Mapbox

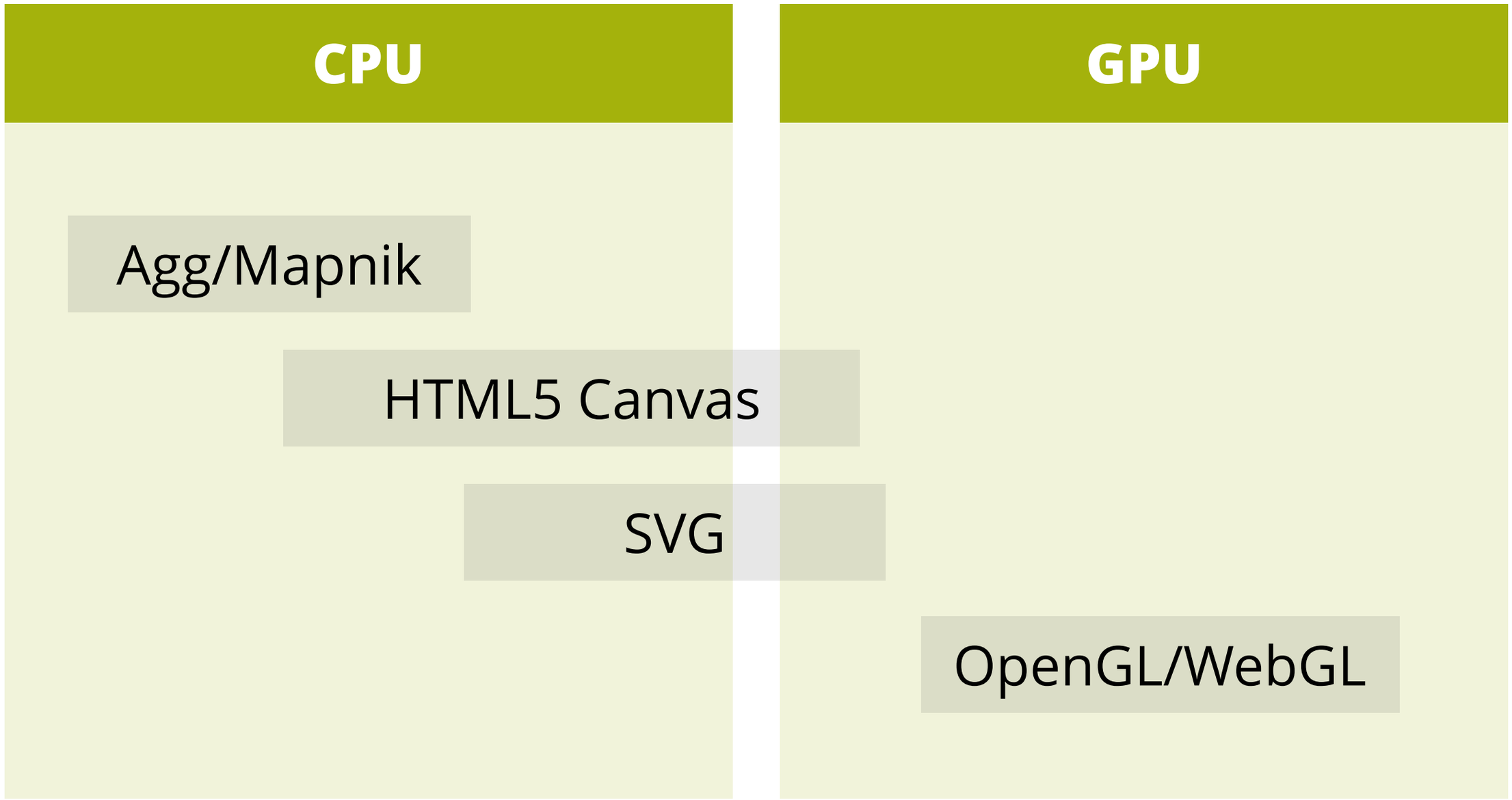
@kkaefer

Rendering Maps with OpenGL

Rendering maps

on the device

in the browser


CPU
GPU
Agg/Mapnik
HTML5 Canvas
SVG
OpenGL/WebGL

THE AGG PROJECT

Anti-Grain Geometry

HTML

Canvas

SVG

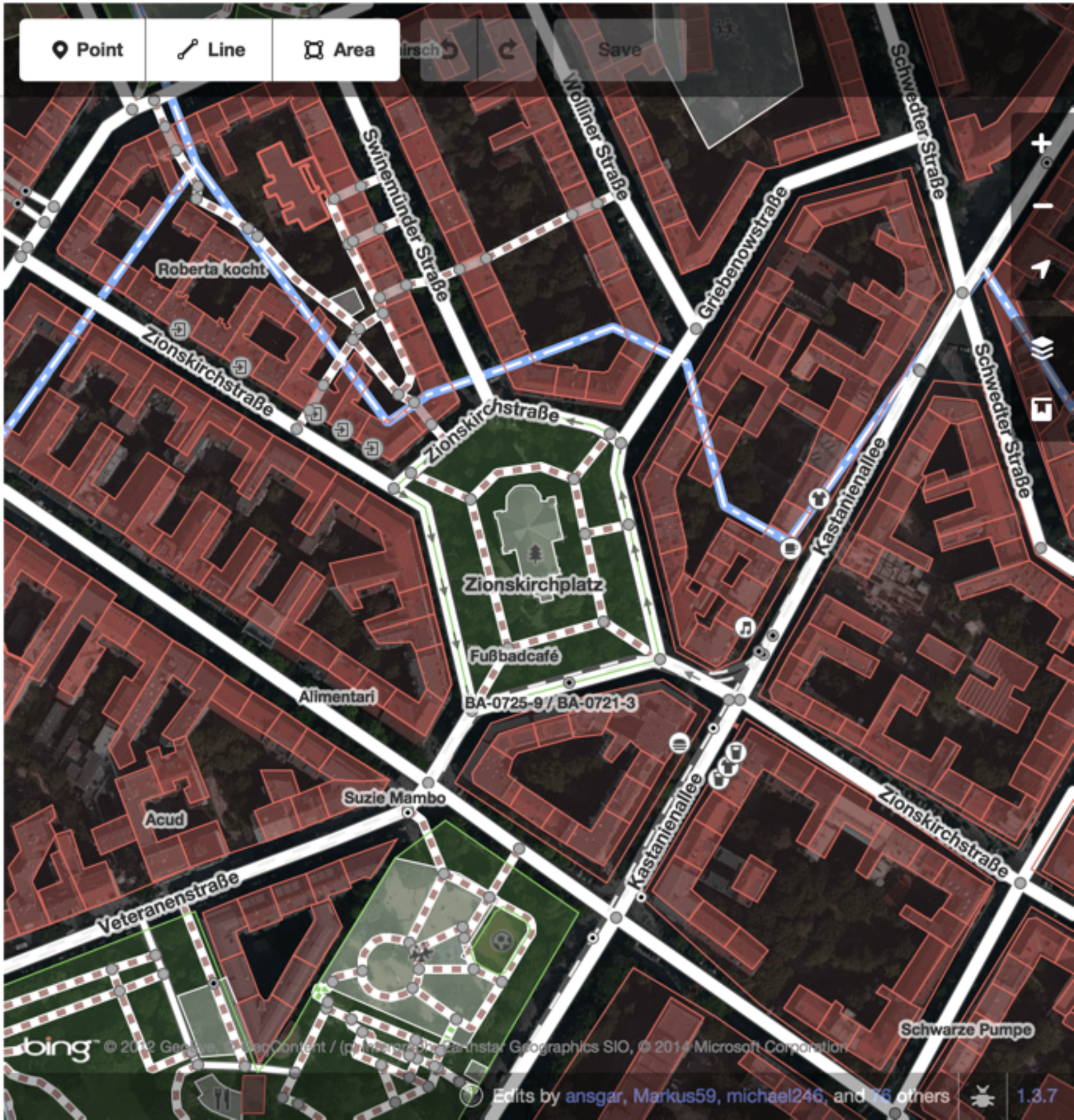
- SVG tiles (e.g. https://github.com/springmeyer/svg-tiles)
- Use as <img src=".../z/x/y.svgz"> in Leaflet (Demo)

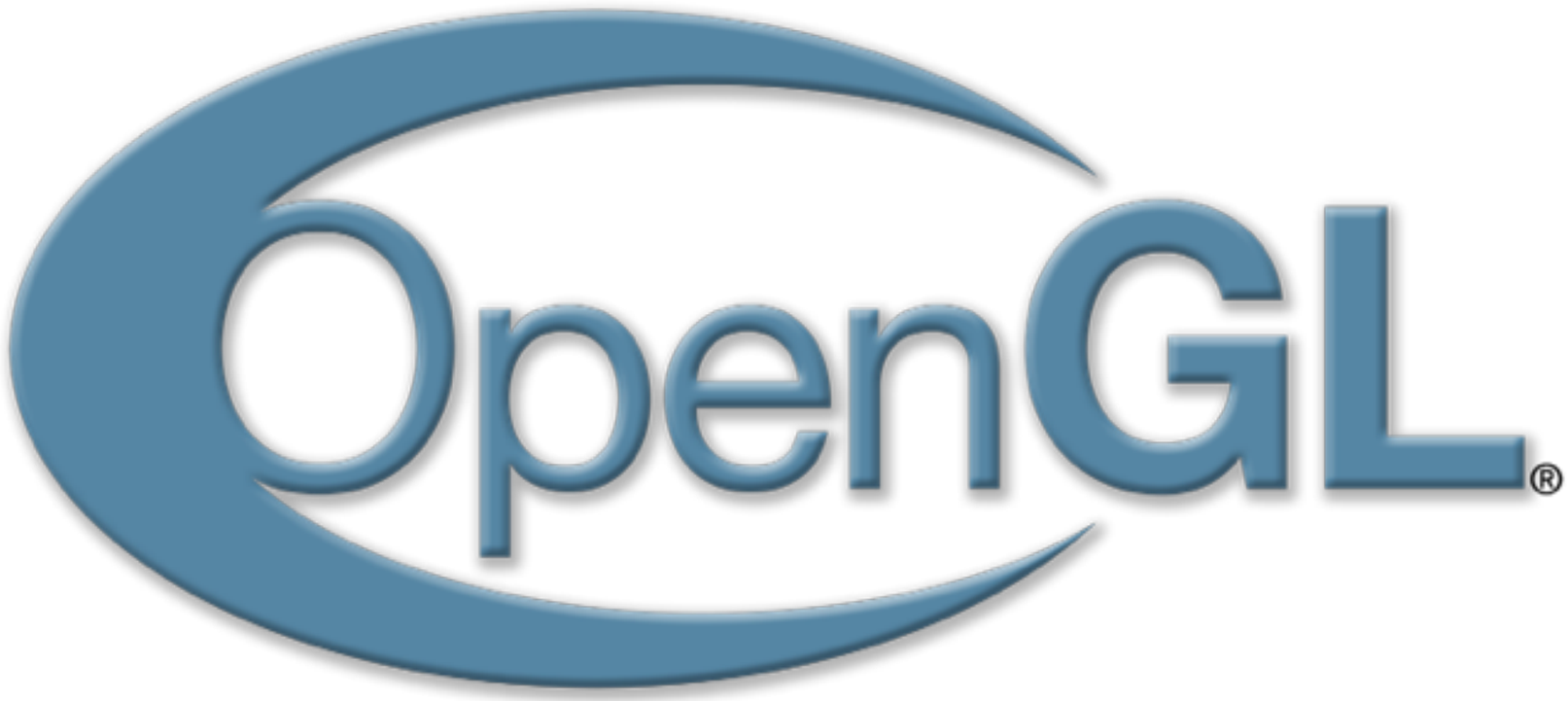
- **Advantages:**
  - Use CSS for map styling
  - Almost no client-side code needed
  - All platforms support SVG

- **Drawbacks:**
  - Rendering SVG is slow
  - SVG tiles are large (XML!), compression helps a little

Search features

Search




OpenGL®

- Based on OpenGL ES 2.0
- Available in all browsers
- Often disabled on old or slow machines

- **Advantages:**
  - Hardware acceleration
  - Pixel level control
- **Drawbacks:**
  - Very complex
  - Fragmented devices

Maply

Google Maps

OpenScienceMap

Apple Maps

Mapbox GL

MapsWithMe

kMaps

Skobbler Mobile SDK

What is a map?

Lines

Polygons

Icons

Text

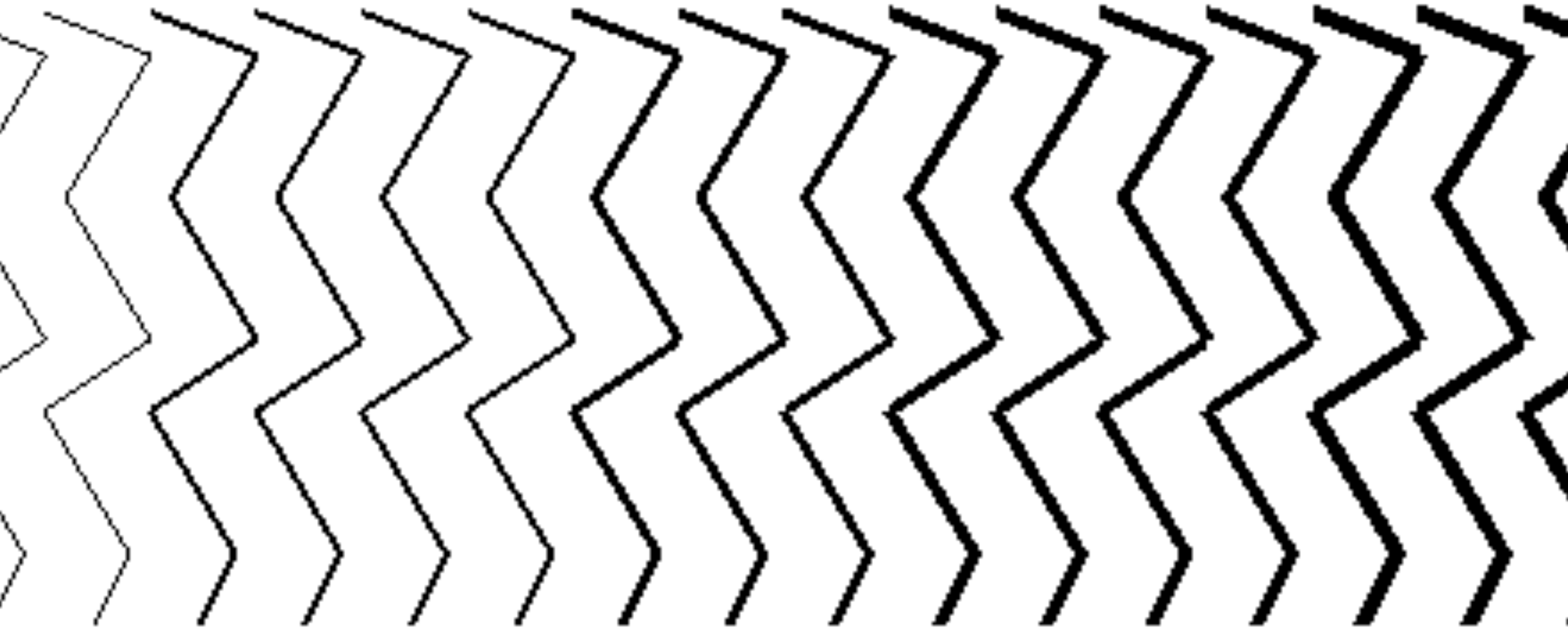
Lines Polygons Icons Text

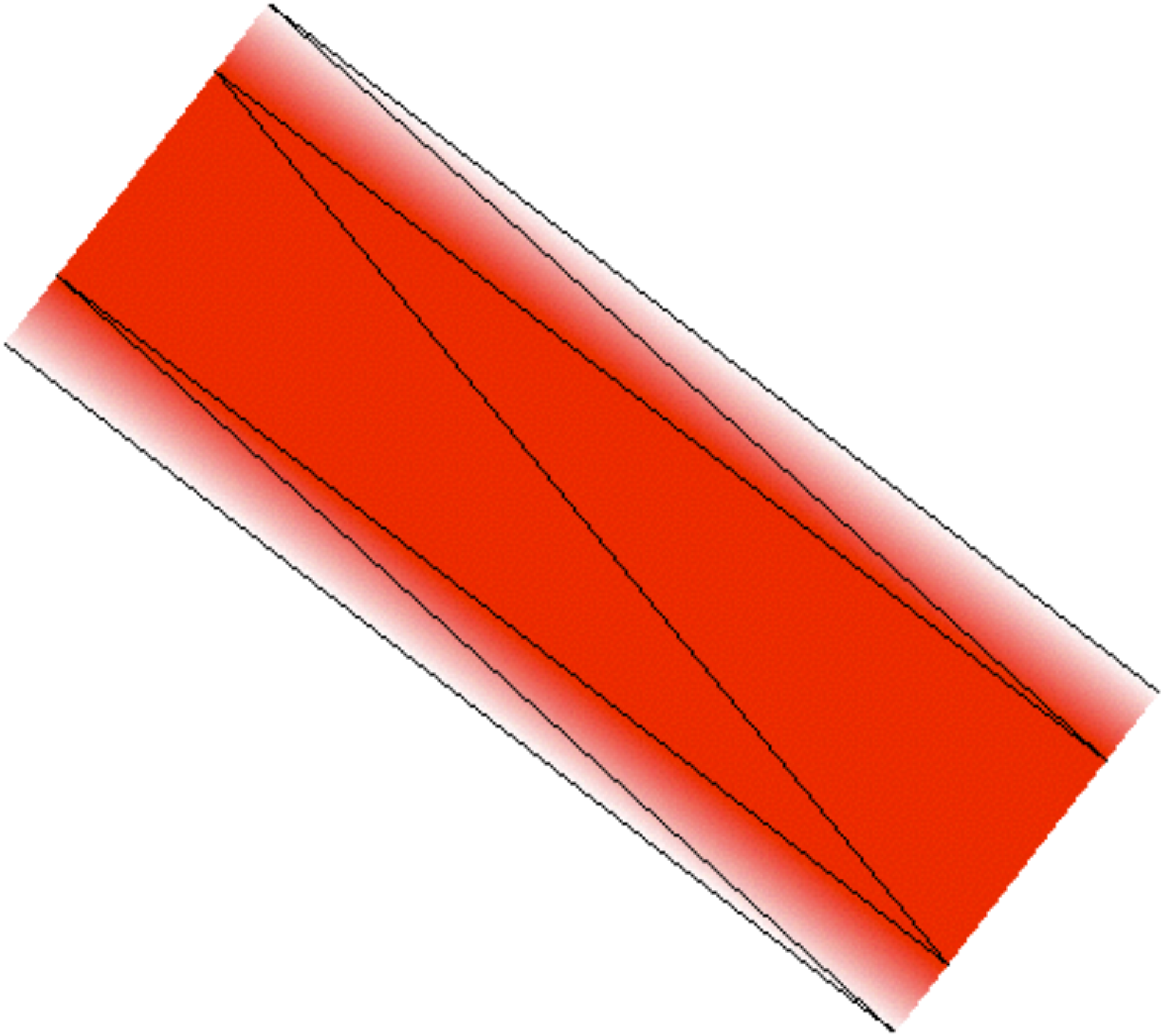
Lines **Polygons** Icons Text

Lines Polygons **Icons** Text

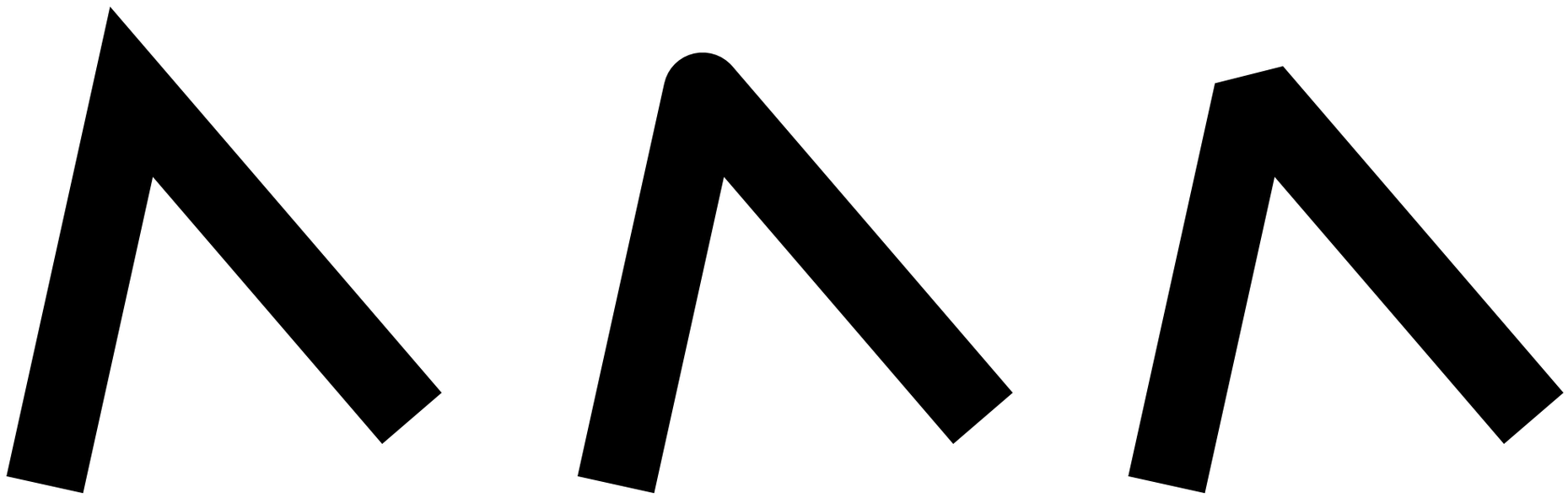
Lines Polygons Icons **Text**

Lines





Miter Round Bevel



Read more on

mapbox.com/blog/drawing-antialiased-lines

Text Rendering

Berlin
Berlin
Berlin
Berlin
Berlin
Berlin
Berlin
Berlin

Berlin

Berlin


the FreeType Project

Improved Alpha-Tested Magnification for Vector Textures and Special Effects

Chris Green*
Valve

(a) 64x64 texture, alpha-blended (b) 64x64 texture, alpha tested (c) 64x64 texture using our technique

Figure 1: *Vector art encoded in a 64x64 texture using (a) simple bilinear filtering (b) alpha testing and (c) our distance field technique*

Abstract

A simple and efficient method is presented which allows improved rendering of glyphs composed of curved and linear elements. A distance field is generated from a high resolution image, and then stored into a channel of a lower-resolution texture. In the simplest case, this texture can then be rendered simply by using the alpha-testing and alpha-thresholding feature of modern GPUs, without a custom shader. This allows the technique to be used on even the lowest-end 3D graphics hardware.

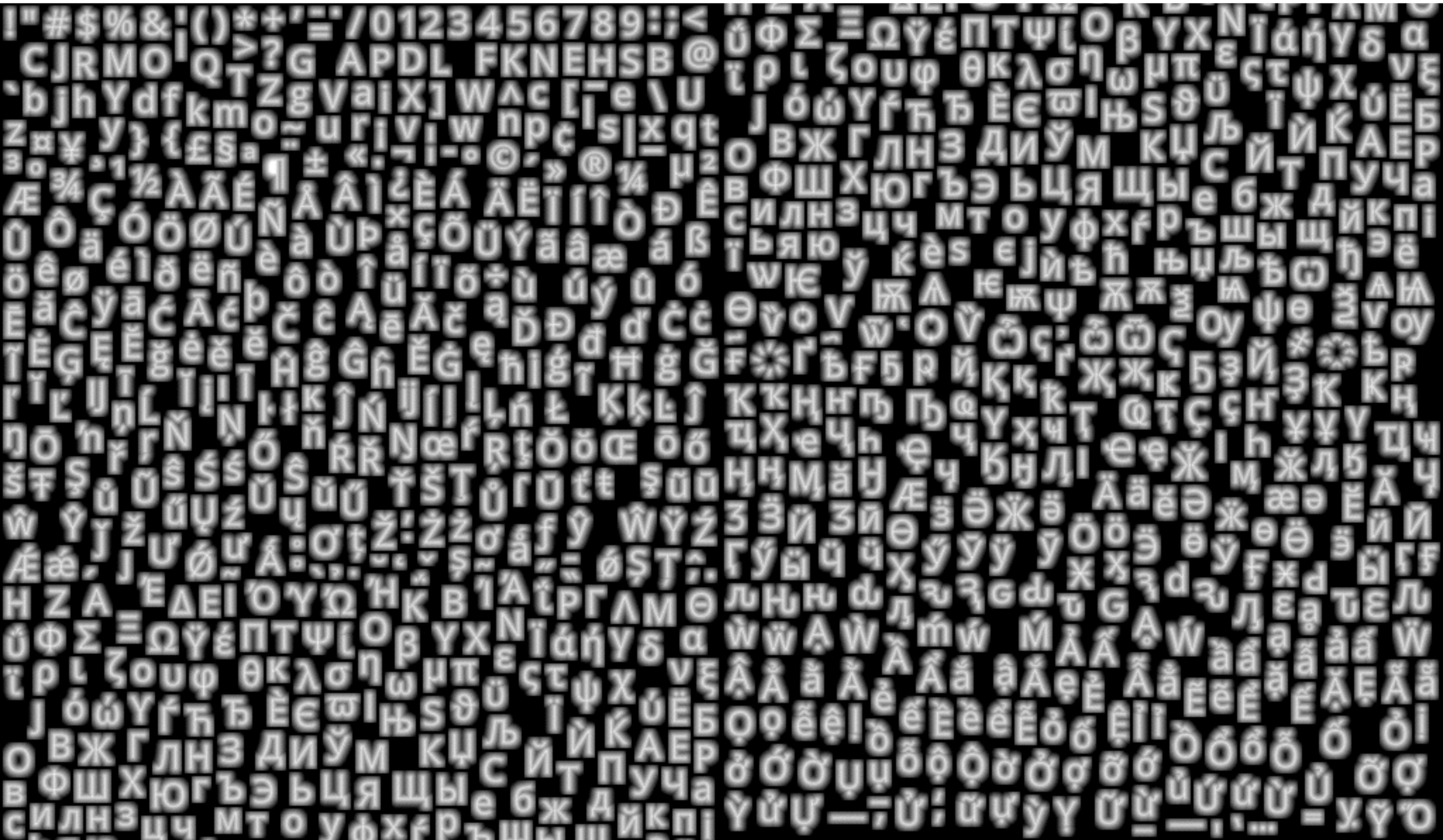
With the use of programmable shading, the technique is extended to perform various special effect renderings, including soft edges, 3D renderings and also user-interface elements. Our technique is capable of generating high quality vector art renderings as shown in Figure 1c.

2 Related work

Many techniques have been developed to accurately render vector graphics using texture-mapping graphics hardware. In [Frisken et al. 2000], distance fields were used to represent both 2-dimensional glyphs and 3-dimensional solid geometry. Quadtrees and octrees were used to adaptively control the resolution of the distance field based upon local variations. While GPU rendering

R

Texture atlas



Demo

Text Shaping

unicode character

font glyph

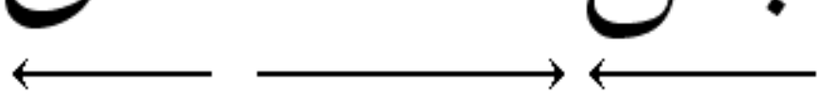
context-dependent shaping

http://scripts.sil.org/cms/scripts/page.php?site_id=nrsi&id=CmplxRndExamples

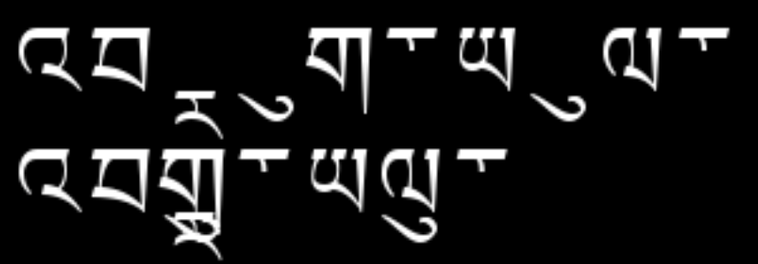
Unshaped: بِسْمِ ٱللَّهِ ٱلرَّحْمَٰنِ ٱلرَّحِيمِ

Shaped: بِسْمِ ٱللَّهِ ٱلرَّحْمَٰنِ ٱلرَّحِيمِ

ابش1234دَفق



bidirectional text



Stacked diacritic symbols

Label placement

No pops

If a label appears, it must never vanish when zooming in

Beem, Daiches, Yap. Dynamic Map Labeling. 2006.

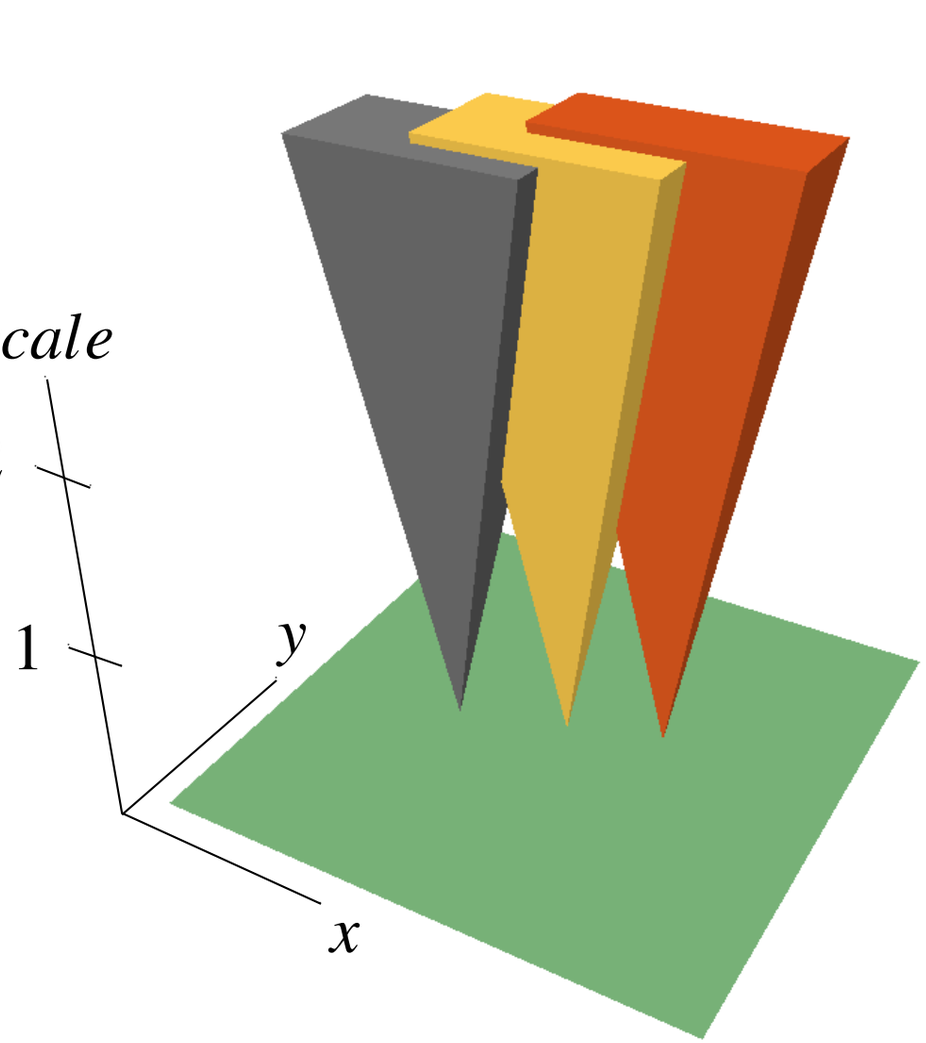
No jumps

Labels may not change position when panning or zooming

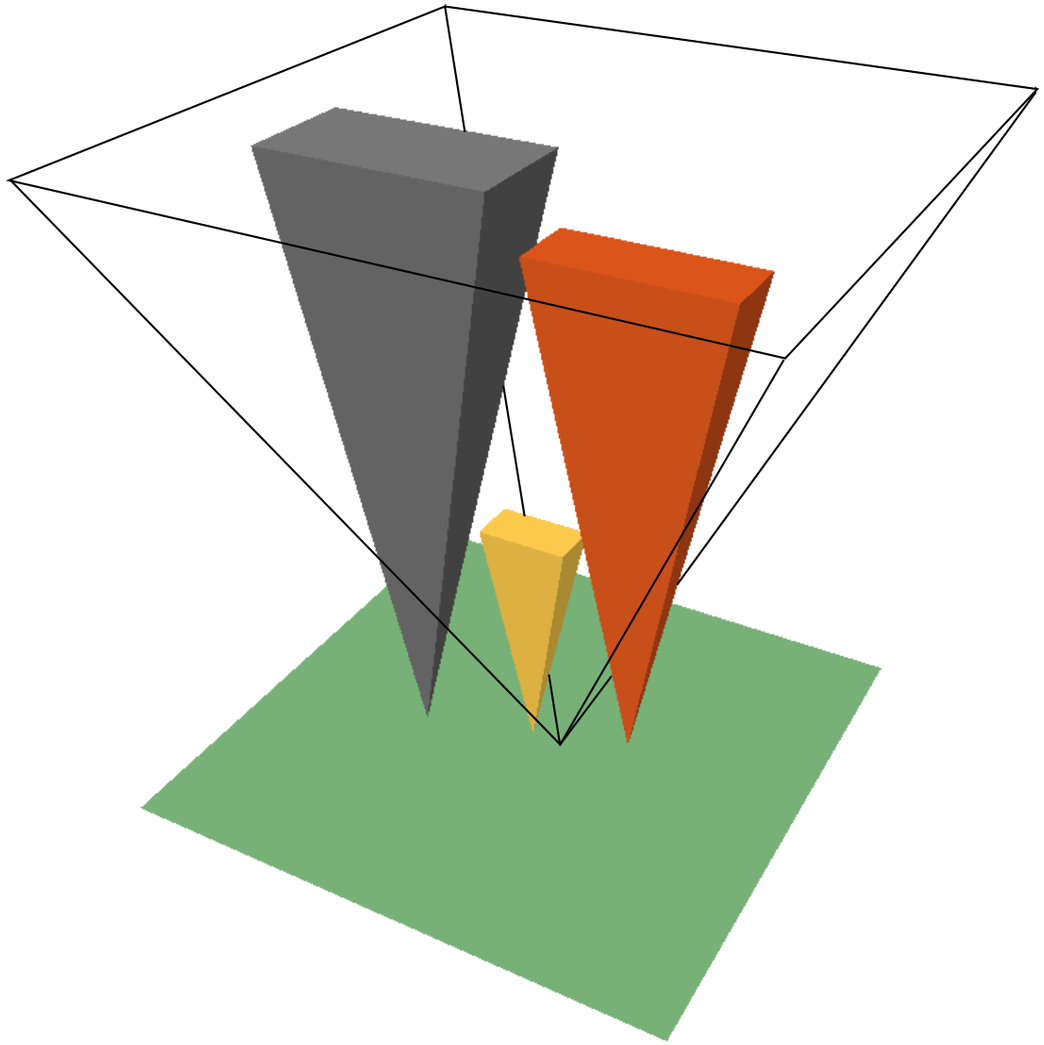
No history

The labelling may not be dependent on navigation history

from: Beem, Daiches, Yap. Dynamic Map Labeling. 2006.



(a)



(b)

Thanks. **Questions?**

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