MapLibre Text Rendering With WebGL

Open Visualization Collaborator Summit 2024
London · 2024-09-11
Oliver Wipfli

About Me

Current	Coordinator at MapLibre since 2022
Future Plan	Maps and Location Consulting
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Oliver Wipfli

MapLibre

MapLibre Organization

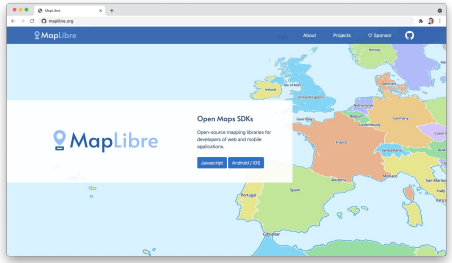
Core Projects

Bart Louwers
Maintainer Native

MapLibre Native

C++ API for iOS, Android, Qt, Node.js

Fork 295 | Starred 1k



MapLibre GL JS

TypeScript API for Web Browsers

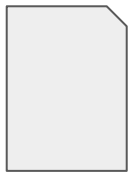
Fork 685 | Starred 6.3k

Harel Mazor
Maintainer Web

MapLibre

Governance

MapLibre Voting Members



MapLibre Charter

Governing Board

Birk Skyum
Independent

Petr Pridal
MapTiler

Yuri Astrakhan
Rivian

Luke Seelenbinder
Stadia Maps

Haowen You
Amazon

financial decisions • overall project strategy
elected • meets quarterly

MapLibre

Sponsors


aws


Meta


MIERUNE


komoot


Radar


JawgMaps


Microsoft

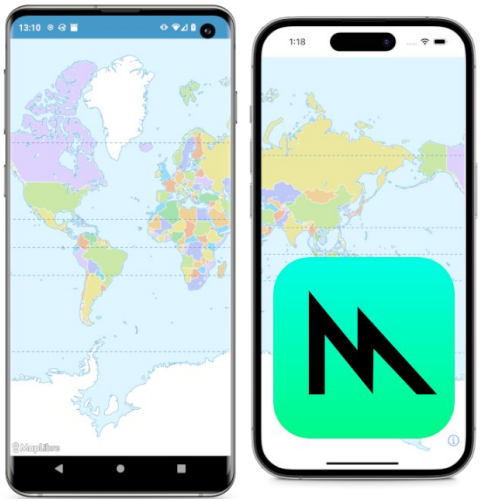

mappedin


mapme

Metal on iOS

aws

Contractors



Meta

Graphics Engineer

MapLibre

Text Rendering

Text Rendering Overview

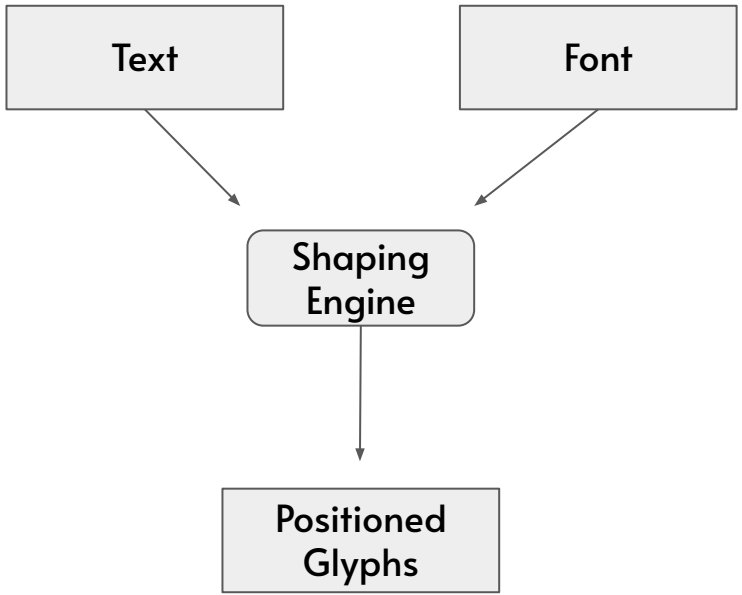
Stages:

1. Segmentation
2. Shaping
3. Rasterization

Text Rendering Overview

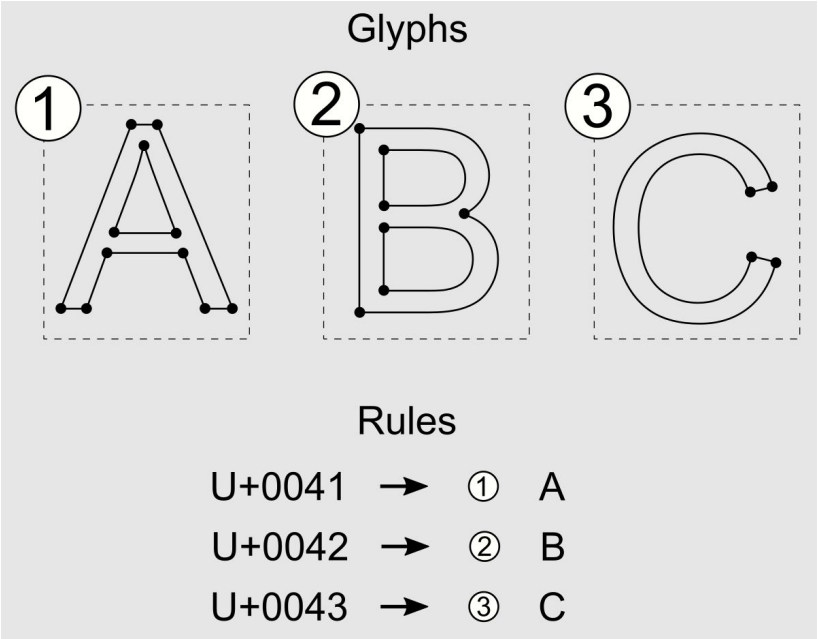
Stages:

1. Segmentation
2. **Shaping**
3. Rasterization



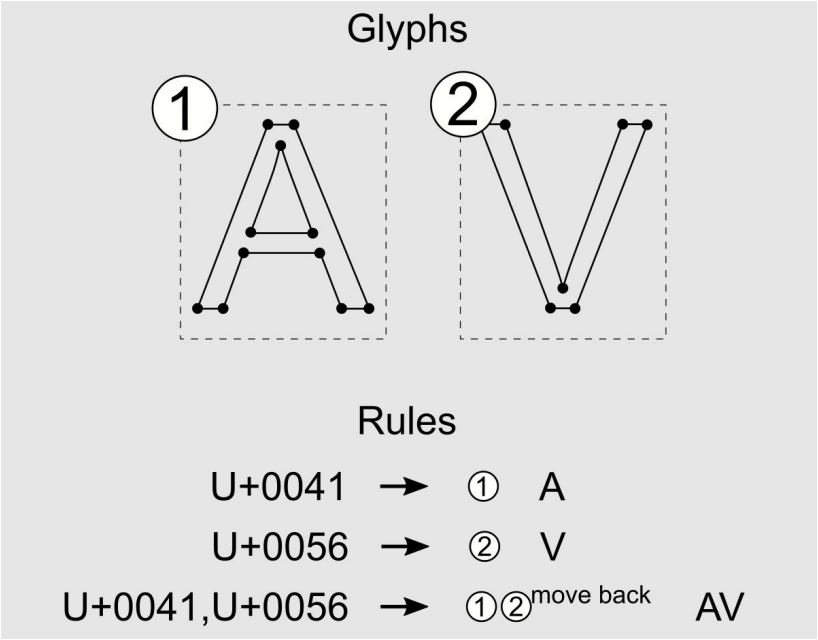
Simple Font

U+004I
Unicode codepoint
Latin Capital Letter A
0x4I = 65 decimal



MapLibre

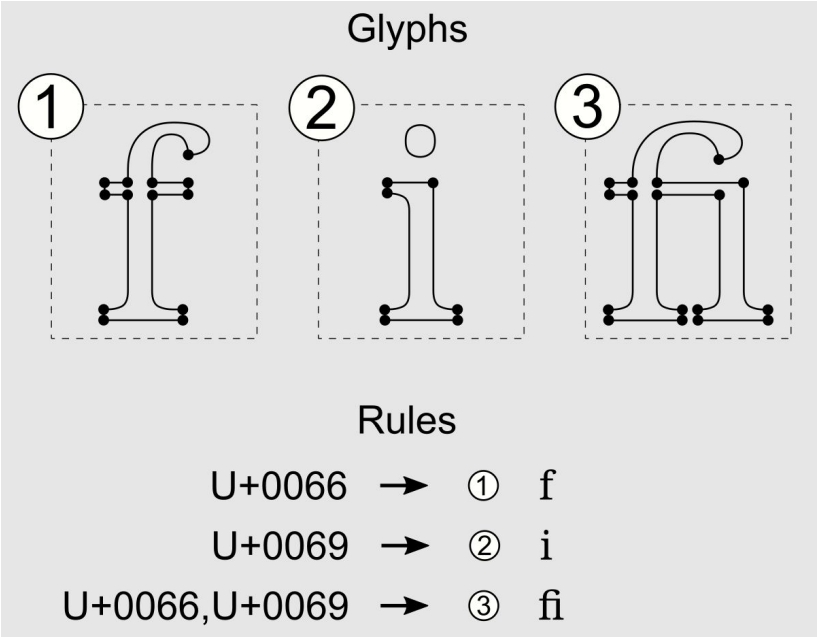
Kerning



Positioned glyph:

- index
- x/y position

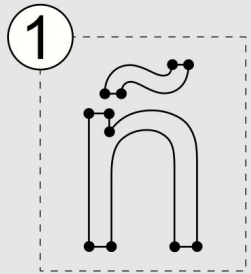
Ligature



MapLibre

Combination

Glyphs



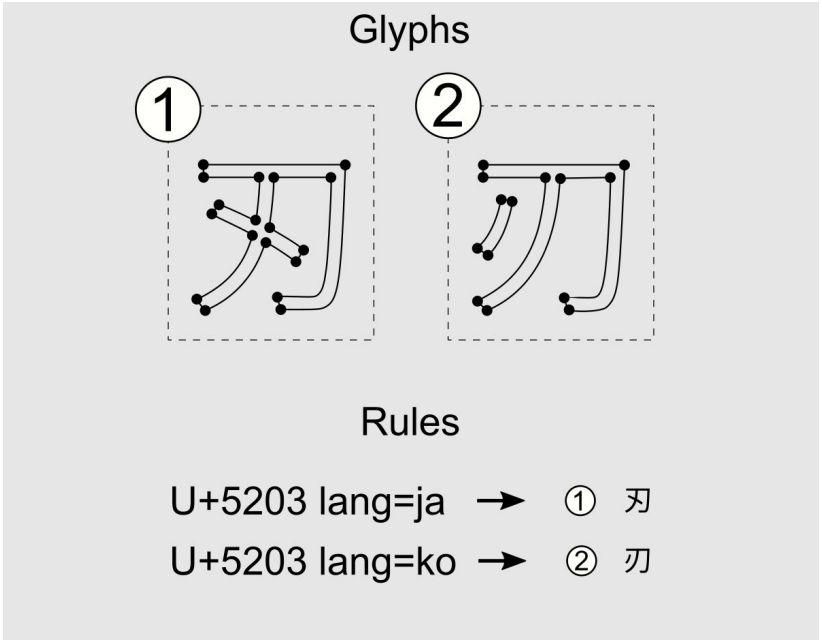
Rules

U+00F1 → ① ñ

U+0064,U+0303 → ① ñ

MapLibre

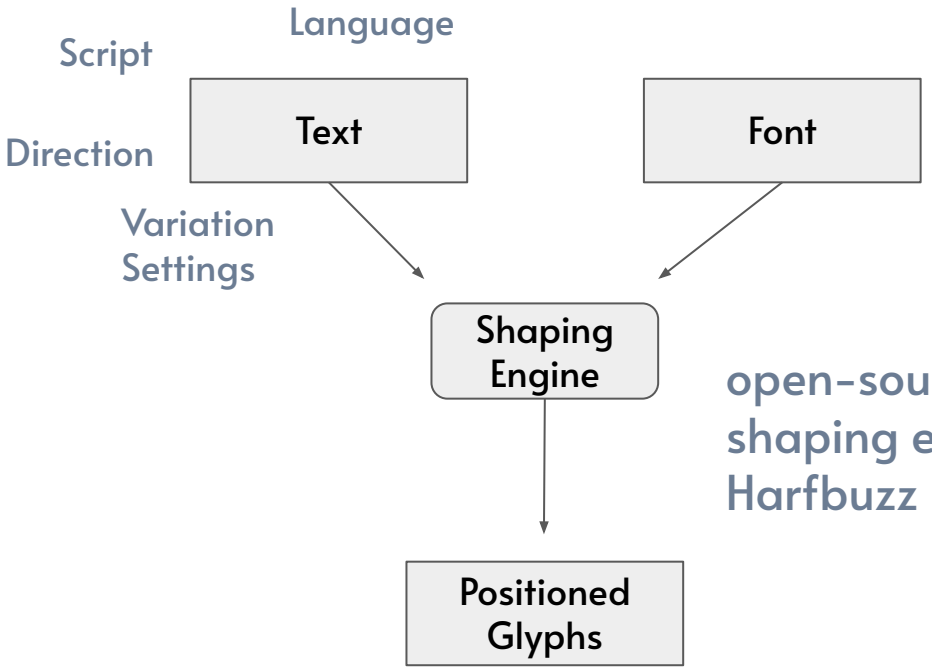
Language Matters



Segmentation

Stages:

1. **Segmentation**
2. Shaping
3. Rasterization



open-source shaping engine: Harfbuzz

Shaping Engine in MapLibre?

No.

MapLibre assumes a **one-to-one mapping** from Unicode codepoint to positioned glyph.

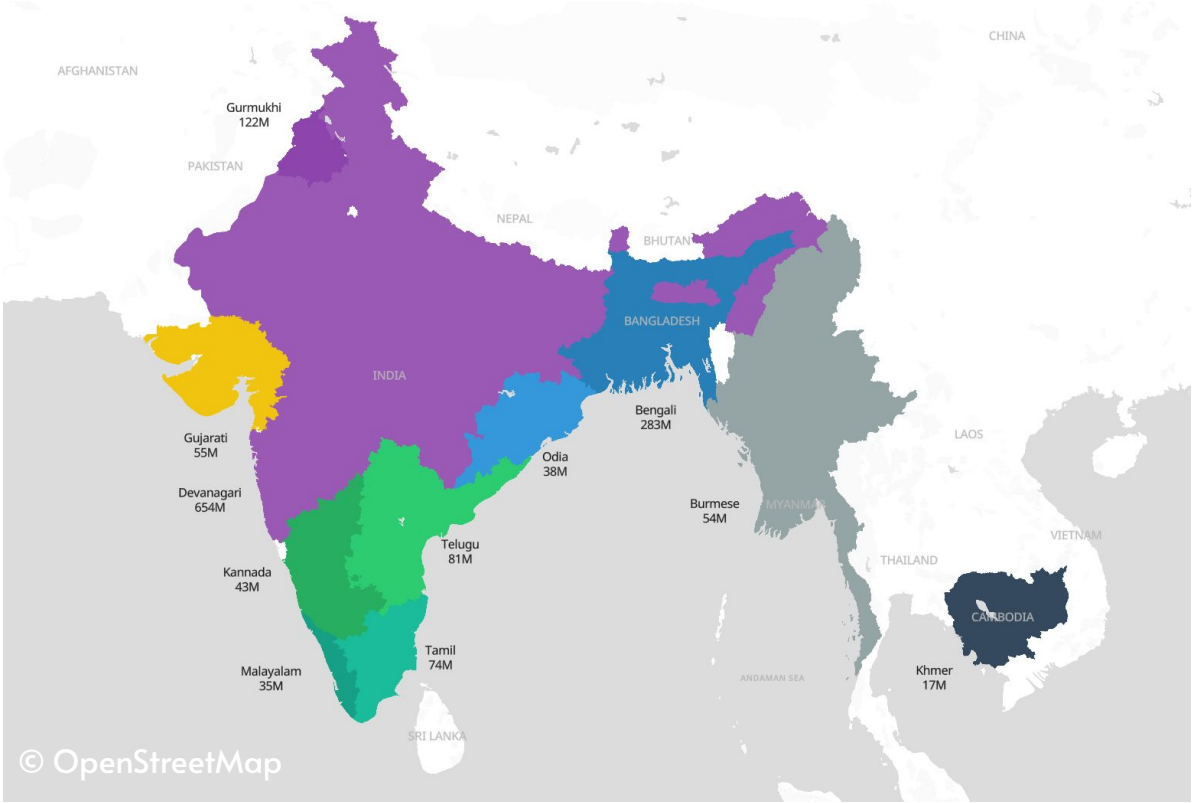
OK for Latin, Greek, Cyrillic, CJK. Special case for RTL Hebrew, Arabic.

U+0041	⇔	A
U+0042	⇔	B
...		
U+03B1	⇔	α
...		
U+5203	⇔	刃
...		

MapLibre

Unsupported Scripts

No support for first languages of ~1.5 billion people

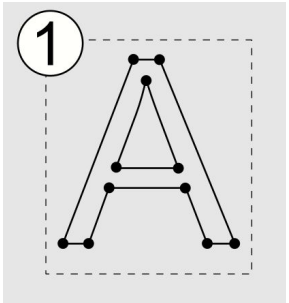


MapLibre

Rasterization

Stages:

1. Segmentation
2. Shaping
3. **Rasterization**



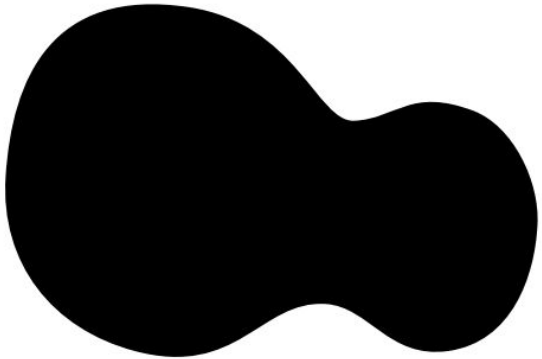
Vector shape to pixel colors

Requirements

Real-time

- Pitch
- Rotate
- Scale

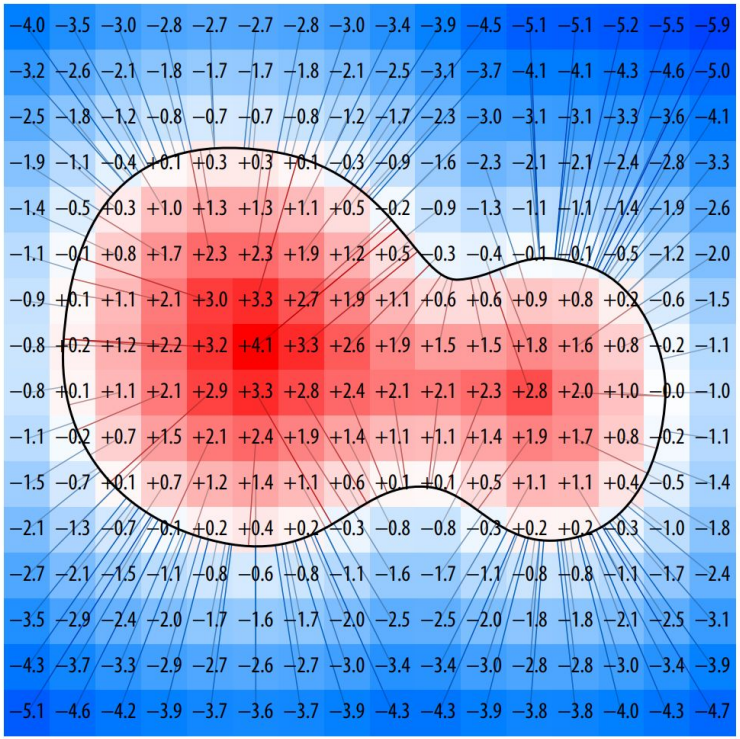
Outlines



Viktor Chlumsky, master thesis
https://github.com/Chlumsky/msdfgen

Signed Distance Field

pixel value
=
distance to shape

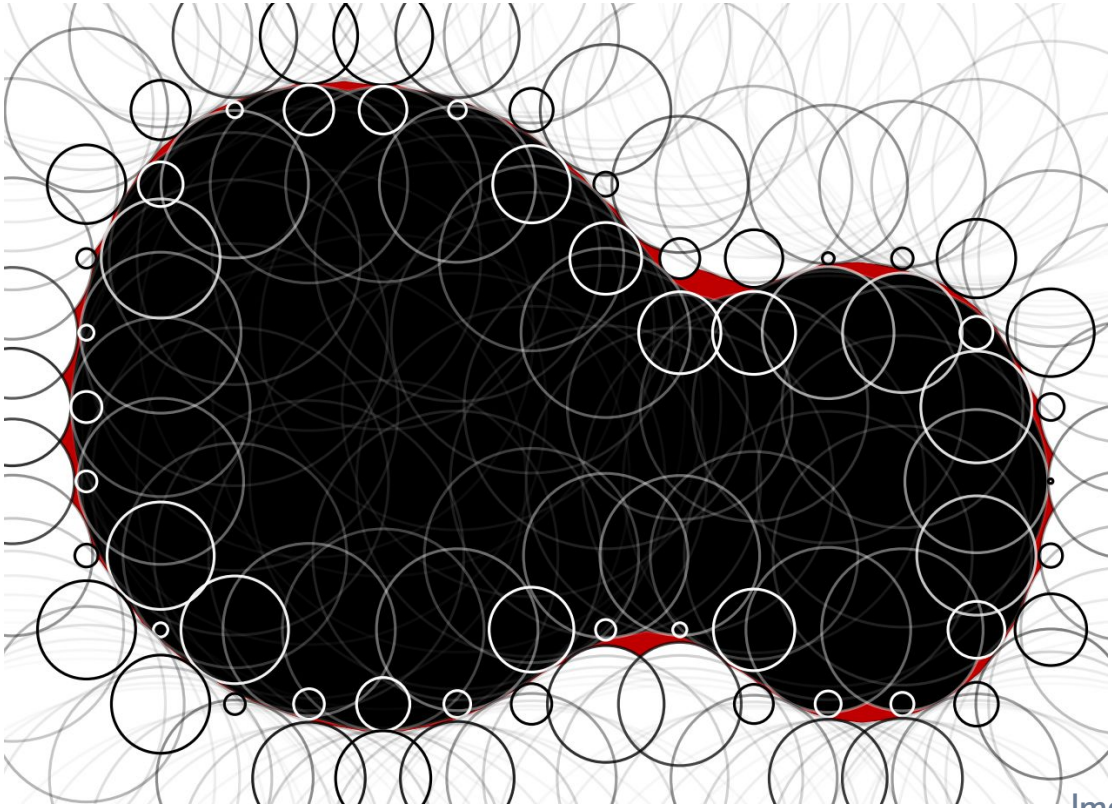


MapLibre

Image: V. Chlumsky

Information Content

white = outside
black = inside
red = ?



MapLibre

Image: V. Chlumsky

Sampling

Interpolate at

- pitch
- rotation
- scale

Outlines: lower threshold

Texture sampling fast on GPUs

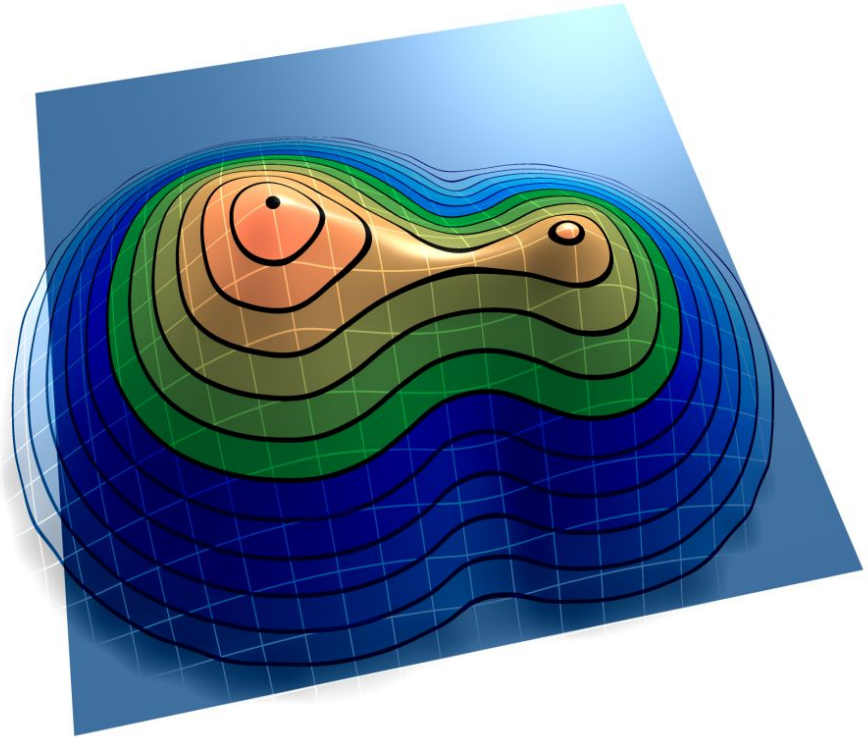


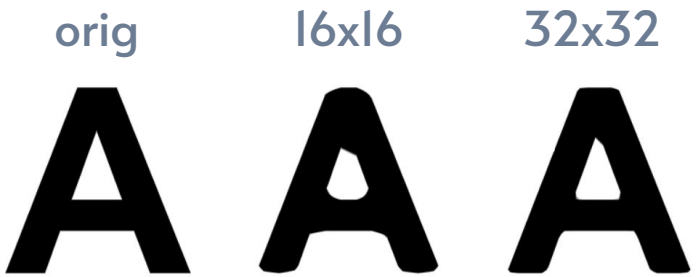
Image: V. Chlumsky

Artifacts

SDF

- Good for sharp edges
- Bad for sharp corners

Ideal for "Sausage Fonts"



Comparison

Apple

Meta (MapLibre)

Google

MapLibre

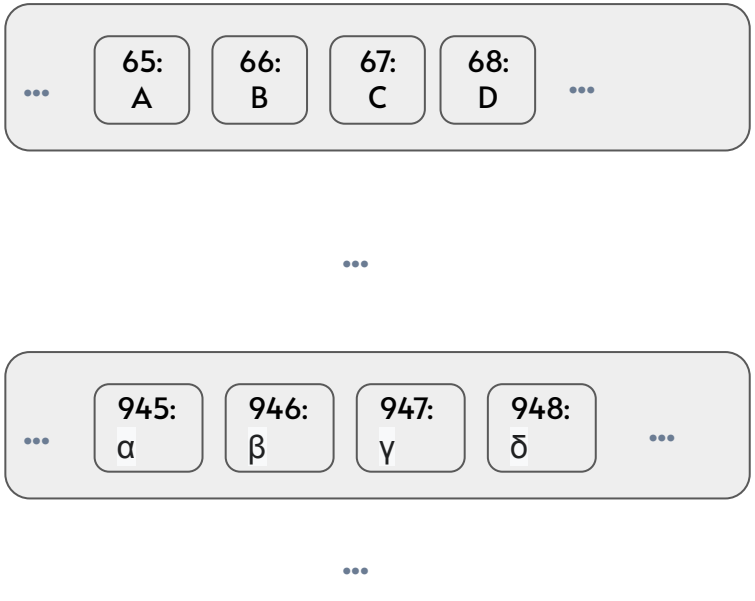
MapLibre Glyph Ranges

/fonts/Arial/0-255.pbf

...

/fonts/Arial/768-1023.pbf

...



MapLibre

TinySDF

Browser HTML
Canvas render "刃"

SDF

Chinese Japanese Korean (CJK)

- 10k+ Unicode codepoints

Fast, but more artifacts

MapLibre

Wish List

- Shaping Engine
  - S/SE Asian Scripts
- Move away from SDFs
  - Better text
  - Better icons

MapLibre

Thank you!