COLORFUL, GRAPHICAL

FONTS IN OPENTYPE

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WHAT IS OPENTYPE?

• Binary font file format (1996)
• Table-based
  • **head** – metadata, font style, ...
  • **hmtx** – horizontal metrics
  • **cmap** – mapping of “character codes” to glyph index values
• Two classes of glyph format
  • **EBDT** – embedded bitmap data table
  • **glyf** & **CFF** – outline fonts
Praecepta eloquentiarum universae mundi reginae ad coram domini nostri ianuas assumptae una cum beatae mariae mater et filio in theatri sancti natalis Ecclesiae capitulorum dominicae.
MUSKETS
CEYLON
HOUSE
WHY SUPPORT COLOURED GLYPHS?

- Text as text, not images
  - Searchable
  - Selectable
  - Editable
  - Accessible
  - Reusable
CURRENT TECHNIQUES: LAYERED FONTS

Forecast Font by Ali Sisk

<span id="cloud"></span><span id="rain"></span><span id="sun"></span>

<style>
  #cloud::before, #rain::before, #sun::before { position: absolute; }
  #cloud::before { content: "\f105"; color: rgb(204, 204, 204); }
  #rain::before { content: "\f104"; color: rgb(130, 178, 228); }
  #sun::before { content: "\f101"; color: rgb(255, 165, 0); }
</style>
CURRENT TECHNIQUES: SVG TEXT

```
<pattern id="polkadot" x="0" y="0" width="20" height="20"
    patternUnits="userSpaceOnUse">
    <rect width="20" height="20" fill="white"/>
    <circle cx="10" cy="10" r="5" fill="crimson"/>
    <circle cx="0" cy="0" r="5" fill="crimson"/>
    <circle cx="0" cy="20" r="5" fill="crimson"/>
    ...
</pattern>

<text fill="url(#polkadot)" stroke="url(#greygradient)" stroked="strokede"></text>
```
PRIOR WORK – TYPE 3 FONTS (1984)

- Arbitrary PostScript programs defining glyphs
- Shapes filled with patterns, shades, colours
- Not supported natively in desktop operating systems
- Not supported by browsers
PRIOR WORK – SVG FONTS (2001)

- SVG document with a **font** element
- Two variants:
  - Tiny fonts – plain outline
  - Full fonts – arbitrary SVG content
<svg xmlns="http://www.w3.org/2000/svg">
  <font>
    <font-face font-family="MyFontName"
              units-per-em="1000" ascent="800" descent="200"/>
    <glyph unicode="A" horiz-adv-x="700">
      <circle cx="350" cy="400" r="400" fill="red"/>
    </glyph>
  </font>
  <text x="100" y="100" font-family="MyFontName">A</text>
</svg>
PRIOR WORK – SVG FONTS (2001)

Pros:
• Graphically expressive
• Easily written by hand, modifiable by script
• Scalable (of course)
• Animatable!

Cons:
• Limited font features
• Does not support non-Latin languages well
PRIOR WORK – APPLE **sbix** TABLE (2009?)

- Initially supported in iPhone OS 3 in Private Use Area
- Unicode 5 added official code points for emoji
- Now almost 1000 in Unicode 7
- iOS 5 and Mac OS X Lion supports the Unicode code points
- Proprietary, undocumented format
- Colour bitmaps (PNGs) at multiple sizes
NEW OPENTYPE TABLE PROPOSALS

- ISO/IEC JTC 1/SC 29/WG 11 working on 3rd edition of Open Font Format (standardised version of OpenType)
- Submissions were invited for colour glyph proposals
NEW OPENTYPE TABLE PROPOSAL #1

- **CBDT** – Google’s color bitmap data table
- Like Apple’s **sbix**, allows glyphs defined using embedded PNGs
- Also allows uncompressed 8 bpp sRGB data
- Render arbitrary graphics, but won’t scale well
- No colour parameterisation
NEW OPENTYPE TABLE PROPOSAL #2

- **COLR** & **CPAL** – Microsoft’s coloured glyph layers
- Font defines one or more palettes
- Palette entries are RGBA values
- Coloured glyphs defined as a list of (plain glyph, palette entry) pairs
- Good fallback
- Scalable
- Only flat colours, no gradients or patterns
NEW OPENTYPE TABLE PROPOSAL #2

<table>
<thead>
<tr>
<th>CPAL</th>
<th>CFF</th>
<th>COLR</th>
</tr>
</thead>
<tbody>
<tr>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>

- Special palette entry 0xFFFFF means “foreground color”
NEW OPENTYPE TABLE PROPOSAL #3

- **SVG** – Mozilla and Adobe’s SVG glyphs
- SVG documents embedded in the font
- Each document defines one or more glyphs
- Elements with `id="glyph123"` define a glyph
- Full SVG graphics allowed
- Fallback to plain outline glyphs
CONTEXT VALUES

- New SVG property values: context-fill, context-stroke, context-fill-opacity, context-stroke-opacity, context-value

```xml
<svg xmlns="http://www.w3.org/2000/svg">
  <g id="glyph85"> <!-- for "o" -->
    <circle cx="230" cy="-230" r="200"/>
    <circle cx="230" cy="-230" r="100"
           fill="context-stroke" stroke="none"/>
  </g>
</svg>
```
PALETTE VALUES

- Microsoft CPAL table values can be used in SVG glyphs
- CSS Variables automatically defined for each palette entry

```xml
<svg xmlns="http://www.w3.org/2000/svg">
  <g id="glyph61701" transform="scale(1,-1)">
    <path fill="var(--color0)" d="M430 131q0 -26 -18 -44t-43 -18h-4h-23h-
    <path fill="var(--color1)" d="M185.5 42q-9.5 6 -12.5 17t3 21q8 13 28.
    <path fill="var(--color2)" d="M371 360v24q0 8 8 8t8 8v-24q0 -8 -8 -8
  </g>
</svg>
```
COMPAARED TO SVG FONTS

- No metrics in the SVG document
- Coordinate space is y-down rather than y-up
- Better mapping of fill & stroke to parts of the glyph
- Use OpenType features for
  - combining mark positioning
  - language-based glyph substitution
  - defining small-caps, lining numerals, swashes (font-variant)
WHICH PROPOSAL WAS ACCEPTED?

- All three of them!
- Different use cases, pros/cons for each
- Draft International Standard just published
SHADOWED SHADOWS

A B C
FUTURE WORK NEEDED

• A way to select a palette from the font?

```css
@font-face {
    font-family: MyColourfulFont;
    src: url(...);
}

h1 { font: 64px MyColourfulFont; font-palette: 2; }
```

• A way to specify custom palette values?

```css
h1 { font-palette-values: blue, orange; }
```
WHERE IS THIS SUPPORTED?

- In browsers, when referenced with @font-face:
  - CBDT – none
  - COLR – Firefox, Internet Explorer
  - SVG – Firefox

- In font editors:
  - CBDT – TransType
  - COLR – TransType, FontCreator, glyphs.app
  - SVG – TransType, SVG-OT Workshop
THANK YOU

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  ● https://www.flickr.com/photos/ghostsigns/14439809713
  ● https://www.flickr.com/photos/medmss/6882588315
  ● https://www.flickr.com/photos/topekalibrary/7776940742
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  ● https://www.flickr.com/photos/nicksherman/6937649273
  ● https://www.flickr.com/photos/ud3/11813895054
LINKS

- [SVG-in-OpenType Workshop](#)