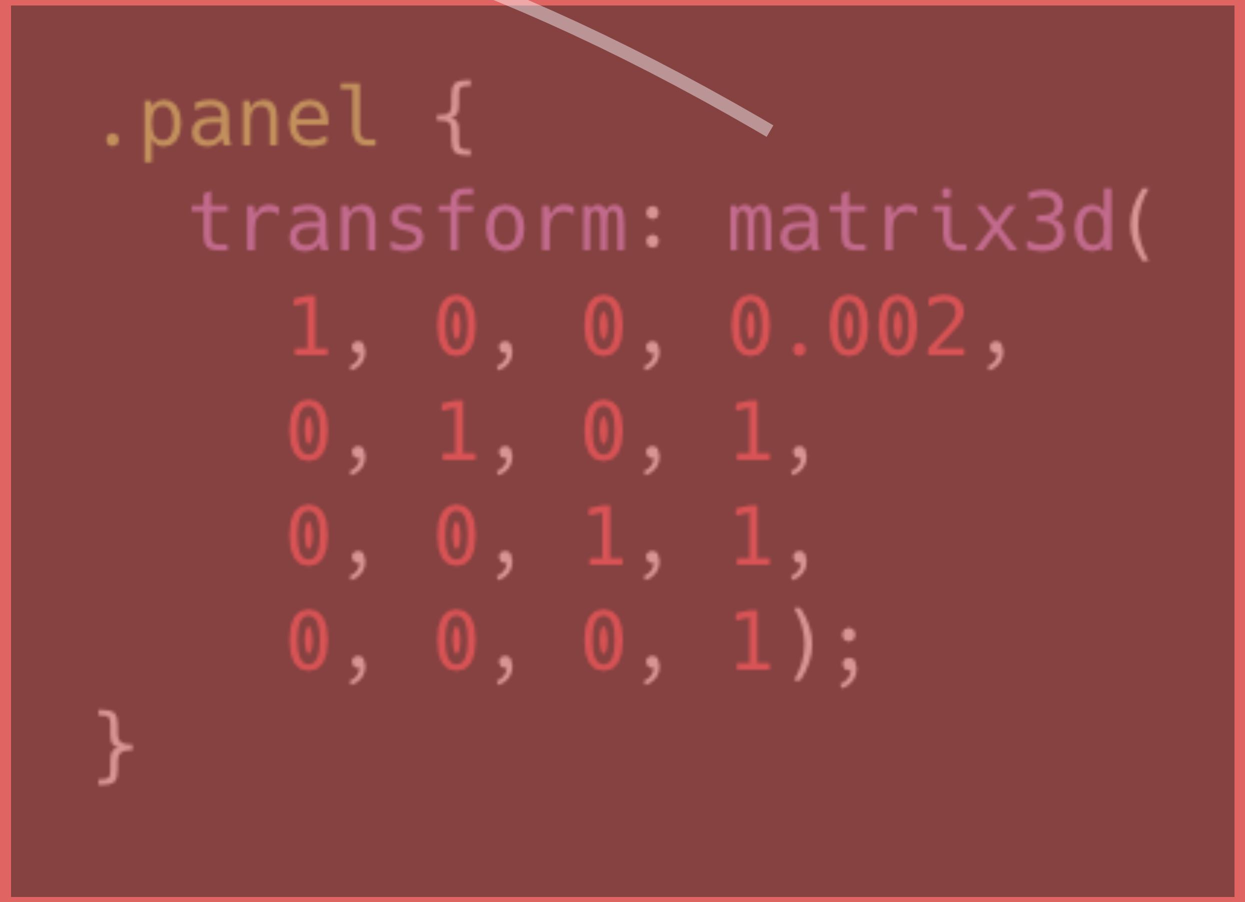
```
.parent {
    perspective: 200px;
}

.panel {
    transform: rotateY(30deg);
}
```



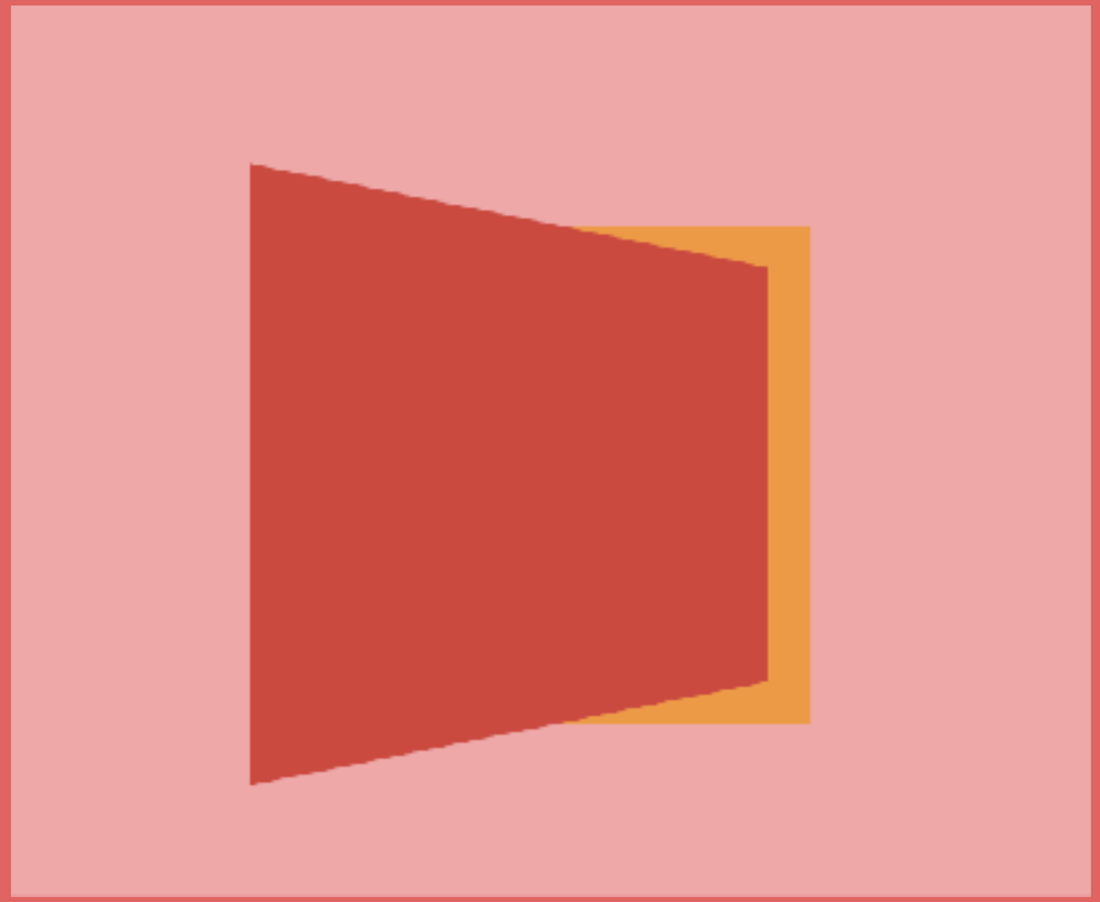
needs perspective
on parent

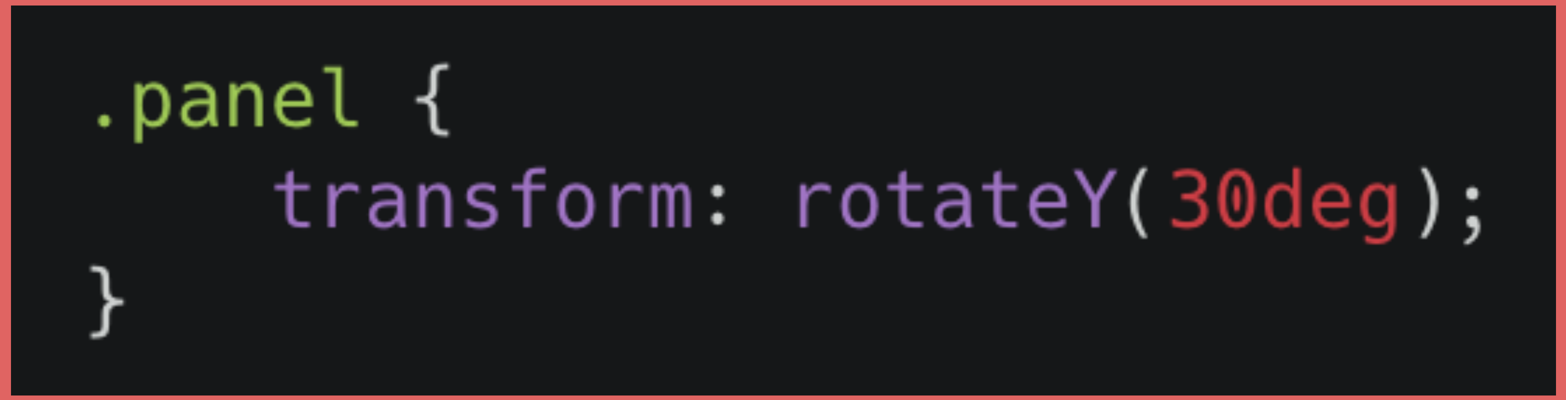
MATRIX 3D

doesn't need
perspective on parent

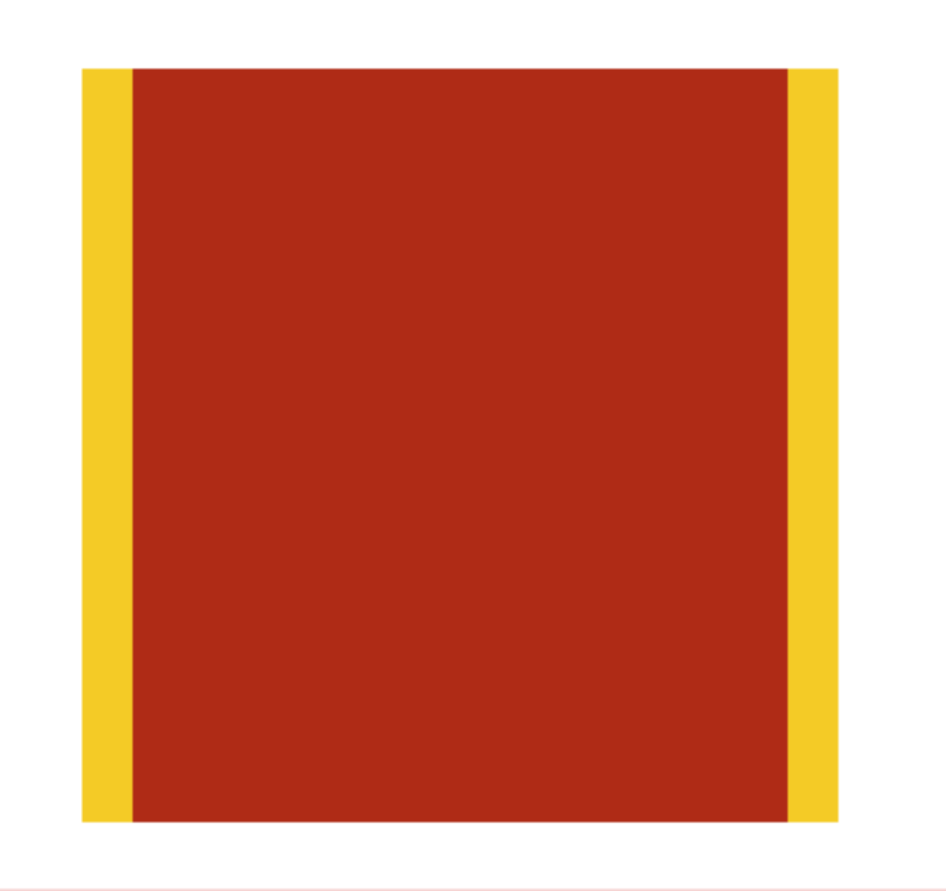


```css
.panel {
  transform: matrix3d(
    1, 0, 0, 0.002,
    0, 1, 0, 1,
    0, 0, 1, 1,
    0, 0, 0, 1);
}
```





```css
.panel {
    transform: rotateY(30deg);
}
```



without perspective

codepen.io/lisilinhart/pen/YzzqGNX

JS + **CSS VARIABLES**

- easily debuggable
- no excessive DOM manipulation
- DOM node independent
- great if you animate multiple child elements
- great for reactive & physics animation
- Transform: Individual Properties

Timing

Animation
Principles

Easing

TIMING

Large moves, complex easing
Hover effects, fading, scaling
100ms
200ms
300ms
400ms

valhead.com/2016/05/05/how-fast-should-your-ui-animations-be

TIMING

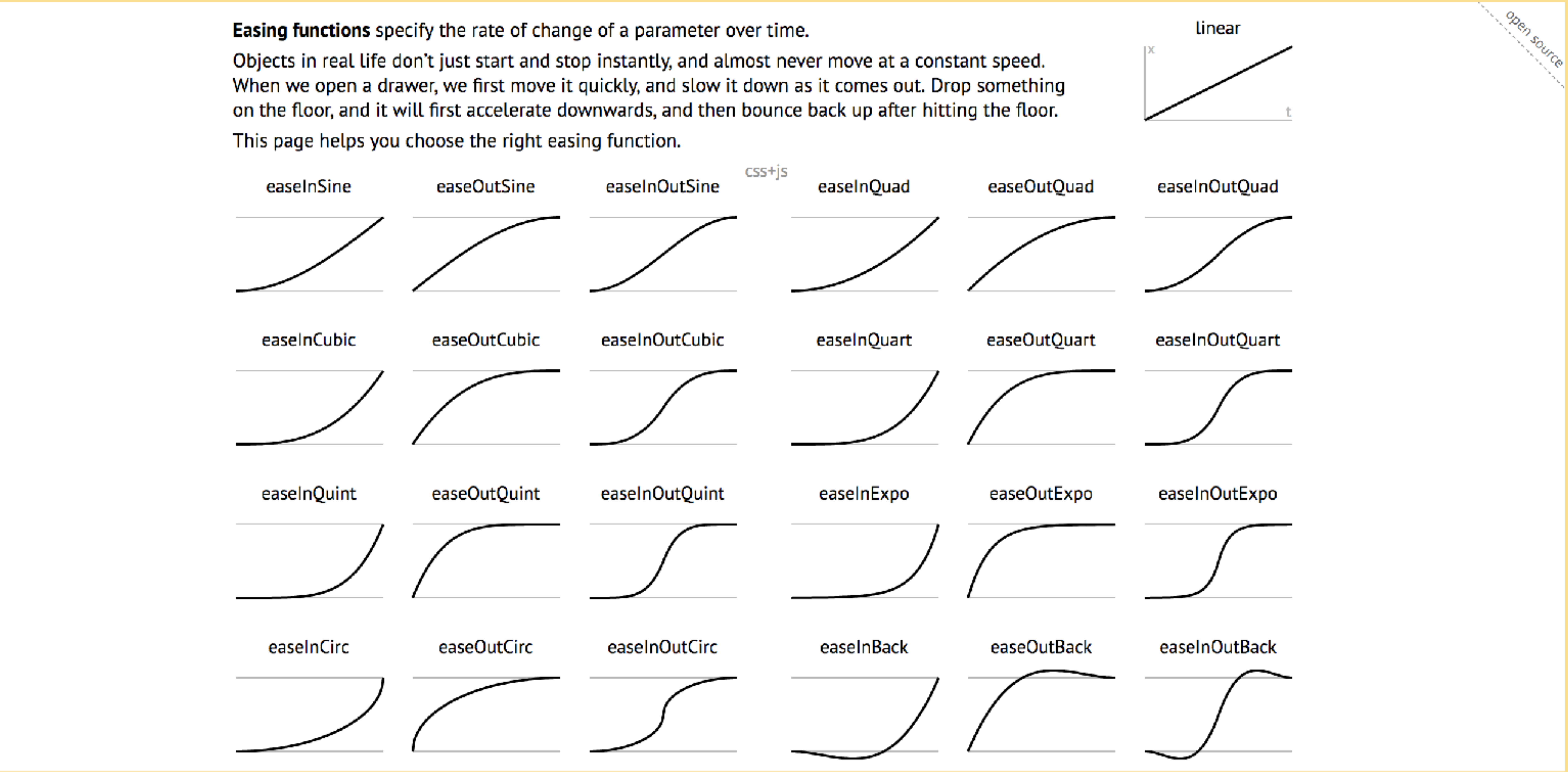
slow transitions
are less distracting

Large moves, complex easing
Hover effects, fading, scaling
100ms
200ms
300ms
400ms

fast animations
are more likely to attract
attention

valhead.com/2016/05/05/how-fast-should-your-ui-animations-be/

EASINGS.NET

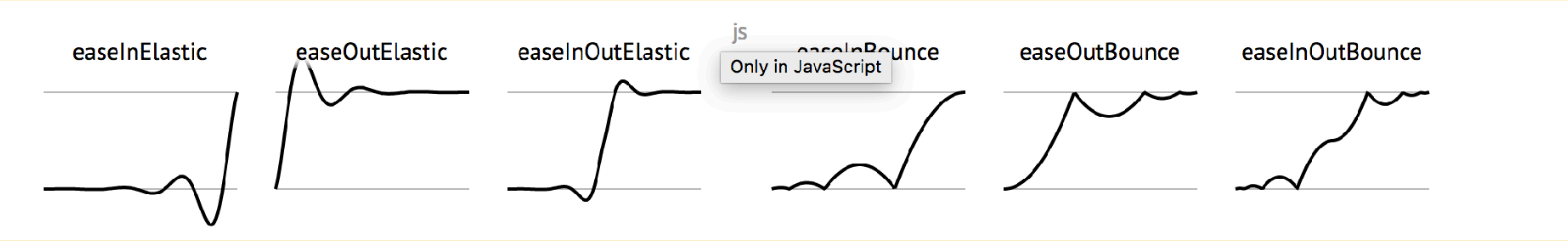


Easing functions specify the rate of change of a parameter over time.

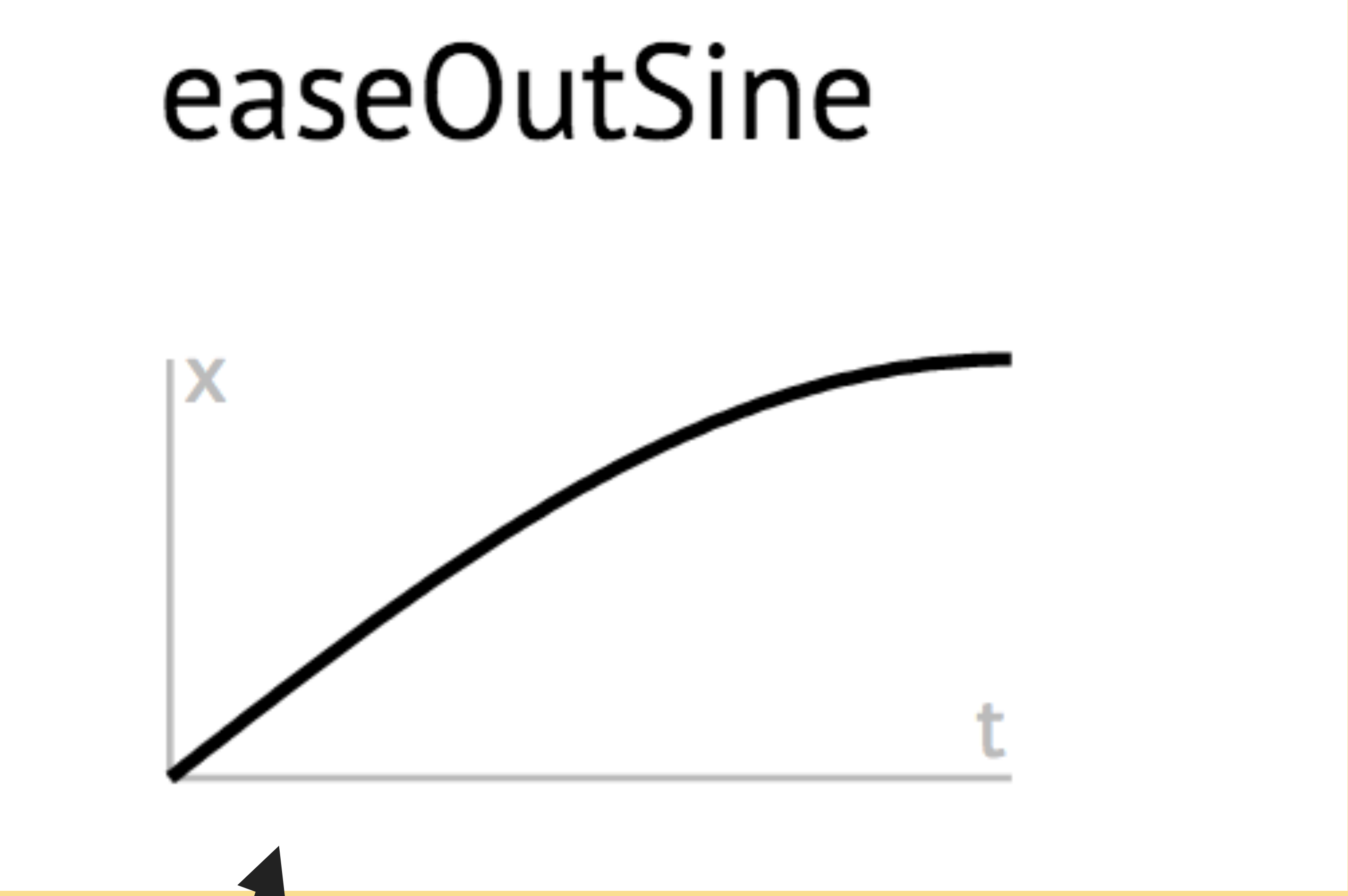
Objects in real life don't just start and stop instantly, and almost never move at a constant speed. When we open a drawer, we first move it quickly, and slow it down as it comes out. Drop something on the floor, and it will first accelerate downwards, and then bounce back up after hitting the floor.

This page helps you choose the right easing function.

EASINGS.NET


easeInElastic
easeOutElastic
easeInOutElastic
js
easeInBounce
Only in JavaScript
easeOutBounce
easeInOutBounce

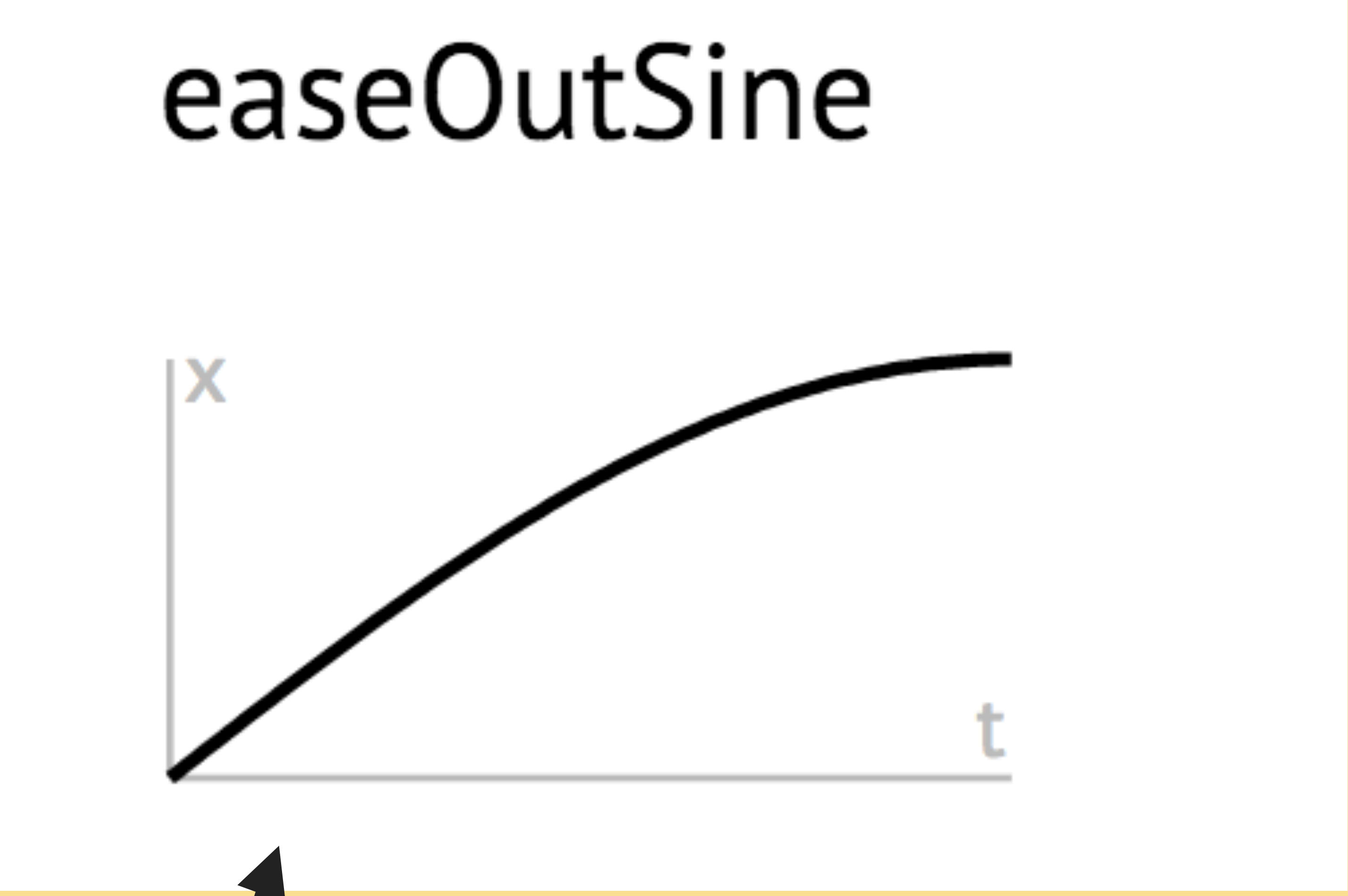
EASING



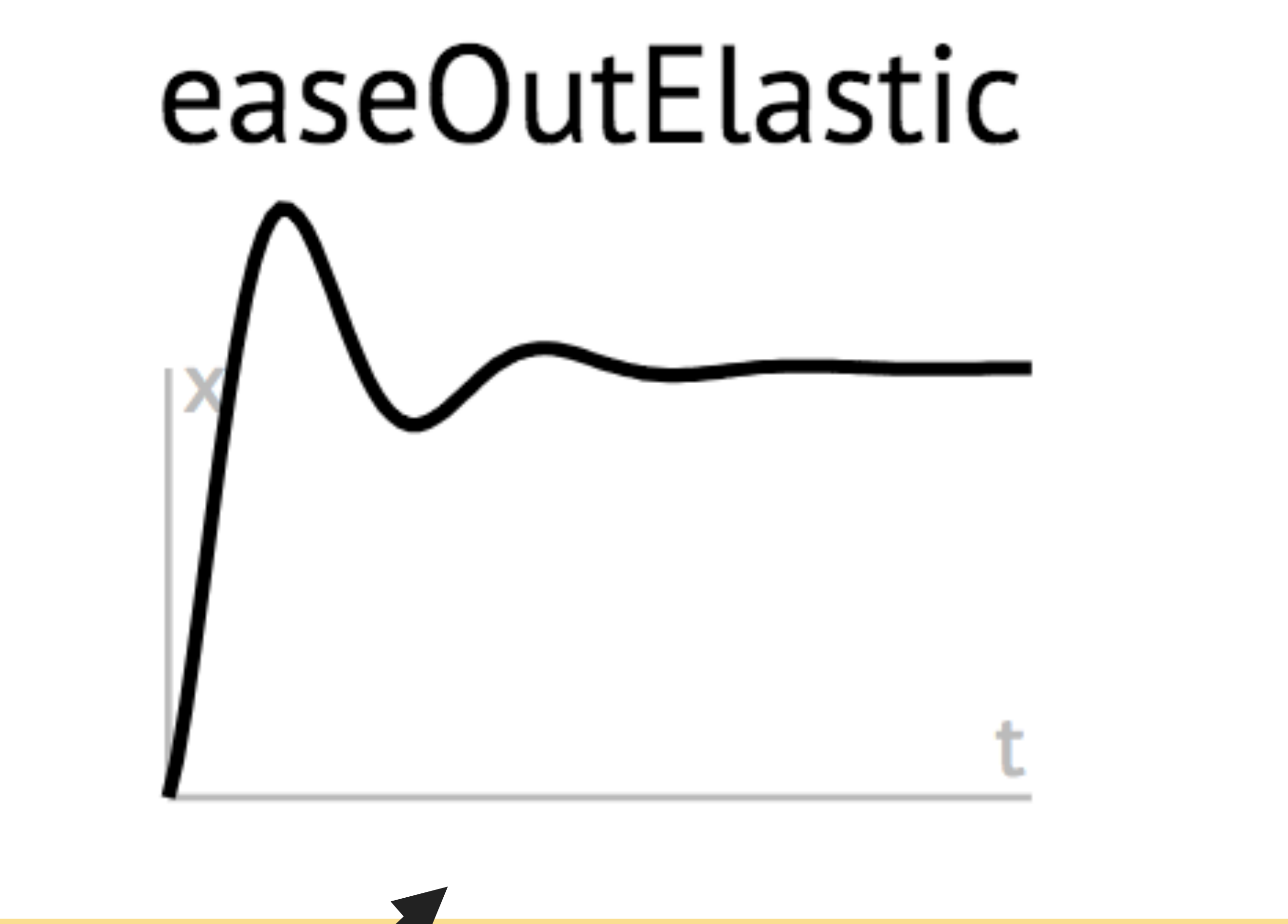
easeout feels more

reactive and instantaneous

EASING

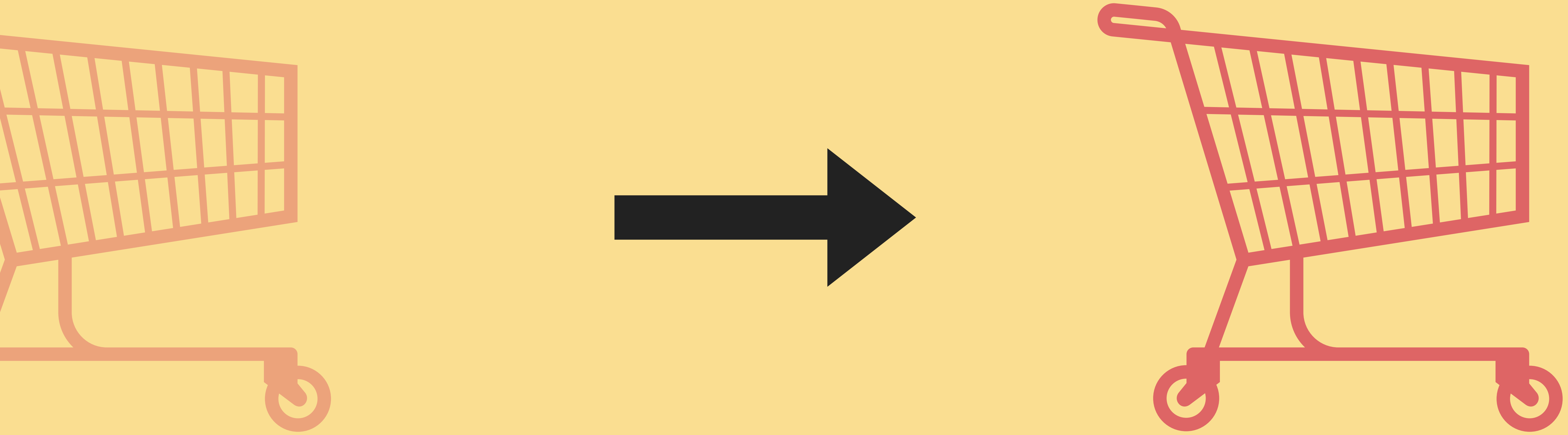


easeout feels more reactive and instantaneous

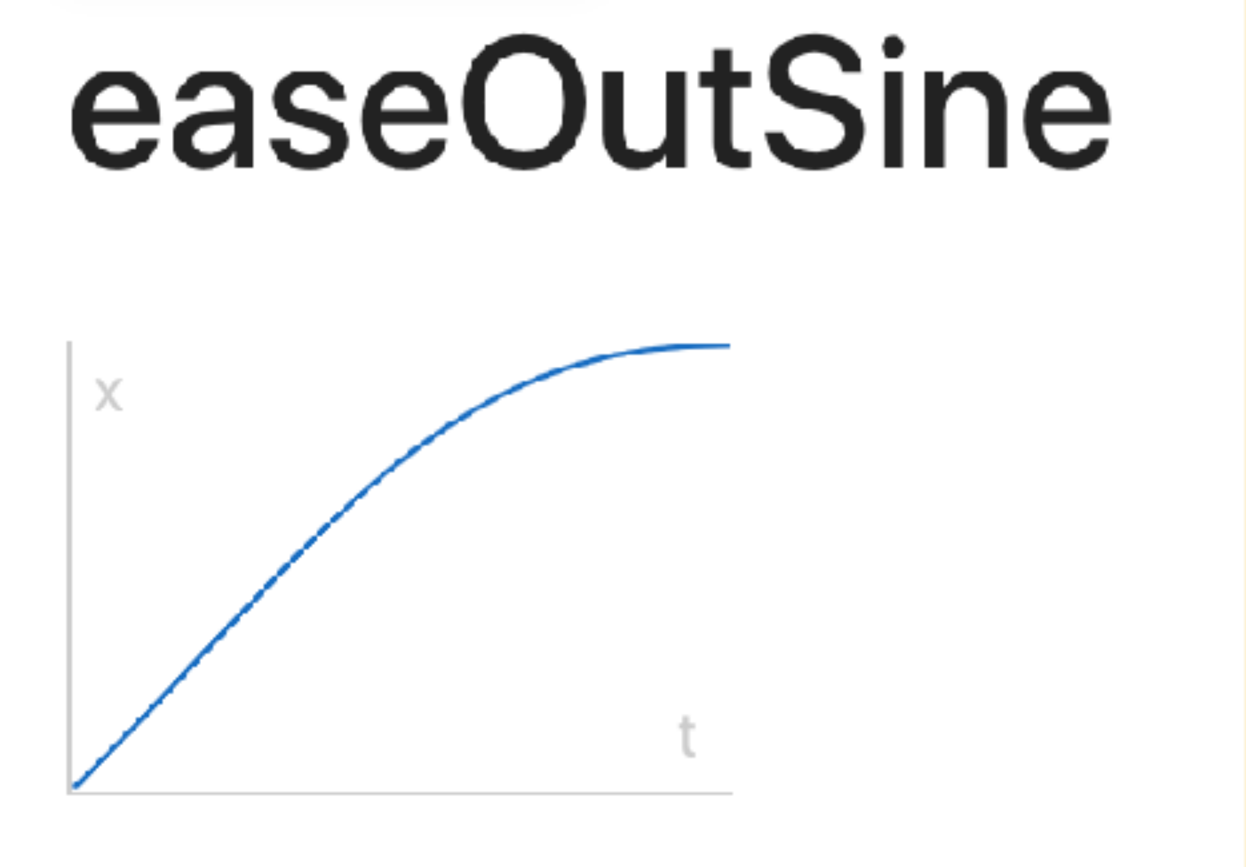


needs more time, because it's a more complex curve

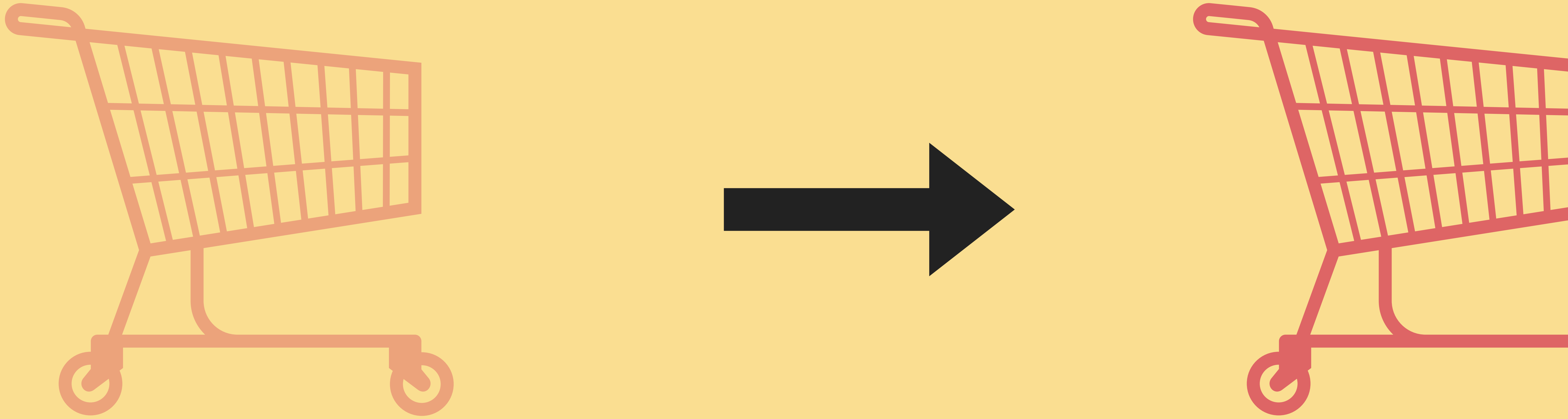
EASING

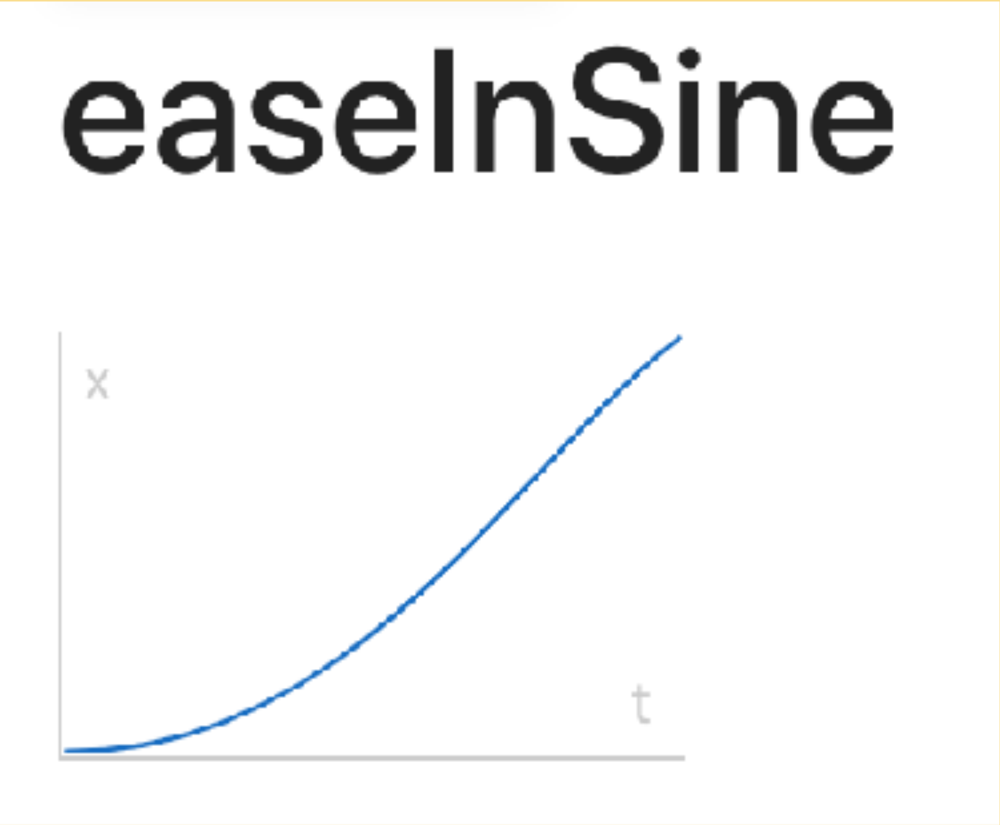


when an element is moving
into the screen it should start quick
and slow down towards the center



EASING





when an element is moving
out of the screen it should start slow
and speed up towards the end

Opportunities for Animation

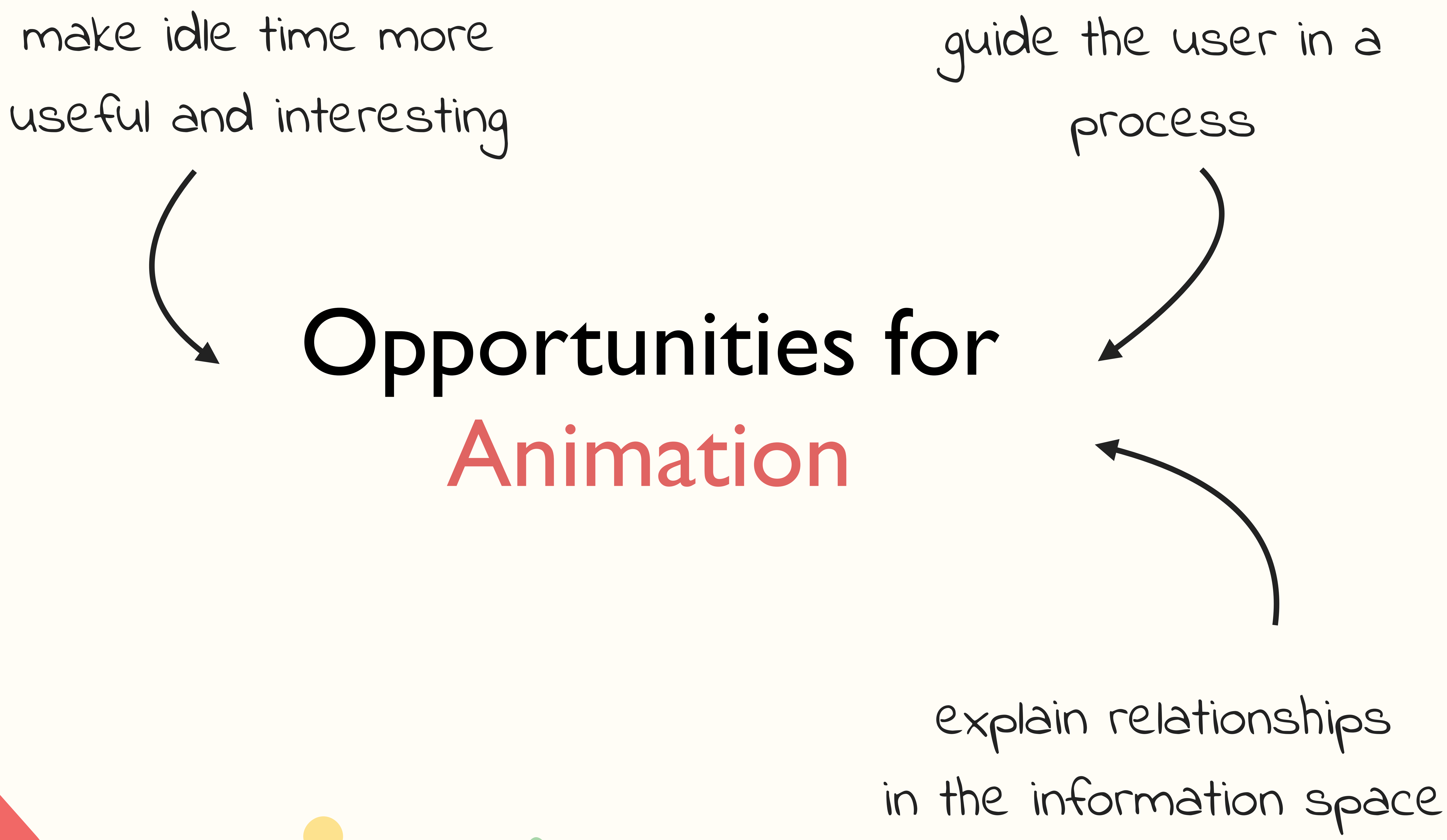
make idle time more useful and interesting

Opportunities for Animation

make idle time more useful and interesting

guide the user in a process

Opportunities for Animation



Opportunities for Animation

make idle time more useful and interesting

guide the user in a process

explain relationships in the information space

Opportunities for Animation

make idle time more useful and interesting

guide the user in a process

get the users attention

explain relationships in the information space

Animation Resources

Animation Resources

Animation At Work - A Book Apart

Book by Rachel Nabors

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keyframe.rs

Twitch Channel by David Khourshid & Stephen Shaw

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Slack Channel to get feedback & inspiration

developers.google.com/web/fundamentals/design-and-ux/animations/

basics to know about animation

“Users should only notice your animation if you need to attract their attention in that moment. Otherwise, micro-interactions and other transitions should be so seamless, users don’t even notice that there is animation”

Heather Daggett - Animation At work

Animate for the user,
don’t create obstacles,

FH Salzburg
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