



# COLRv1 in Chromium & OSS

**WEB ENGINES HACKFEST**  
A Coruña

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# In this talk

- Color Fonts?
- How does the COLRV1 format work?
- New Use Cases on the web
- Open-Source COLRV1 stack and tools
- Preview: WIP Variable COLRV1

Color Fonts?

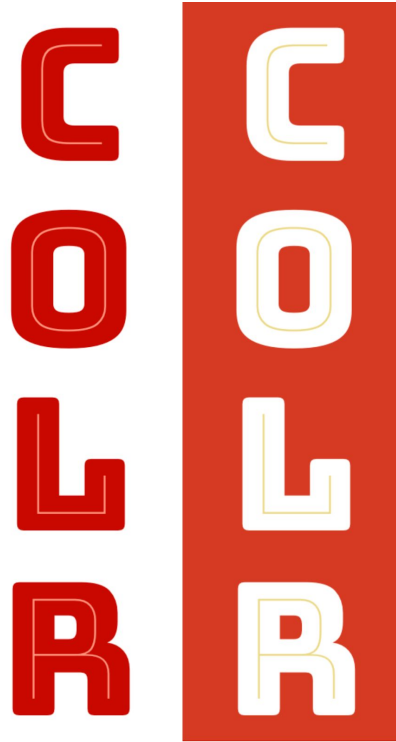
*Lobster*

*Lobster*

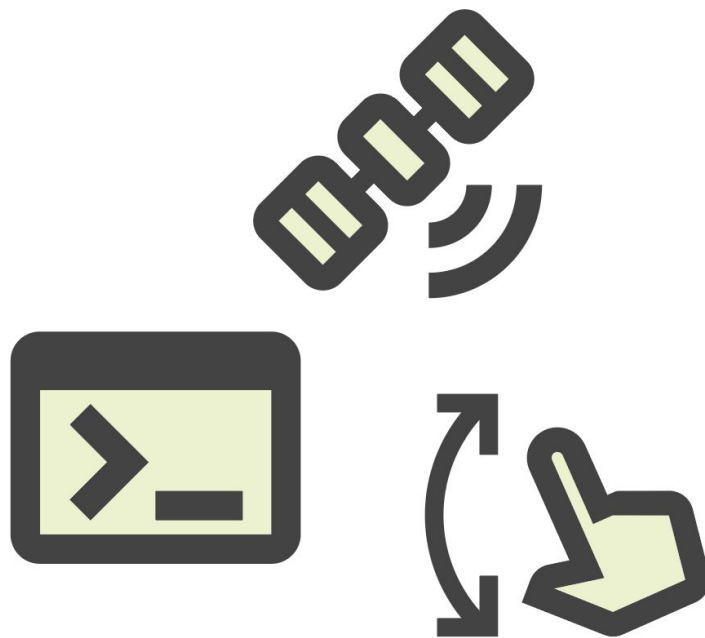


National Park Emoji from Noto Emoji by Jennifer Daniel

<https://github.com/googlefonts/noto-emoji/>



Bungee by DJR <https://djr.com/bungee>



كوفى ريف

Reem-Kufi Arabic font by Khaled Hosny  
<https://github.com/aliftype/reem-kufi>



# COLRv1 Format

**COLRv1 glyphs are a  
directed acyclic graph  
of paint operations.**

**Rendering a COLRv1 glyph means:**

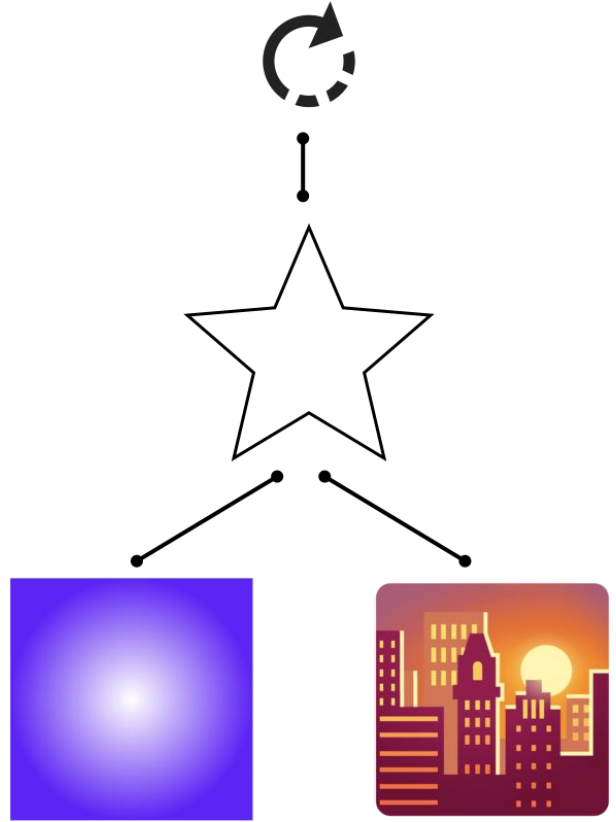
**Traverse the graph and execute the 2D graphics operation in each node.**

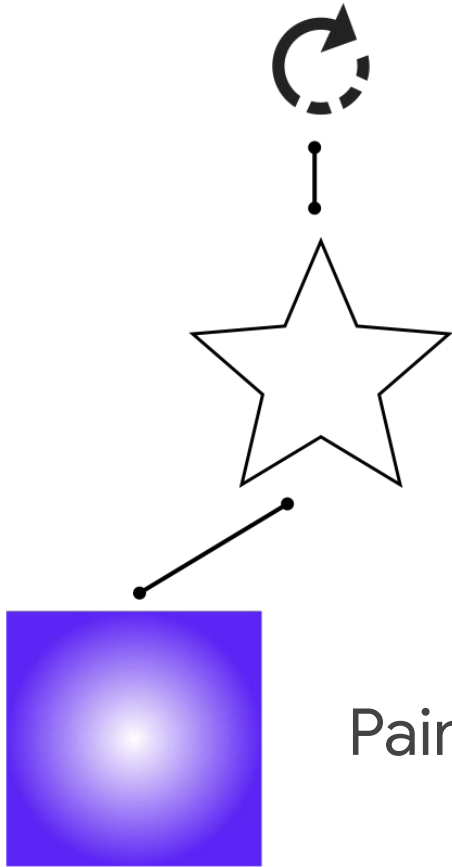
PaintRotate

PaintGlyph

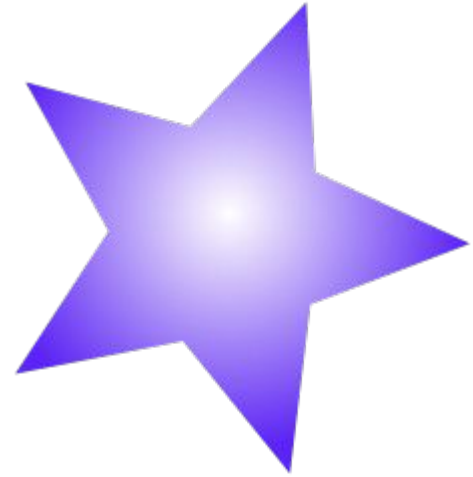
PaintRadialGradient

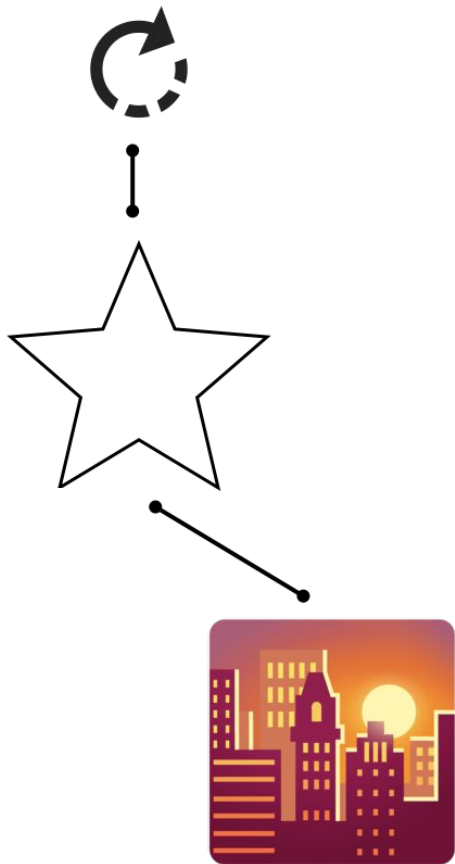
PaintColrGlyph





PaintRadialGradient





PaintColrGlyph

# COLRv1 Paint Tables

Paint**Glyph**  
PaintColrLayers  
PaintColrGlyph

Paint**Composite**

Paint**Solid**  
Paint**LinearGradient**  
Paint**RadialGradient**  
Paint**SweepGradient**

Paint**Transform**  
Paint**Translate**  
Paint**Scale**  
PaintScaleAroundCenter  
PaintScaleUniform  
PaintScaleUniformAroundCenter  
Paint**Rotate**  
PaintRotateAroundCenter  
Paint**Skew**  
PaintSkewAroundCenter

PaintVarSolid  
PaintVarLinearGradient  
PaintVarRadialGradient  
PaintVarSweepGradient

PaintVarTransform  
PaintVarTranslate  
PaintVarScale  
PaintVarScaleAroundCenter  
PaintVarScaleUniform  
PaintVarScaleUniformAroundCenter  
PaintVarRotate  
PaintVarRotateAroundCenter  
PaintVarSkew  
PaintVarSkewAroundCenter

# Transform & Compose: Layer reuse

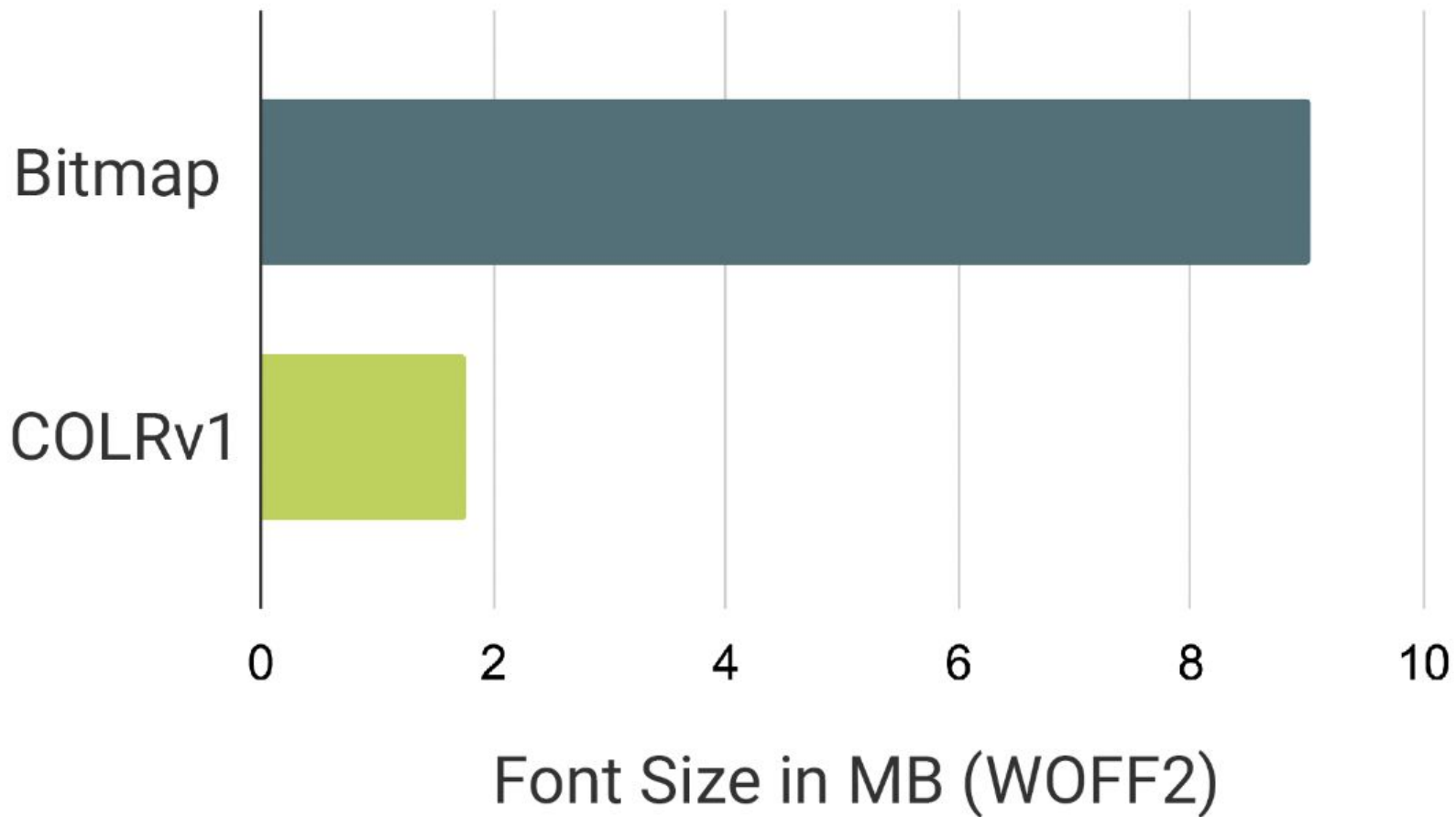


Reuse, offset, scaled



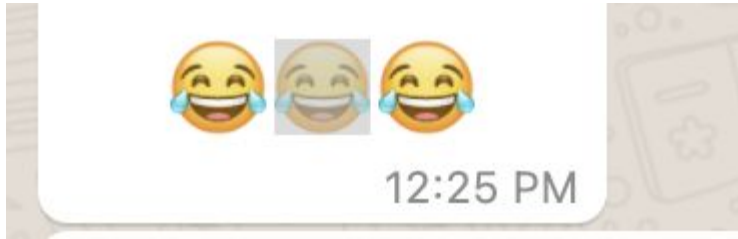


# New Web Use Cases





# Overcome image replacement



```
▼ <span class="_3R6rC"> == $0
```

```
  
```

```
</span>
```

# COLRv1 in Chrome & OSS

Rasterisation

COLRv1 Color Gradient Vector x +

developer.chrome.com/blog/colrv1-fonts/

Chrome Developers Search docs, blogs and more

Check out what's new for the web platform at Google IO! [Join the party](#) [Dismiss](#)

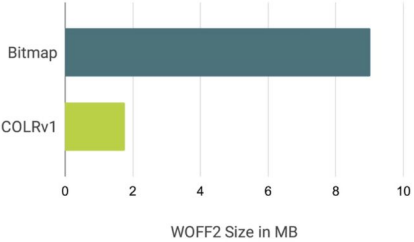

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Format	WOFF2 Size in MB
Bitmap	~9
COLRv1	~1.5

## COLRv1 Color Gradient Vector Fonts in Chrome 98

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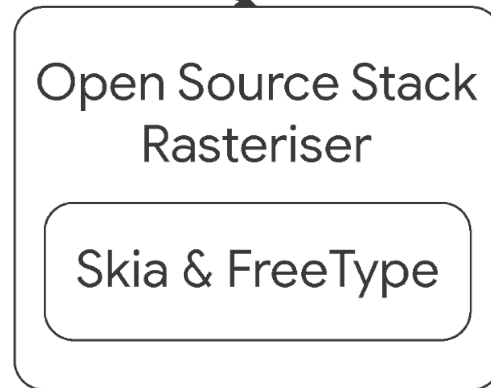
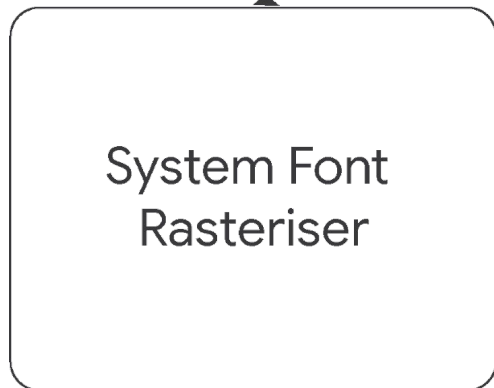
[Table of contents](#) ▾

<https://developer.chrome.com/blog/colrv1-fonts/>

# Hybrid Font Stack



Font Format Supported  
by Operating System?



# Open-Source Foundations for COLRV1 in Chrome

Chrome's Font Stack

Loads and displays COLRV1 web fonts

Skia Graphics Library

Traverses COLRV1 glyph graph,  
executes graphics operations

FreeType Library

Understands COLRV1  
& CPAL tables



# Open-Source Foundations for COLRv1 in Chrome

## **FreeType 2.11.0**

2021-07-19

Our new release brings an additional rendering module to create Signed Distance Fields (SDF) for glyphs; it also introduces an experimental interface to access **'COLR' v1** fonts.

As usual, there are many more fixes and features; please see [here](#) for more.

# COLRv1 in Chrome & OSS

Font Production

# Open-Source Foundations for COLRV1 Font Production

nanoemoji

fonttools

picosvg

# {SVG} → Font

Design tools tend to provide SVGs

SVGs are complex

- Simplify them first!

<https://github.com/googlefonts/picosvg>

- Exactly 1 <defs>
  - Contains only gradients
- Only groups and paths
- Only absolute coordinates
- Apply clip paths
- Strokes → paths



# To Fontland!

<https://github.com/googlefonts/nanoemoji>

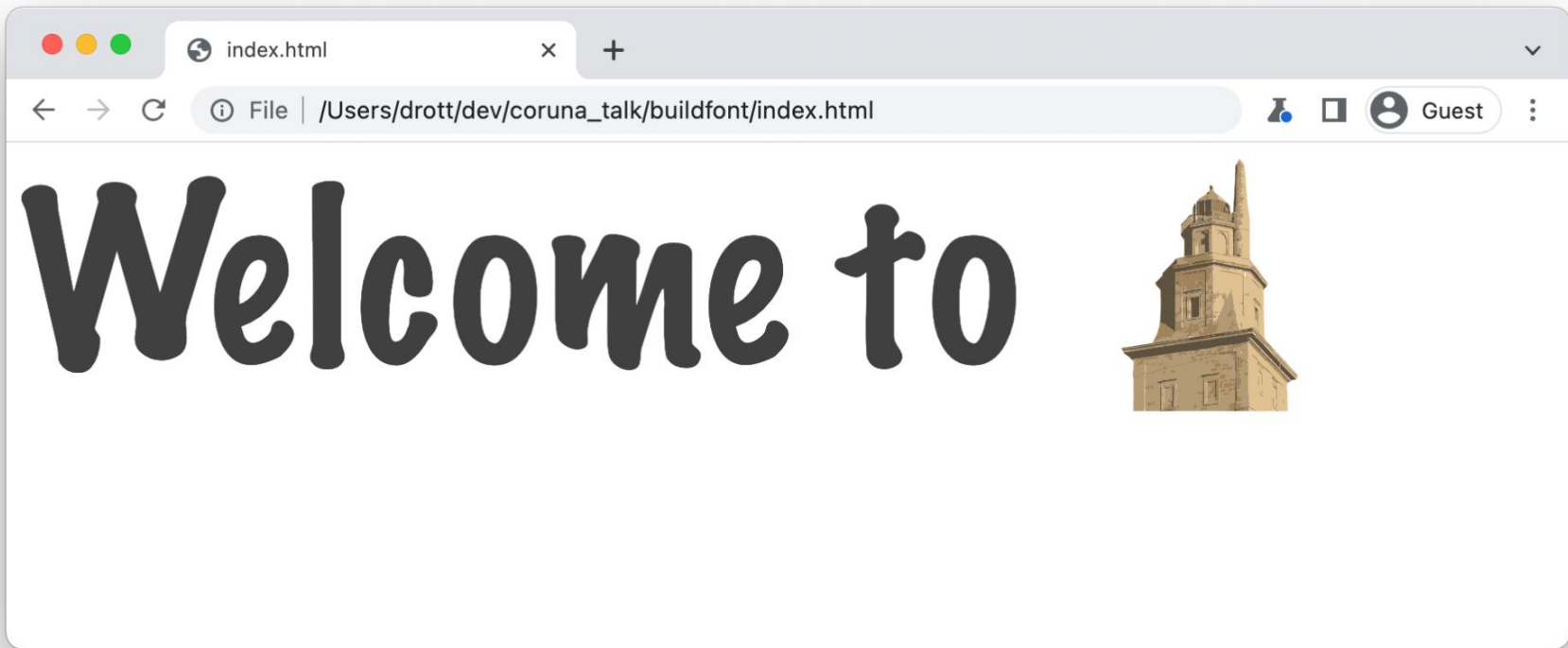
- {svgs} → color font
  - COLR v0 or v1
    - Outlines in glyf, cff, or cff2
  - Depends on picosvg
  - Optional: OT-SVG output
  
- Tries to produce a compact font

.otf

# Nanoemoji Demo

```
$ nanoemoji --family "Hercules  
Emoji" --color_format glyf_colr_1  
svg/emoji_u1F6A8.svg
```

```
File "/opt/homebrew/Cellar/python@3.9/3.9.12/Frameworks/Python.framework/Versions/3.9/lib/python3.9/subprocess.py", line 528, in run
    raise CalledProcessError(retcode, process.args,
subprocess.CalledProcessError: Command '['ninja', '-C', '/Users/drott/dev/coruna_talk/buildfont/build/build']' returned non-zero exit status 1.
(venv) → build git:(main) x cd ..
(venv) → buildfont git:(main) x nanoemoji --family "Hercules Emoji" --color_format glyf_colr_1 svg/emoji_u1F6A8.svg
I0613 09:23:26.051822 4372661632 nanoemoji.py:593] Proceeding with 1 config(s)
I0613 09:23:26.052364 4372661632 nanoemoji.py:556] Wrote build/Font.toml
I0613 09:23:26.052424 4372661632 nanoemoji.py:599] Generating build.ninja
I0613 09:23:26.053493 4372661632 ninja.py:113] ninja -C /Users/drott/dev/coruna_talk/buildfont/build
ninja: Entering directory `/Users/drott/dev/coruna_talk/buildfont/build'
[3/3] /Users/drott/dev/color-fonts/...t.fea --glyphmap_file Font.glyphmap
I0613 09:23:28.491578 4337501568 __init__.py:44] Pre-processing glyphs
I0613 09:23:28.510922 4337501568 base.py:178] Running DecomposeComponentsFilter on HerculesEmoji-Regular
I0613 09:23:28.511209 4337501568 base.py:178] Running CubicToQuadraticFilter
```





# COLRv1 in OSS

- Black Foundry Python based renderer
  - <https://github.com/BlackFoundryCom/black-renderer>
- FontGoggles
  - <https://fontgoggles.org/>

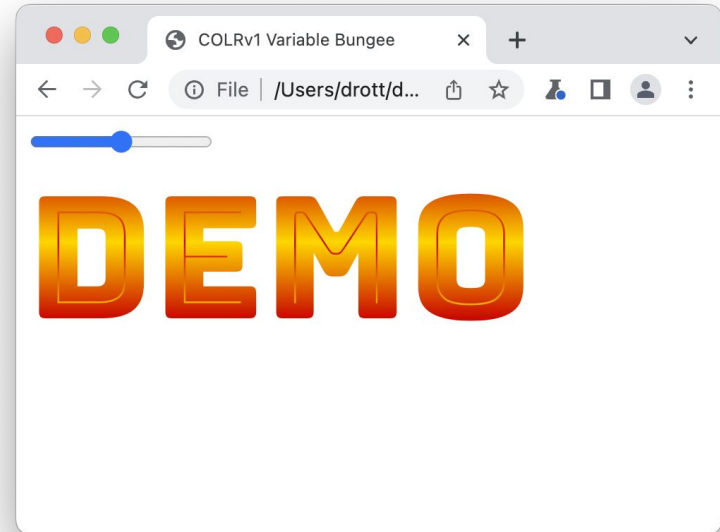


Variable  
COLRv1

# Variable Color Fonts

Elements become variable:

- Shapes (glyph outlines)
- Gradient placement, color stop offsets
- Color value alphas
- Transforms (e.g., rotation angles)



Based on Bungee Font by DJR  
<https://djr.com/bungee>

Wrapping up

# Wrapping up

- Color Fonts and their use on the web
- COLRv1 Internals
- COLRv1 in open-source libraries for
  - Rasterisation
  - Font Production
- Variable COLRv1

Thank you!

