

July 12, 2019

behdad@fb.com

Behdad Esfahbod

https://docs.google.com/presentation/d/1mjUDvi0J2X0TAaD5WTfp313zZV-pvSTStCeNBsv_E3s/

**Fonts.
Aren't
they,
like,
done?**

Background

- **2000–2006** FarsiWeb (FriBidi, Pango)
- **2006–2010** Red Hat (Pango, Cairo, HarfBuzz, Fontconfig, vte/gnome-terminal)
- **2010–2019** Google (GLyphy, HarfBuzz, Chrome, Android, FontTools, Noto, Google Fonts)
- ...

Overview

Concepts:

- Text shaping
- Font rasterization
- Color fonts
- Variable fonts
- Font subsetting

Open Source projects:

- [HarfBuzz](#)
- [FreeType](#)
- [FontTools](#)
- [Noto Fonts](#)

Standards:

- [Unicode](#)
- [OpenType](#)
- [W3C WebFonts WG](#)

Text shaping (& layout)

Reading:

- [Unicode, OpenType, and Fonts: Closing the Circle](#)
- [Reflections on Building the HarfBuzz Indic Shaper](#)

Demo:

- [Nope, Not Arabic](#)
- [Pango Script Gallery](#)

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मश्रति	मिश्रित
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Special Ligatures in Zapfino

Mme. *M^{me}*

Mr. *M^r*

Zapfino *Zapfino*

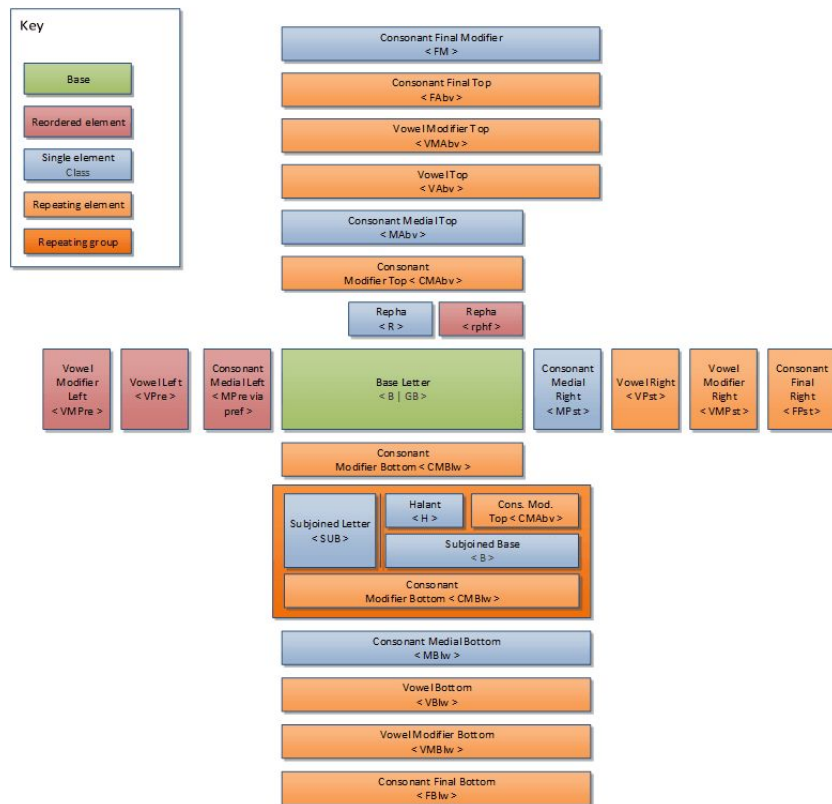
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Universal



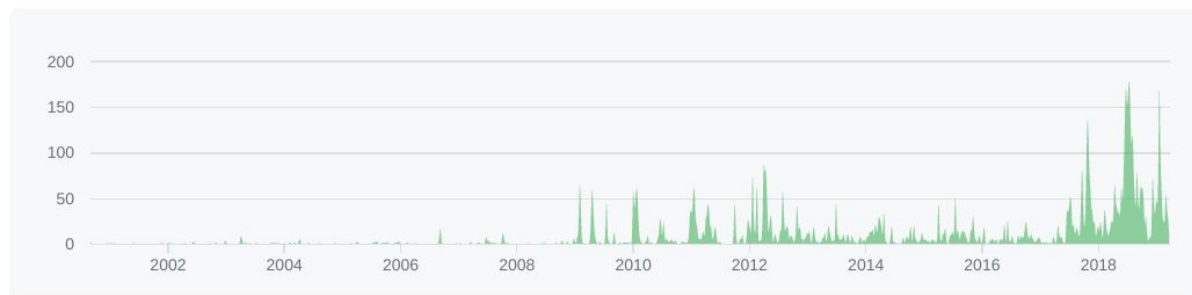
Machine

HarfBuzz

Dec 17, 2000 – Jul 12, 2019

Contributions: **Commits** ▾

Contributions to master, excluding merge commits



HarfBuzz

Concepts:

- Efficient
- Portable
- Robust
- Modern
- User-friendly
- Data-driven
- Delightful C++ (YMMV!)



HarfBuzz

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```
void closure (hb_closure_context_t *c) const
{
    unsigned d = deltaGlyphID;
    + hb_iter (this+coverage)
    | hb_filter (*c->glyphs)
    | hb_map ([d] (hb_codepoint_t g) { return (g + d) & 0xFFFFu; })
    | hb_sink (c->output)
    ;
}
```

HarfBuzz

Who uses:

- GNOME / KDE
- Chrome / Firefox
- Android / ChromeOS
- LibreOffice, XeTeX, LuaTeX, ...
- PlayStation, smart TVs, ...
- OpenJDK
- Adobe Photoshop, Scribus, ...
- Microsoft Edge!!!
- Photopea, Prezi, ...
- Emacs
- ...

@simulate

Holy shit font rendering is a pain in the ass..

Why are there no proper guides for harfbuzz and pango out there?



devrant.com



Khaled Hosny

@KhaledGhetas

Following



So far I've helped (in a way or another) migrating LibreOffice, XeTeX, Scribus, Emacs and LuaTeX to HarfBuzz (as well as ImageMagick, Pillow and others, via Raqm).

Khaled Hosny—fixing libre text layout one application at a time.

1:35 PM - 4 Jul 2019

Speaking of...

Khaled Hosny



Werner Lemberg



Cosimo Lupo



Chrome



OS	ChromeOS	Linux	Android	Windows	Mac OS
Shaping	HarfBuzz	HarfBuzz	HarfBuzz	HarfBuzz	HarfBuzz
Font Rasterizing for existing fonts	FreeType	FreeType	FreeType	DirectWrite	CoreText
Variable Fonts	FreeType	FreeType	FreeType	FreeType	CoreText FreeType
Color Fonts	FreeType	FreeType	FreeType	FreeType	FreeType

Font rasterization

Concepts:

- Hinting
- Subpixel rendering
- Subpixel positioning
- Gamma, sRGB, ...

Reading:

- [High-DPI, Subpixel Text Positioning, Hinting](#)
- [The Raster Tragedy at Low-Resolution Revisited](#)

CPU-based:

- [FreeType](#)
- [stb_truetype.h](#)
- [font-rs](#)

GPU-based:

- [freetype-gl](#)
- [Glyphy](#)
- [msdfgen](#)
- [pathfinder](#)
- [SLUG library](#)
- ...

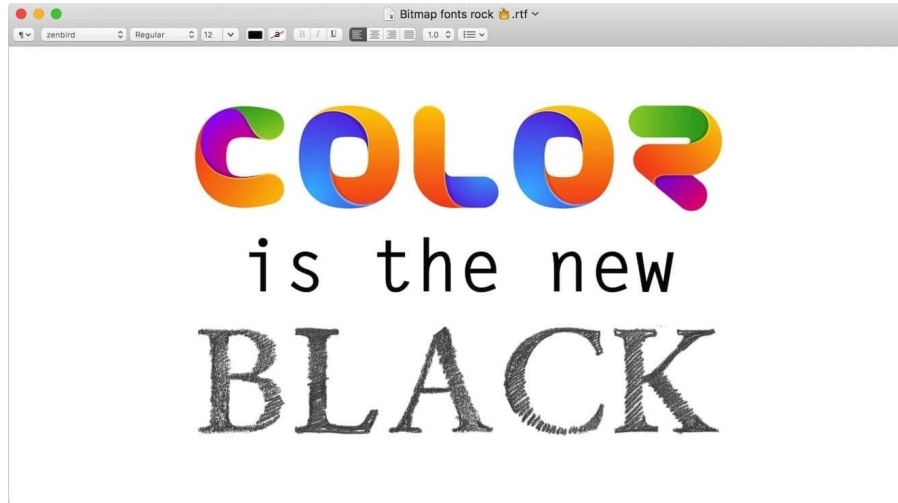
Color fonts (~2012)

Make your own pickles:

- Apple 'sbix'
- Google 'CDBT/CBLC'
- Microsoft 'COLR/CPAL'
- Adobe/Mozilla/W3C 'SVG'

Demo:

- [colorfonts.wtf](https://www.colorfonts.wtf)



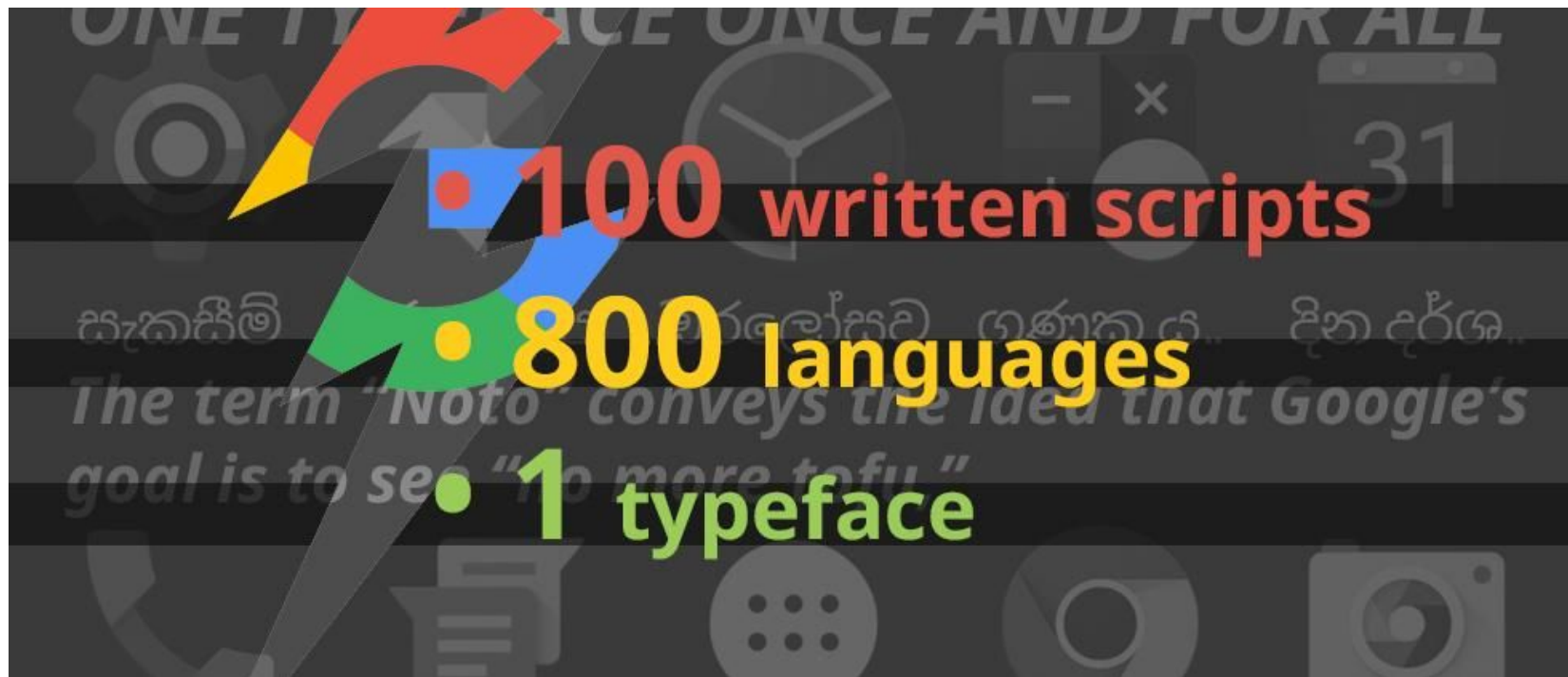
<https://www.colorfonts.wtf>

Noto fonts



“all” of Unicode
homogenous
open source

Noto fonts



[Google Noto font aims for every script and language from all of human history](#)

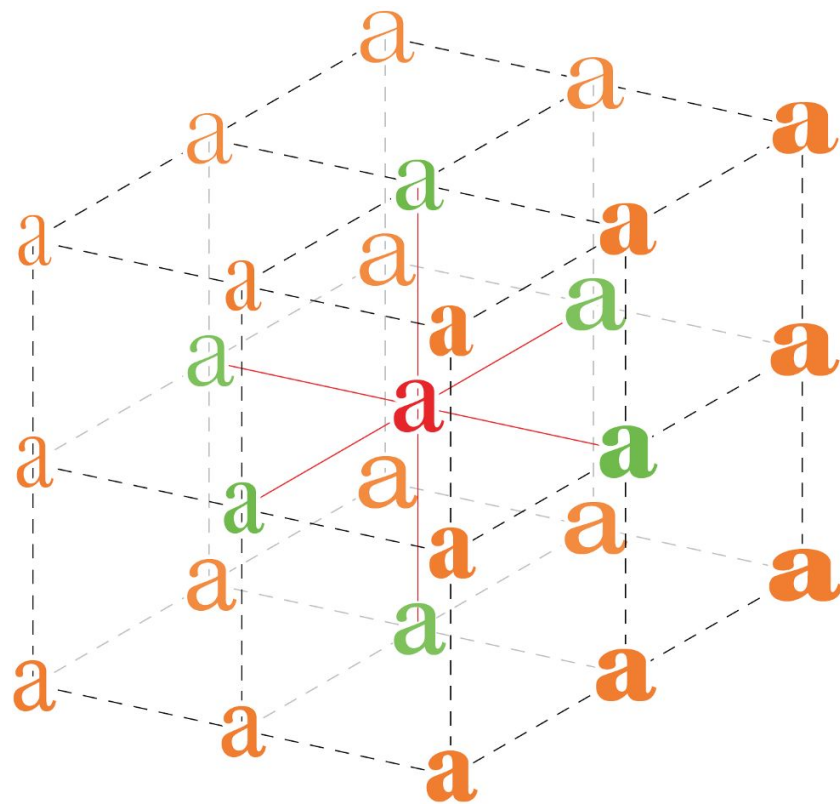
Variable fonts (~2016)

Reading:

[Introducing OpenType Variable Fonts](#)

Demo:

v-fonts.com



[Introducing OpenType Variable Fonts](#)

Color Variable Emoji Font

Demo:

pixelambacht.nl/demo/mrpoo



pixelambacht.nl/demo/mrpoo

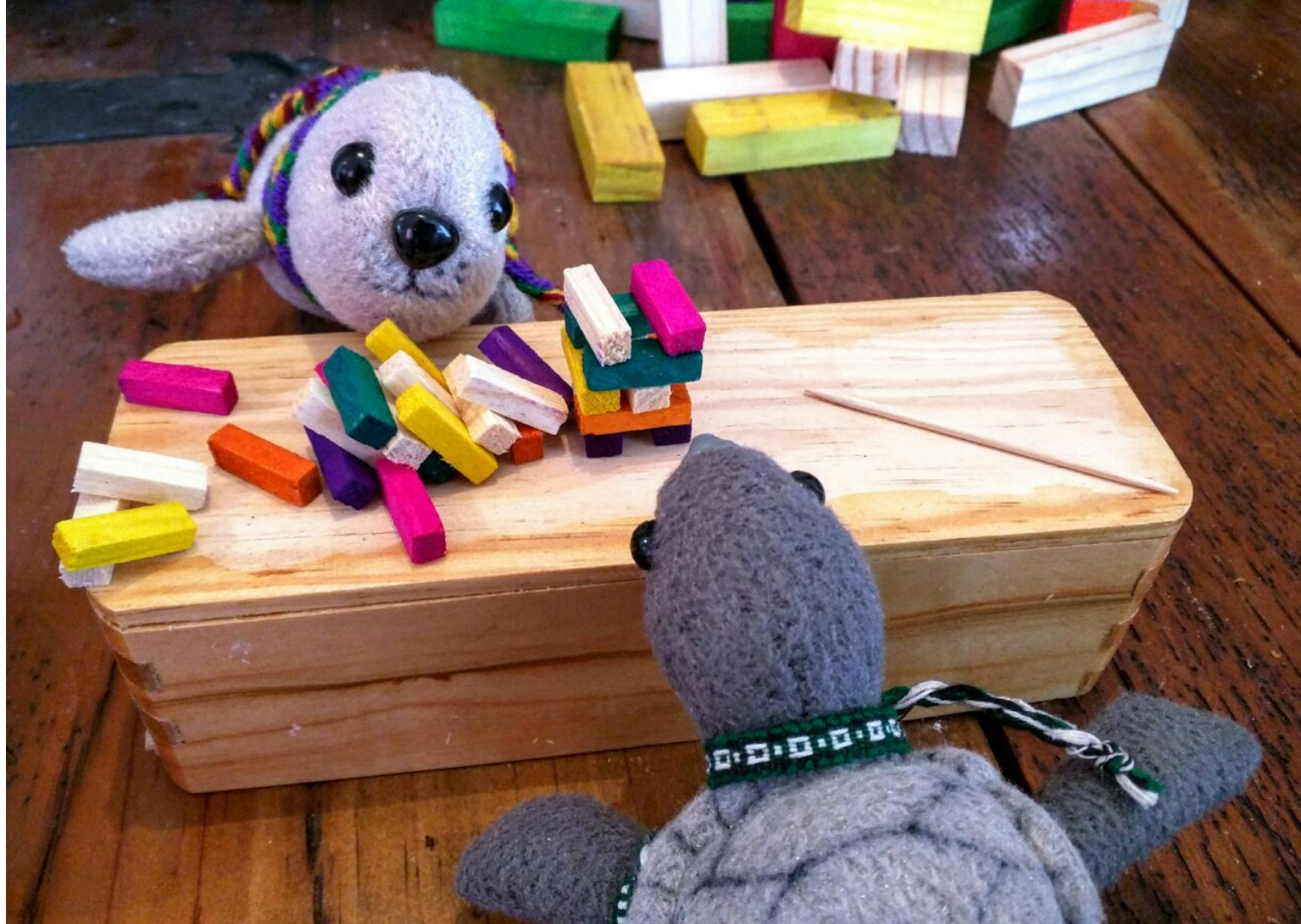
FontTools



FontTools



FontTools



**how I learned
to stop
worrying and
love the
integral**



\$ fontmake

ufo2ft

MutatorMath

fontMath

glyphsLib

fonttools.ufoLib

ttfautohint

fonttools.varLib

psautohint

fonttools.ttLib

cu2qu

fonttools.cffLib

booleanOperations

compreffor

fonttools.feaLib

fonttools.mtiLib

fonttools.otlLib

Sentence ▾

40px ▾



Categories ▾

Language ▾

Font Properties ▾

Viewing 922 of 922 font families

Sort by: Trending now ▾

Roboto



Christian Robertson (12 styles)

All their equipment and
instruments are alive.

Literata



TypeTogether (8 styles)

A red flare
silhouetted the
jagged edge of a wing.

Bahianita



Omnibus-Type (1 style)

I watched the storm, so beautiful yet
terrific.

Open Sans



Steve Matteson (10 styles)

Almost before we
knew it, we had left
the ground.

Lato



Łukasz Dziedzic (10 styles)

A shining crescent far
beneath the flying
vessel.

Montserrat

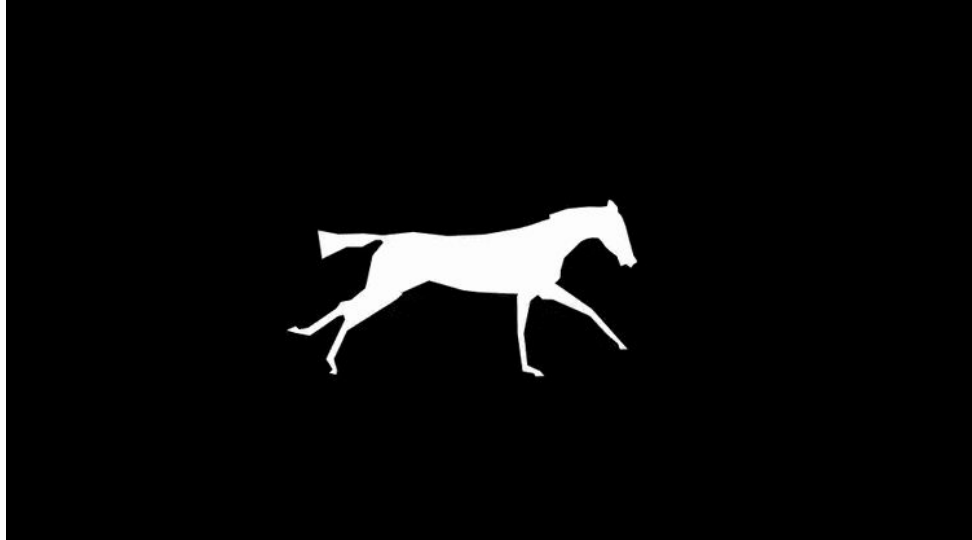


Julieta Ulanovsky, Sol Matas, Juan Pablo del Peral, Jacques Le Bailly (18 styles)

It was going to be a
lonely trip back.

Font subsetting

[Faster Horse](#)



OpenType

- ~1996 TrueType+CFF $\Rightarrow$ OpenType
- ~2000 OpenType Layout
- ~2006 Indic2 Specifications
- ~2013 Color fonts
- ~2014 Universal Shaping Engine
- ~2016 Variable fonts
- ~2019 ???

W3C WebFonts WG

- [WOFF](#)
- [WOFF2](#)
- [“Progressive Font Enrichment”](#)
(*aka* Font Streaming)

Further reading

Whitepapers and presentations:

- **2018 Digital Typography**. With Nicolas Rougier. Mini-course at SIGGRAPH. [Slides](#).
- **2018 Faster Horse. C++ Font Subsetter: Fast, Flexible, and Secure**. Rewriting Python-based FontTools font subsetter in C++ in HarfBuzz. [Slides](#). [Video](#).
- **2018 99 Proof Smal Batch Distillery** Rewriting FontTools's GSUB/GPOS table packing. [Slides](#). [Video](#).
- **2017 Update on Font Variations in FontTools & Chrome**. I showed how I used calculus, symbolic computation, and code generation, to speed up a design tool by 10x in Python. [Slides](#). [Video](#).
- **2016 OpenType GX, an exploratory proposal** Work that led to OpenType 1.8 Font Variations. [Slides](#). [Video](#).
- **2015 Universal Shaping** I showed that OpenType Layout format is *Turing complete*. [Slides](#). [Video](#).
- **2014 Reflections on Building the HarfBuzz Indic Shaper**.
- **2014 Unicode, OpenType, and Fonts: Closing the Circle** With Roozbeh Pournader. [Slides](#). [Video](#).
- **2014 GLyphy: high-quality glyph rendering using OpenGL ES2 shaders**. [Video](#).
- **2012 High-DPI, Subpixel Text Positioning, Hinting, What happens when an unstoppable bullet hits an impenetrable wall?**.
- **2010 State of Text Rendering**. Overdue for an update, still a good read to understand the pieces of the Free Software text rendering stack.

