CSS Houdini

Painting the Web

About me

I'm a Frontend Engineer with a passion for web animation and UX. The past two years I've been lecturing about web development at the University of Applied Science Salzburg. Now I'm an Developer Experience Engineer at Storyblok.

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What is CSS Houdini?

What is CSS Houdini

CSS Houdini is a W3C effort to define lower-level CSS DOM APIs for authors to understand, recreate, and extend high-level CSS authoring features.

https://wiki.mozilla.org/CSS/Houdini

What is CSS Houdini

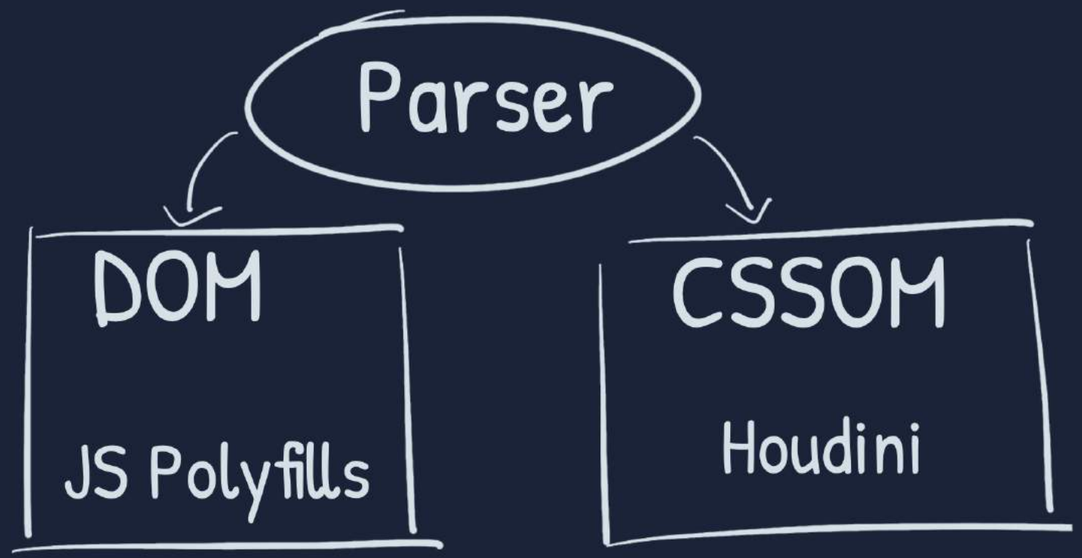
Extending CSS via JS

Houdini introduces low-level JavaScript APIs for the browser's render engine. This is simimlar to how Service Workers are a low-level JavaScript API for the browser's cache.

What is CSS Houdini

Access to the rendering engine

Houdini allows you to extend the CSS with new features using JavaScript, hook into CSS rendering engine and tell the browser how to apply CSS during a render process.



Can we use it?

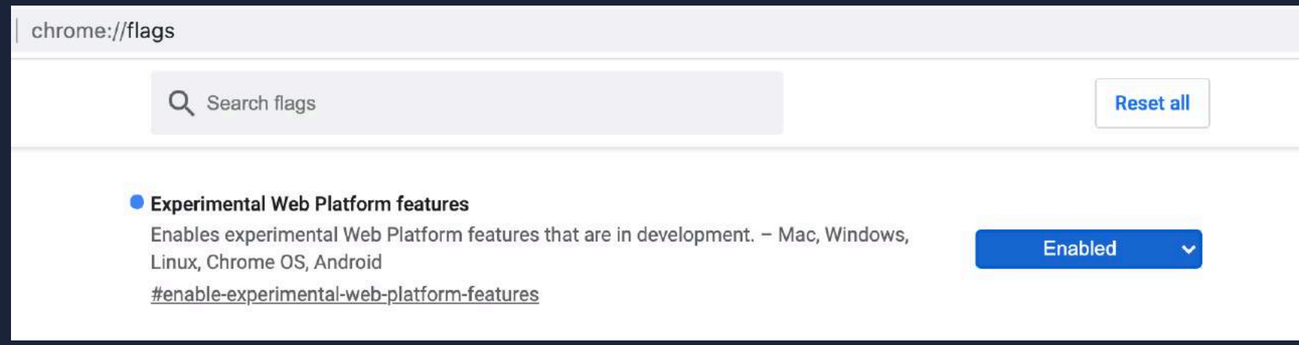
see ishoudinireadyyet?

Is Houdini ready yet?

	Google Chrome	Microsoft Edge	Opera	Samsung Internet	Mozilla Firefox	Apple Safari	Spec
Engine	Blink				Gecko	WebKit	-
Layout API (Explainer Demos)	Partial support (Canary) Details	Partial support (Canary) Details	Partial support (Developer) Details	No signal	Under consideration Details	No signal	First Public Working Draft Spec
Paint API (Explainer Demos Article)	Shipped (Chrome 65) Details	Shipped (Edge 79) Details	Shipped (Opera 52) Details	Shipped (Internet 9.2) Details	Under consideration Details	In Development Details	Candidate Recommendation Spec
Parser API (Explainer)	No signal	No signal	No signal	No signal	No signal	No signal	Proposal Spec
Properties & Values API (Demos Article)	Shipped (Chrome 78) Details	Shipped (Edge 79) Details	Shipped (Opera 65) Details	Shipped (Internet 12.0) Details	Under consideration Details	Partial support (Safari TP 67) Details	Working Draft Spec
AnimationWorklet (Explainer Demos Article)	Partial support (Chrome 71) Details	Partial support (Edge 79)	Partial support (Opera 58)	Partial support (Internet 10.2 Beta)	No signal	No signal	First Public Working Draft Spec
Typed OM (Explainer Article)	Shipped (Chrome 66) Details	Shipped (Edge 79) Details	Shipped (Opera 53) Details	Shipped (Internet 9.2) Details	Under consideration Details	In Development Details	Working Draft Spec
Font Metrics API (Explainer)	No signal	No signal	No signal	No signal	No signal	No signal	Proposal Spec

Testing it out

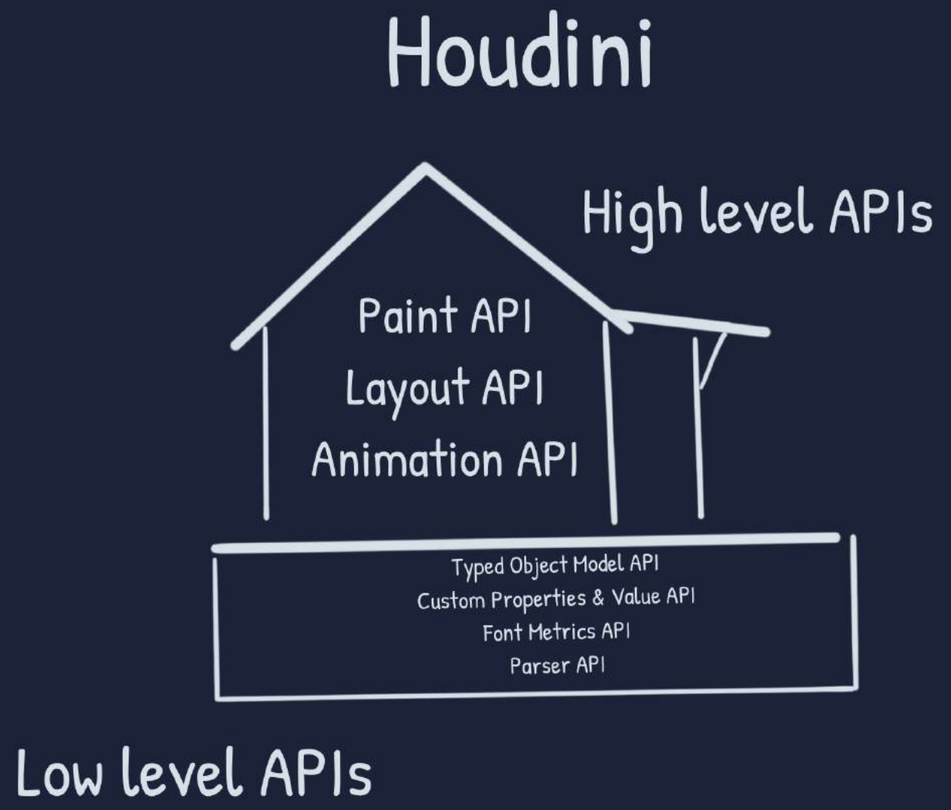
Activate experimental web platform features on chrome://flags/



Houdini APIs

Houdini APIs

The Houdini APIs allow you to work with the CSS parser, CSSOM, cascade, the layout, paint and composite rendering stages.



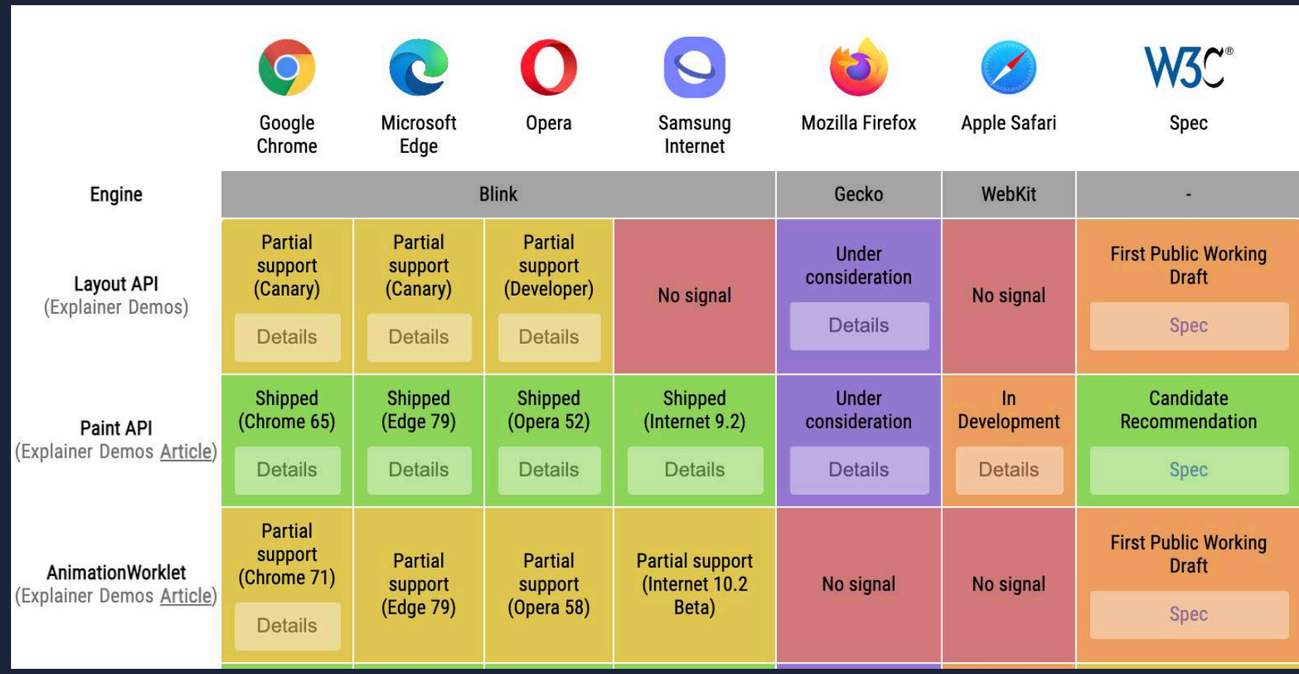
Houdini APIs - High Level

The high level apis are closely related to the browser's rendering process (style → layout → paint → composite)

→ Paint API

→ Layout API

→ Animation API



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Paint API (High-level)

An extension point for the browser’s paint rendering step where visual properties (color, background, border, etc.) are determined.

→ similar to a canvas drawing context

→ can "paint" anywhere, images are supported

→ has already quite good browser support (apart from Firefox)

Paint API (High-level)

Demo:
https://css-houdini.rocks/tooltip

Read more:
https://houdini.glitch.me/paint

Layout API (High-level)

An extension point for the browser's layout rendering step where element dimensions, position, and alignment are determined.

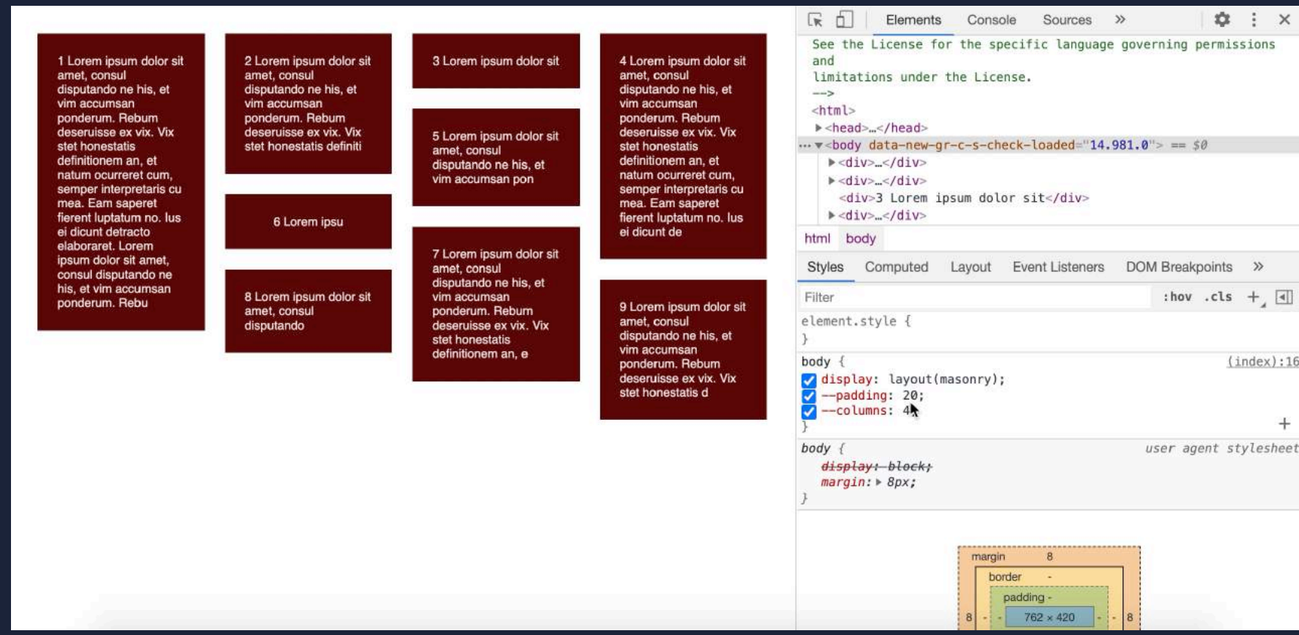
→ make your own display properties. Masonry, here we come!

→ Able to polyfill layout specs like Container Queries

Layout API (High-level)

Demo:
https://googlechromelabs.github.io/houdini-samples/layout-worklet/masonry/

Read more:
https://houdini.glitch.me/layout



Animation API (High-level)

An extension point for browser's composite rendering step where layers are drawn to the screen and animated. The Animation API allows animation effects to be tied to user input like scrolling in a performant way

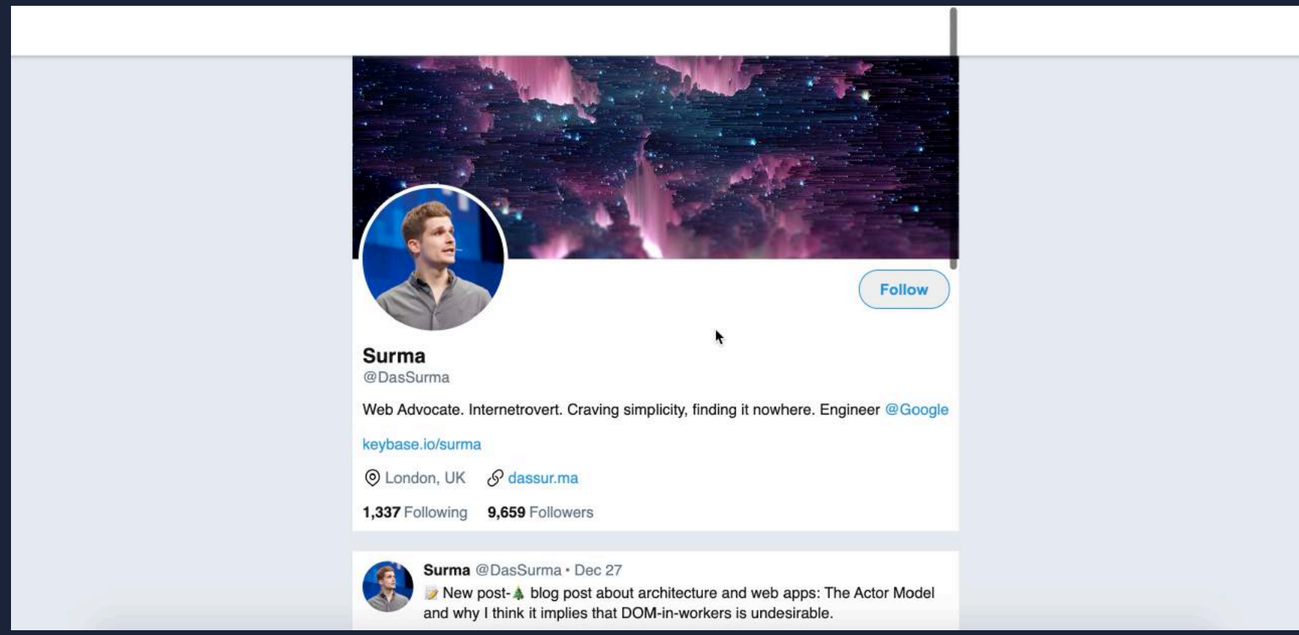
→ Allows animations based on user input

→ Allows performant parallax

Animation API (High-level)

Demo:
https://googlechromelabs.github.io/houdini-samples/animation-worklet/twitter-header/

Read more:
https://houdini.glitch.me/animation



Houdini APIs - Low Level

The low level APIs form a foundation for high-level APIs. They are closely related to the parser extensions -> CSSOM, cascade

→ Typed Object Model API

→ Custom Properties & Values API

→ Font Metrics API

→ Parser API

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Typed Object Model API (Low-level)

Before Houdini the only way for JavaScript to interact with CSS was by parsing CSS represented as string values and modifying them. The Typed OM gives shape and structure to CSS values that previously were simple strings. It's an extension to the existing CSS Object Model (CSSOM) that exposes CSS values as typed JavaScript objects, instead of a simple strings.

```
selectedElement.computedStyleMap().get("font-size");

{
  value: 20,
  unit: "px"
}

selectedElement.attributeStyleMap.set("font-size", CSS.em(2));
```

Read more: https://houdini.glitch.me/typed-om

Custom Properties & Values API (Low-level)

Custom Properties give shape, structure, and constraints to CSS Variables. The CSS Properties And Values API allows developers to extend CSS variables by adding a type, initial value and define inheritance.

→ Types are preserved between CSS & JS

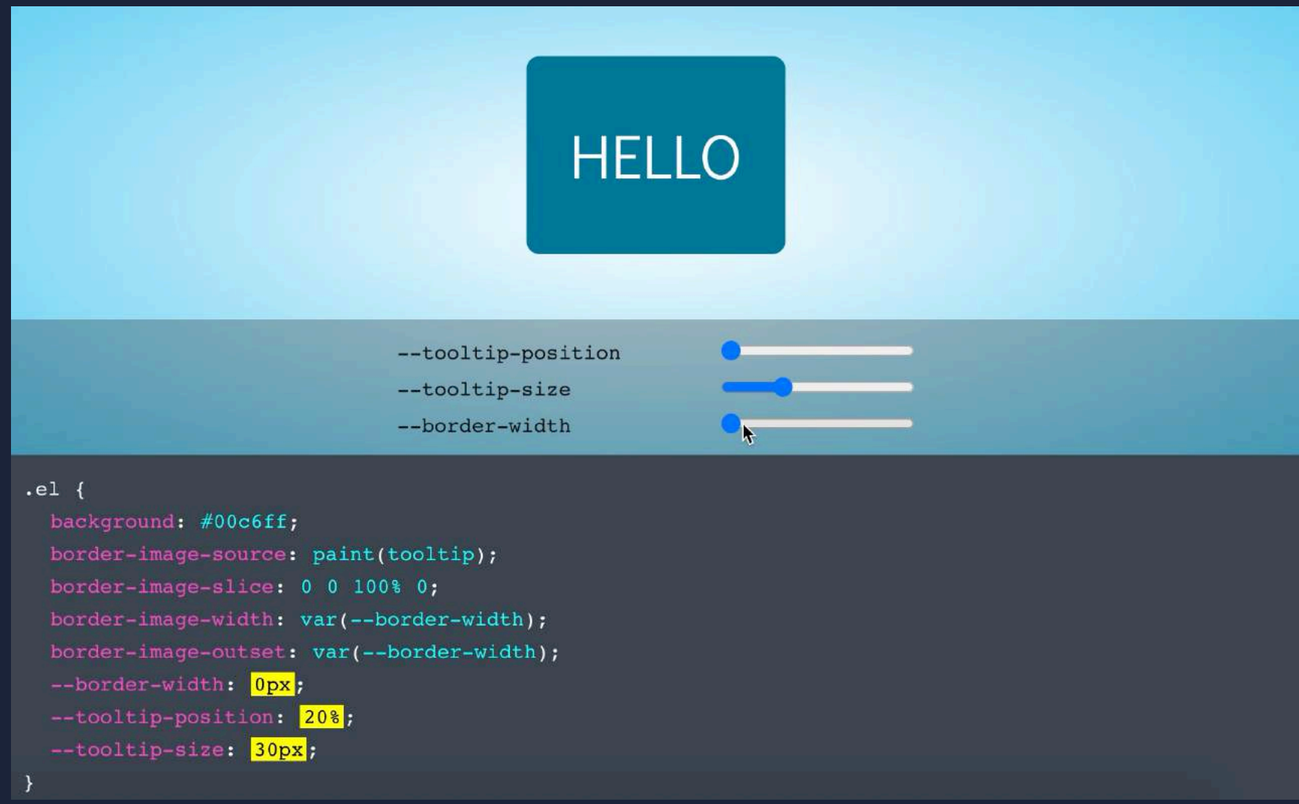
→ Good browser support already

```
CSS.registerProperty({
  name: "--colorPrimary",
  syntax: "<color>",
  inherits: false,
  initialValue: "blue",
});
```

Custom Properties & Values API (low-level)

Demo:
https://css-houdini.rocks/tooltip

Read more:
https://houdini.glitch.me/custom-properties



Font Metrics API (Low-level)

(Very Early Stage) The Font Metrics API will provide methods for measuring dimensions of text elements that are being rendered on screen in order to allow developers to affect how text elements are being rendered on screen. Multi-line dynamic text truncation is an example of one of those features.

Worklets

Worklets are extension points for rendering engines. Worklets are scripts that run during render and are independent of the main JavaScript environment. Conceptually, they're similar to Web Workers. The have very restricted access to the global scope.

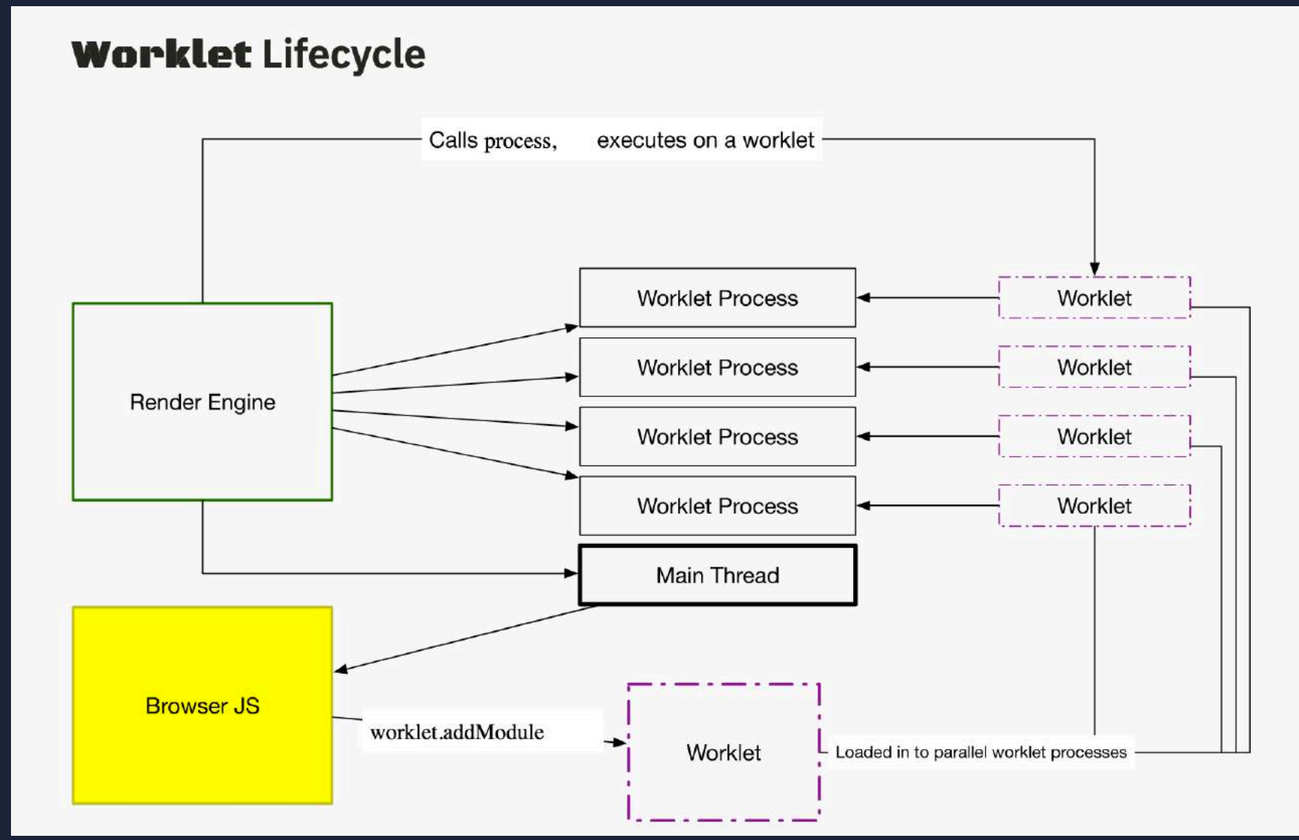
Houdini introduces following Worklets to extend the browser render engine:

→ Paint Worklet - Paint API

→ Animation Worklet - Animation API

→ Layout Worklet - Layout API

https://houdini.glitch.me/worklets



The Paint API

The Paint API

What does it do?

The Paint API works very similar to the canvas drawing context. We can use JS to create custom drawing function that draw an image in CSS. We can then use this function for any CSS property that expects an image. You could use it for the background-image, the border-image or the list-style-image.

The Paint API

Why do wee need it?

- → example: extra.css
- → instead of polyfills like the conic gradient polyfill
- → Reduce DOM nodes number, e.g. when drawing lots of particles
- → create fancy painting features

How to use in CSS

```
.slanted-bg {
  background-image: paint(slanted-bg);
}
```

How to use in CSS - Test for support

```
.slanted-bg  {
    background: papayawhip;
}

@supports (background: paint(slanted-bg)) {
  .slanted-bg  {
    background: paint(slanted-bg);
  }
}
```

How to register in JS

1. Declare a custom paint class
2. Register paint
3. Load worklet

How to register in JS

Declare class

```
class SlantedBackground {
  paint(ctx, geom, props, args) {
    // paint implementation
  }
}
```

How to register in JS

Register paint

```
registerPaint('slanted-bg', SlantedBackground);
```

How to register in JS

Load Worklet

```
if ('paintWorklet' in CSS) {
  CSS.paintWorklet.addModule('slanted-bg-module.js');
}
```

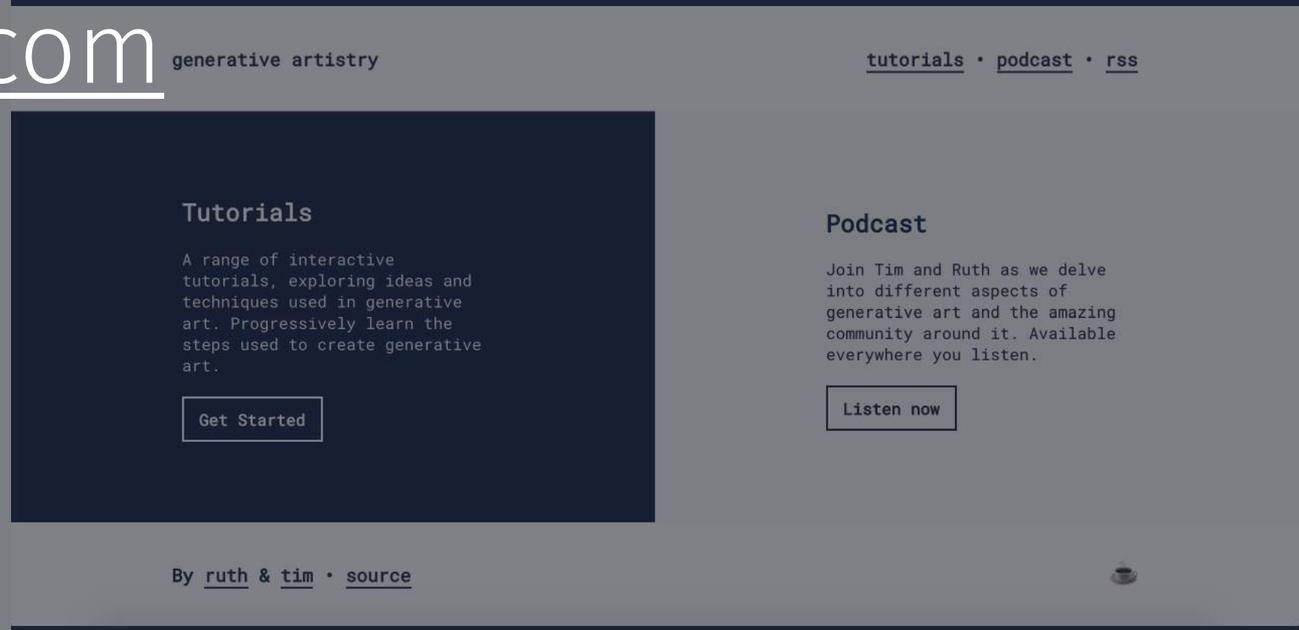
Paint API Example

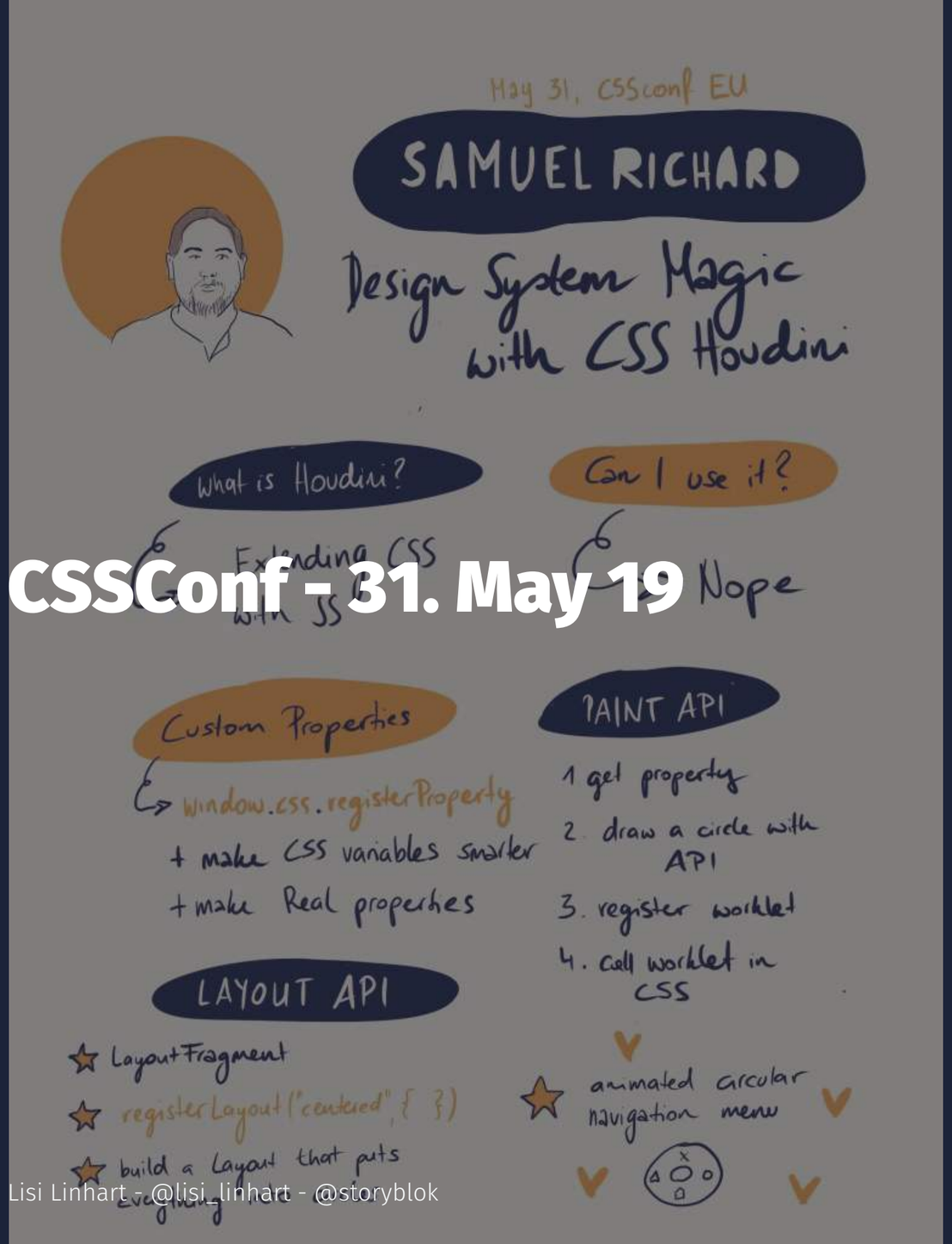
How my Houdini Journey started

Lisi Linhart - @lisi_linhart - @storyblok

FFConf - 19. Nov 18

https://generativeartistry.com





CSSConf - 31. May 19

Samuel Richard

Design System Magic with CSS Houdini

How my Houdini Journey started

🤔 Canvas & Houdini seem really similar

How my Houdini Journey started

https://generativeartistry.com/tutorials/tiled-lines

```
var canvas = document.querySelector('canvas');
var context = canvas.getContext('2d');

for(var x = 0; x < size; x += step) {
  for(var y = 0; y < size; y+= step) {
    var leftToRight = Math.random() >= 0.5;

    if(leftToRight) {
        context.moveTo(x, y);
        context.lineTo(x + width, y + height);
    } else {
        context.moveTo(x + width, y);
        context.lineTo(x, y + height);
    }

    context.stroke();
  }
}
```

How my Houdini Journey started

Let's try it in Houdini

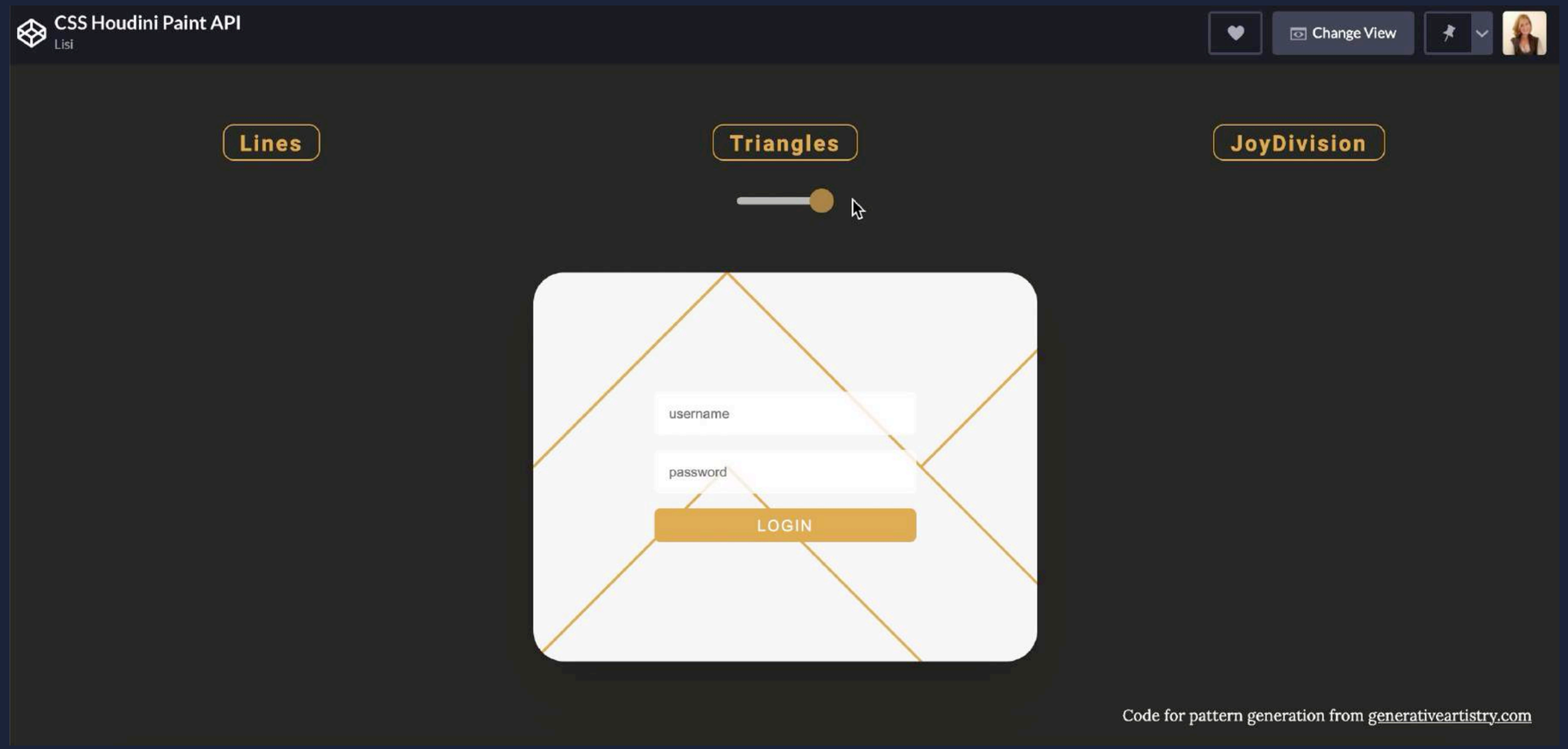
```
paint(ctx, geom) {
    for (let y = 0; y <= geom.height; y += size) {
        for (let x = 0; x <= geom.width; x += size) {
          let leftToRight = Math.random() >= 0.5;

          if (leftToRight) {
            ctx.moveTo(x, y + size);
            ctx.lineTo(x + size, y);
          } else {
            ctx.moveTo(x, y);
            ctx.lineTo(x + size, y + size);
          }

          ctx.stroke();
        }
      }
  }
```

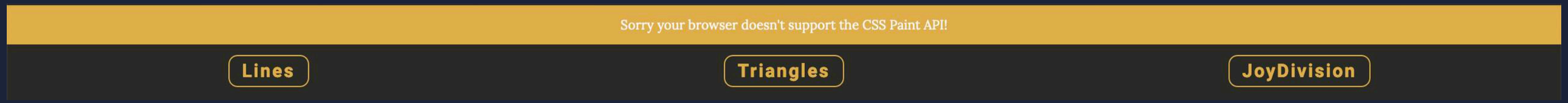
How my Houdini Journey started

Houdini & Generative Art



https://codepen.io/lisilinhart/pen/LYEJWQQ

1. Register & Support




```
if (CSS.paintWorklet) {
    CSS.paintWorklet.addModule('/lisilinhart/pen/LYEJWQQ.js');
} else {
    document.body.classList.add('warning');
}
```

2. Use in CSS

```
.card {
    background: var(--c-light);
    background-image: paint(generative);
    --type: var(--drawType, lines); /* Types: lines,joyDivision,triangles */
    --size: 120;
    --line-color: #E0AF53;
    --line-width: 2;
}

input[value="lines"]:checked ~ .card {
    --drawType: lines;
}
```

3. JS - registerPaint - input

```
if (typeof registerPaint !== "undefined") {
  registerPaint("generative", class {

    paint(ctx, geom, properties) {
      ...
    }
  });
}
```

The JS - paint()

```
registerPaint("generative", class {
    static get inputProperties() {
      return ["--type", "--size", "--line-color", "--line-width"];
    }

    paint(ctx, geom, properties) {
      let drawType = String(properties.get("--type")).replace(' ', '');
      let size = Number(properties.get("--size"));
      let lineWidth = Number(properties.get("--line-width"));
      let lineColor = String(properties.get("--line-color"));
      ctx.lineWidth = lineWidth;
      ctx.strokeStyle = lineColor;

        const drawFunctions = {
            "lines":  () => this.drawLines(ctx, geom.width, geom.height, size),
            "joyDivision": () => this.drawJoyDivision(ctx, geom.width, geom.height, size),
            "triangles": () => this.drawTriangles(ctx, geom.width, geom.height, size),
        };

        drawFunctions[drawType]();
    }
});
```

The JS - drawLines()

```
registerPaint("generative", class {
    static get inputProperties() { ... }

    paint(ctx, geom, properties) { ... }

    drawLines(ctx, width, height, size) {
        for (let y = 0; y <= height; y += size) {
            for (let x = 0; x <= width; x += size) {
            let leftToRight = Math.random() >= 0.5;

            if (leftToRight) {
                ctx.moveTo(x, y + size);
                ctx.lineTo(x + size, y);
            } else {
                ctx.moveTo(x, y);
                ctx.lineTo(x + size, y + size);
            }

            ctx.stroke();
            }
        }
     }
});
```

How does it perform compared to current CSS features?

I wrote an article about it:

Performance depends on various factors:

→ Painting performance between current features and Houdini Paint Examples are quite similar

→ Painting performance depends on your Houdini module complexity

→ CSS Houdini adds the overhead of loading the module

→ Consider adding a CSS fallback until it's loaded (progressive enhancement!)

Conclusion

What is the CSS Houdini all about?

CSS Houdini allows us to hook into the browser rendering process, so we can develop various CSS features that can be easily shared, implemented and, potentially, added to CSS specification itself.

What are the advantages

→ close access to the CSSOM and parser

→ better performance than JS polyfills

→ great for features that depend on requestAnimationFrame or scroll interactions

→ build any CSS feature you want

What is the Paint API all about?

- → Extend the browser render engine in various ways
- → Not all features have wide browers support: ishoudinireadyyet?
- → Allows you to easily include and adapt features that previously where not possible in CSS
- → great for reducing DOM nodes
- → no need for JS polyfills, we can just implement our own CSS features!

What to keep in mind

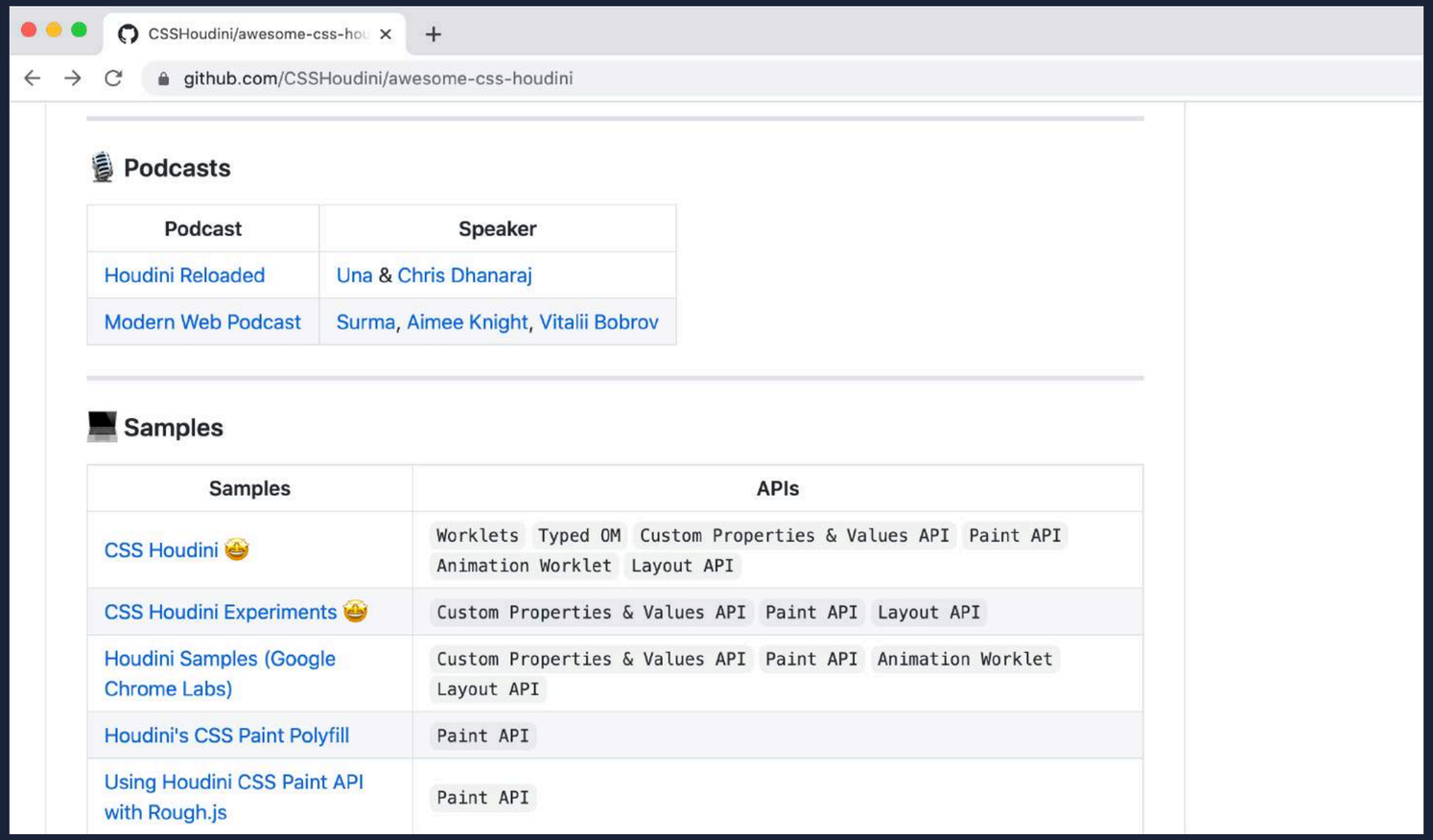
- → Houdini is an experimental technology and is not production ready yet
- → always check for browser support before implementing any styles using this technique
- → be careful with animated effects and not do overdo it
- → great for progressive enhancement

How do I get started?

How do I get started?

https://houdini.glitch.me

How do I get started?



https://github.com/nucliweb/awesome-css-houdini

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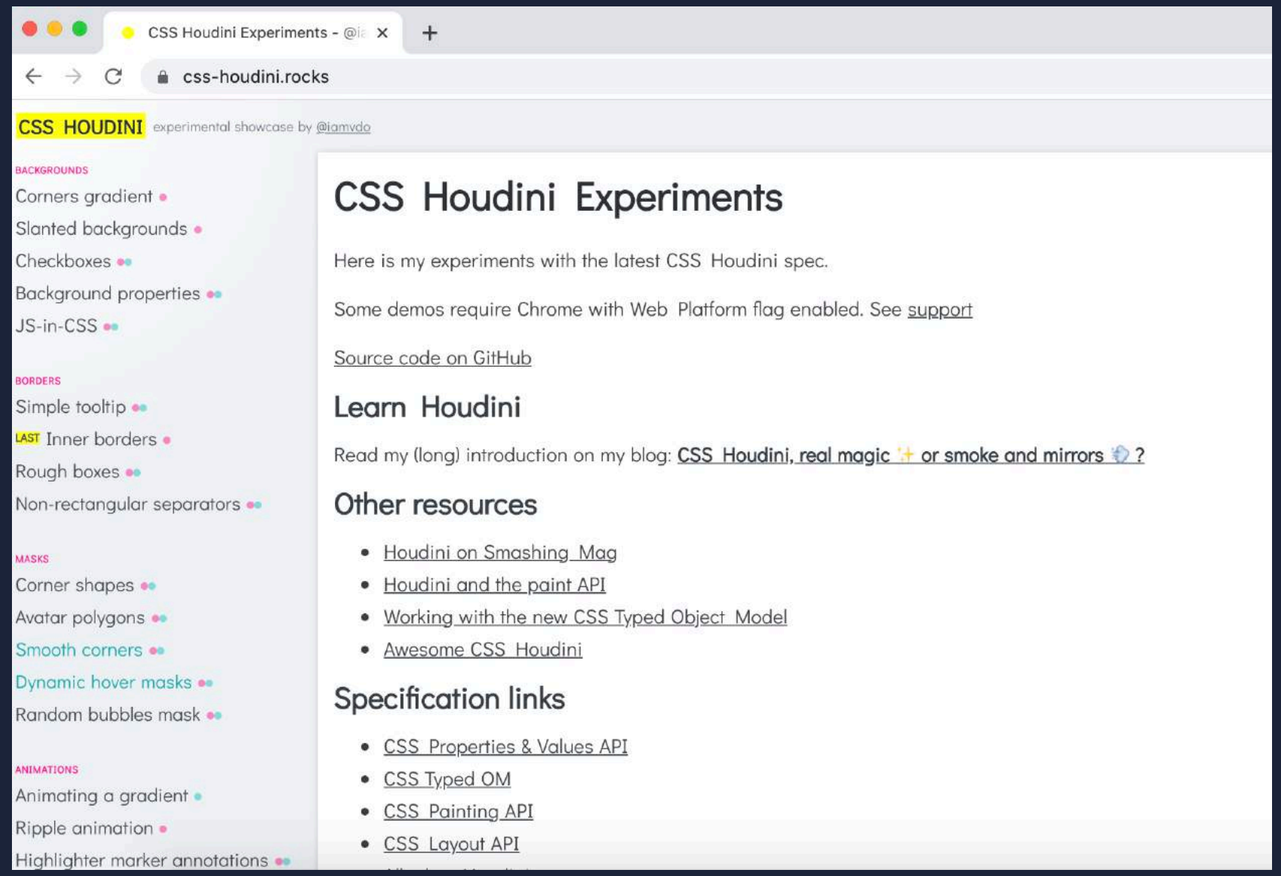
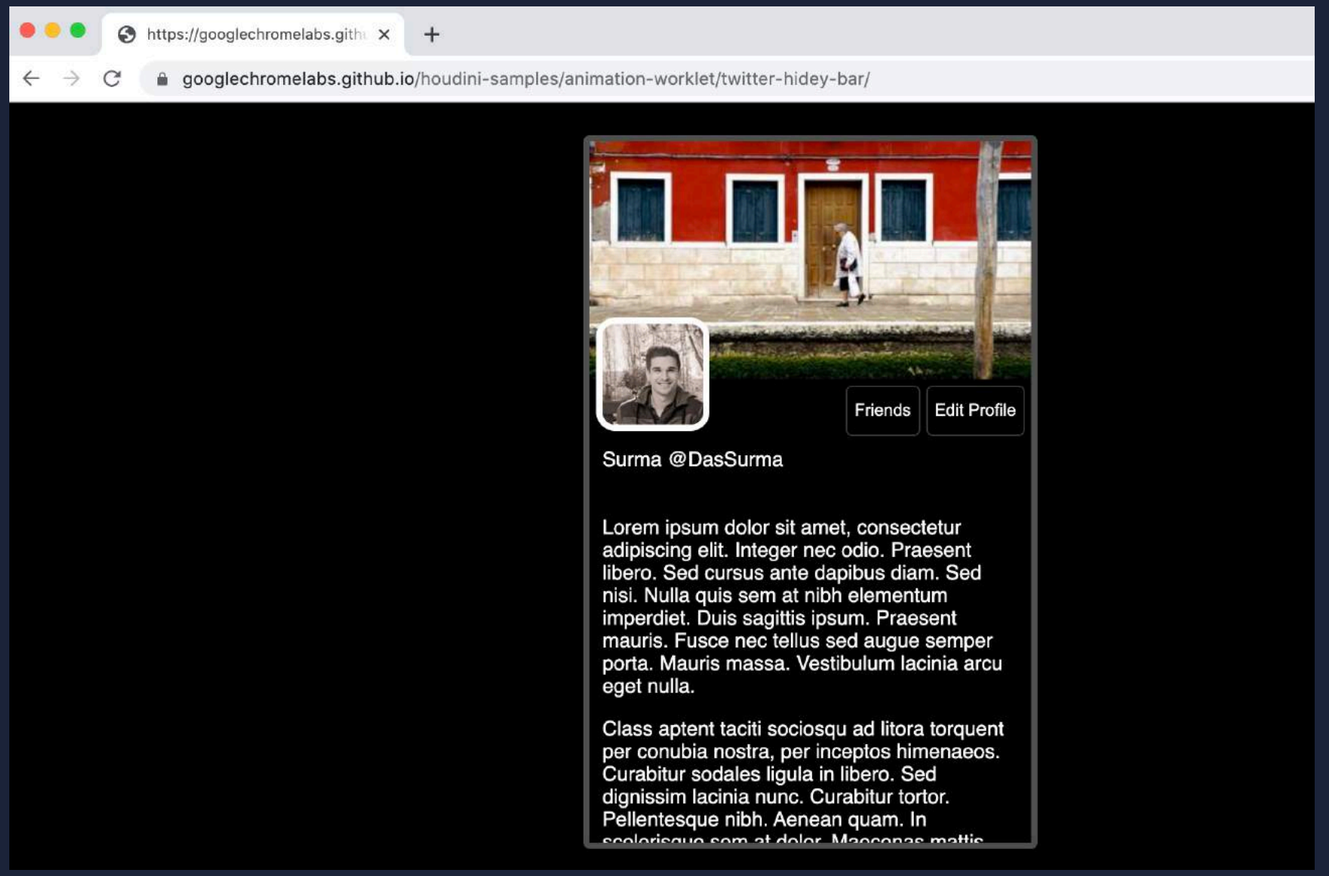


http://css-houdini.rock

How do I get started?



https://googlechromelabs.github.io/houdini-samples/

Articles

→ CSS Tricks - Paint API

→ Logrocket - Paint API

→ Google Developers - Houdini

→ Google Developers - Paint API

→ Smashing Magazine - CSS Houdini

The End

Thank you for joining!

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→ My twitter

→ My Codepen

→ Storyblok

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