The fontspec package
Font selection for XeLaTeX and LuaLaTeX

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Part I
Getting started

1 History

This package began life as a LaTeX interface to select system-installed macOS fonts in Jonathan Kew's XeTeX, the first widely-used Unicode extension to TeX. Over time, XeTeX was extended to support OpenType fonts and then was ported into a cross-platform program to run also on Windows and Linux.

More recently, LuaTeX is fast becoming the TeX engine of the day; it supports Unicode encodings and OpenType fonts and opens up the internals of TeX via the Lua programming language. Hans Hagen's ConTeXt Mk. IV is a re-write of his powerful typesetting system, taking full advantage of LuaTeX's features including font support; a kernel of his work in this area has been extracted to be useful for other TeX macro systems as well, and this has enabled fontspec to be adapted for LaTeX when run with the LuaTeX engine.

2 Introduction

The fontspec package allows users of either XeTeX or LuaTeX to load OpenType fonts in a LaTeX document. No font installation is necessary, and font features can be selected and used as desired throughout the document.

Without fontspec, it is necessary to write cumbersome font definition files for LaTeX, since LaTeX's font selection scheme (known as the 'NFSS') has a lot going on behind the scenes to allow easy commands like `\emph` or `\bfseries`. With an uncountable number of fonts now available for use, however, it becomes less desirable to have to write these font definition (`.fd`) files for every font one wishes to use.

Because fontspec is designed to work in a variety of modes, this user documentation is split into separate sections that are designed to be relatively independent. Nonetheless, the basic functionality all behaves in the same way, so previous users of fontspec under XeTeX should have little or no difficulty switching over to LuaTeX.

This manual can get rather in-depth, as there are a lot of details to cover. See the documents `fontspec-example.tex` for a complete minimal example to get started quickly.

2.1 Acknowledgements

This package could not have been possible without the early and continued support the author of XeTeX, Jonathan Kew. When I started this package, he steered me many times in the right direction.

I've had great feedback over the years on feature requests, documentation queries, bug reports, font suggestions, and so on from lots of people all around the world. Many thanks to you all.

Thanks to David Perry and Markus Böhning for numerous documentation improvements and David Perry again for contributing the text for one of the sections of this manual.

Special thanks to Khaled Hosny, who was the driving force behind the support for LuaLaTeX, ultimately leading to version 2.0 of the package.

3 Package loading and options

For basic use, no package options are required:

```
\usepackage{fontspec}
```

Package options will be introduced below; some preliminary details are discussed first.

3.1 Font encodings

The (default) `tuenc` package option switches the NFSS font encoding to `TU`. `TU` is a new Unicode font encoding, intended for both XeTeX and LuaTeX engines, and automatically contains support for symbols covered by LaTeX's traditional `T1` and `TS1` font encodings (for example, `\%`, `\textbullet`, `\"u`, and so on). Some additional features are provided by fontspec to customise some encoding details; see Part V on page 50 for further details.

Pre-2017 behaviour can be achieved with the `euenc` package option. This selects the `EU1` or `EU2` encoding (XeTeX/LuaTeX, resp.) and loads the xunicode package for symbol support. Package authors and users who have referred explicitly to the encoding names `EU1` or `EU2` should update their code or documents. (See internal variable names described in Section 5 on page 63 for how to do this properly.)

3.2 Maths fonts adjustments

By default, fontspec adjusts LaTeX's default maths setup in order to maintain the correct Computer Modern symbols when the roman font changes. However, it will attempt to avoid doing this if another maths font package is loaded (such as mathpazo or the unicode-math package).

If you find that fontspec is incorrectly changing the maths font when it shouldn't be, apply the `no-math` package option to manually suppress its behaviour here.

3.3 Configuration

If you wish to customise any part of the fontspec interface, this should be done by creating your own `fontspec.cfg` file, which will be automatically loaded if it is found by XeTeX or LuaTeX. A `fontspec.cfg` file is distributed with fontspec with a small number of defaults set up within it.

To customise fontspec to your liking, use the standard `.cfg` file as a starting point or write your own from scratch, then either place it in the same folder as the main document for isolated cases, or in a location that XeTeX or LuaTeX searches by default; *e.g.* in MacTeX: `~/Library/texmf/tex/latex/`.

The package option `no-config` will suppress the loading of the `fontspec.cfg` file under all circumstances.

3.4 Warnings

This package can give some warnings that can be harmless if you know what you're doing. Use the `quiet` package option to write these warnings to the transcript (`.log`) file instead.

Use the `silent` package option to completely suppress these warnings if you don't even want the `.log` file cluttered up.

4 Interaction with LaTeX 2ε and other packages

This section documents some areas of adjustment that fontspec makes to improve default behaviour with LaTeX 2ε and third-party packages.

4.1 Commands for old-style and lining numbers

\oldstylenums
\liningnums

LaTeX's definition of `\oldstylenums` relies on strange font encodings. We provide a fontspec-compatible alternative and while we're at it also throw in the reverse option as well. Use `\oldstylenums{`⟨*text*⟩`}` to explicitly use old-style (or lowercase) numbers in ⟨*text*⟩, and the reverse for `\liningnums{`⟨*text*⟩`}`.

4.2 Italic small caps

Support now provided by LaTeX 2ε in 2020.

4.3 Emphasis and nested emphasis

Support now provided by LaTeX 2ε in 2020.

4.4 Strong emphasis

\strong
\strongenv

The `\strong` macro is used analogously to `\emph` but produces variations in weight. If you need it in environment form, use `\begin{strongenv}...\end{strongenv}`.

As with emphasis, this font-switching command is intended to move through a range of font weights. For example, if the fonts are set up correctly it allows usage such as `\strong{...\strong{...}}` in which each nested `\strong` macro increases the weight of the font.

\strongfontdeclare

Currently this feature set is somewhat experimental and there is no syntactic sugar to easily define a range of font weights using fontspec commands. Use, say, the following to define first bold and then black (`k`) font faces for `\strong`:

```
\strongfontdeclare{\bfseries,\fontseries{k}\selectfont}
```

\strongreset

If too many levels of `\strong` are reached, `\strongreset` is inserted. By default this is a no-op and the font will simply remain the same. Use `\renewcommand\strongreset{\mdseries}` to start again from the beginning if desired.

An example for setting up a font family for use with `\strong` is discussed in 4.3.1 on page 17.

Part II
General font selection

1 Main commands

This section concerns the variety of commands that can be used to select fonts.

`\setmainfont{`⟨*font*⟩`}[`⟨*font features*⟩`]`
`\setsansfont{`⟨*font*⟩`}[`⟨*font features*⟩`]`
`\setmonofont{`⟨*font*⟩`}[`⟨*font features*⟩`]`

These are the main font-selecting commands of this package which select the standard fonts used in a document, as shown in Example 1. Here, the scales of the fonts have been chosen to equalise their lowercase letter heights. The `Scale` font feature will be discussed further in Section 6 on page 24, including methods for automatic scaling. Note that further options may need to be added to select appropriate bold/italic fonts, but this shows the main idea.

Note that while these commands all look and behave largely identically, the default setup for font loading automatically adds the `Ligatures=TeX` feature for the `\setmainfont` and `\setsansfont` commands. These defaults (and further customisations possible) are discussed in Section 1 on page 19.

`\newfontfamily`⟨*cmd*⟩`{`⟨*font*⟩`}[`⟨*font features*⟩`]`
`\setfontfamily`⟨*cmd*⟩`{`⟨*font*⟩`}[`⟨*font features*⟩`]`
`\renewfontfamily`⟨*cmd*⟩`{`⟨*font*⟩`}[`⟨*font features*⟩`]`
`\providefontfamily`⟨*cmd*⟩`{`⟨*font*⟩`}[`⟨*font features*⟩`]`

These commands define new font family commands (like `\rmfamily`). The `new` command checks if ⟨*cmd*⟩ has been defined, and issues an error if so. The `renew` command checks if ⟨*cmd*⟩ has been defined, and issues an error if not. The `provide` command checks if ⟨*cmd*⟩ has been defined, and silently aborts if so. The `set` command never checks; use at your own risk.

`\fontspec{`⟨*font*⟩`}[`⟨*font features*⟩`]`

The plain `\fontspec` command is not generally recommended for document use. It is an ad hoc command best suited for testing and loading fonts on a one-off basis.

All of the commands listed above accept comma-separated ⟨*font feature*⟩=⟨*option*⟩ lists; these are described later:

- For general font features, see Section 6 on page 24
- For OpenType fonts, see Part IV on page 31
- For XeTeX-only general font features, see Part VII on page 56
- For LuaTeX-only general font features, see Part VI on page 54
- For features for AAT fonts in XeTeX, see Section 3 on page 58

Example 1: Loading the default, sans serif, and monospaced fonts.

```
\setmainfont{texgyrebonum-regular.otf}
\setsansfont{lmsans10-regular.otf}[Scale=MatchLowercase]
\setmonofont{Inconsolatazi4-Regular.otf}[Scale=MatchLowercase]

\rmfamily Pack my box with five dozen liquor jugs\par
\sffamily Pack my box with five dozen liquor jugs\par
\ttfamily Pack my box with five dozen liquor jugs
```

Pack my box with five dozen liquor jugs
Pack my box with five dozen liquor jugs
Pack my box with five dozen liquor jugs

2 Font selection

In both LuaTEX and XETEX, fonts can be selected (using the ⟨*font*⟩ argument in Section 1) either by 'font name' or by 'file name', but there are some differences in how each engine finds and selects fonts — don't be too surprised if a font invocation in one engine needs correction to work in the other.

2.1 By font name

Fonts known to LuaTEX or XETEX may be loaded by their standard names as you'd speak them out loud, such as *Times New Roman* or *Adobe Garamond*. 'Known to' in this case generally means 'exists in a standard fonts location' such as `~/Library/Fonts` on macOS, or `C:\Windows\Fonts` on Windows. In LuaTEX, fonts found in the TEXMF tree can also be loaded by name. In XETEX, fonts found in the TEXMF tree can be loaded in Windows and Linux, but not on macOS.

The simplest example might be something like

```
\setmainfont{Cambria}[ ... ]
```

in which the bold and italic fonts will be found automatically (if they exist) and are immediately accessible with the usual `\textit` and `\textbf` commands.

The 'font name' can be found in various ways, such as by looking in the name listed in a application like *Font Book* on Mac OS X. Alternatively, TEXLive contains the `otfinfo` command line program, which can query this information; for example:

```
otfinfo -i `kpsewhich lmroman10-regular.otf`
```

results in a line that reads:

```
Preferred family:    Latin Modern Roman
```

(The 'preferred family' name is usually better than the 'family' name.)

LuaTEX users only In order to load fonts by their name rather than by their filename (*e.g.*, 'Latin Modern Roman' instead of 'ec-lmr10'), you may need to run the script `luaotfload-tool`, which is distributed with the luaotfload package. Note that if you do not execute this script beforehand, the first time you attempt to typeset the process will pause for (up to) several minutes. (But only the first time.) Please see the luaotfload documentation for more information.

2.2 By file name

XeTeX and LuaTeX also allow fonts to be loaded by file name instead of font name. When you have a very large collection of fonts, you will sometimes not wish to have them all installed in your system's font directories. In this case, it is more convenient to load them from a different location on your disk. This technique is also necessary in XeTeX when loading OpenType fonts that are present within your TeX distribution, such as `/usr/local/texlive/2013/texmf-dist/fonts/opentype/public`. Fonts in such locations are visible to XeTeX but cannot be loaded by font name, only file name; LuaTeX does not have this restriction.

When selecting fonts by file name, any font that can be found in the default search paths may be used directly (including in the current directory) without having to explicitly define the location of the font file on disk.

Fonts selected by filename must include bold and italic variants explicitly, unless a `.fontspec` file is supplied for the font family (see Section 2.3). We'll give some first examples specifying everything explicitly:

```
\setmainfont{texgyrepagella-regular.otf}[
     BoldFont       = texgyrepagella-bold.otf ,
     ItalicFont     = texgyrepagella-italic.otf ,
     BoldItalicFont = texgyrepagella-bolditalic.otf ]
```

fontspec knows that the font is to be selected by file name by the presence of the '`.otf`' extension. An alternative is to specify the extension separately, as shown following:

```
\setmainfont{texgyrepagella-regular}[
     Extension      = .otf ,
     BoldFont       = texgyrepagella-bold ,
     ... ]
```

If desired, an abbreviation can be applied to the font names based on the mandatory 'font name' argument:

```
\setmainfont{texgyrepagella}[
     Extension      = .otf ,
     UprightFont    = *-regular ,
     BoldFont       = *-bold ,
     ... ]
```

In this case 'texgyrepagella' is no longer the name of an actual font, but is used to construct the font names for each shape; the `*` is replaced by 'texgyrepagella'. Note in this case that `UprightFont` is required for constructing the font name of the normal font to use.

To load a font that is not in one of the default search paths, its location in the filesystem must be specified with the `Path` feature:

```
\setmainfont{texgyrepagella}[
     Path           = /Users/will/Fonts/ ,
     UprightFont    = *-regular ,
     BoldFont       = *-bold ,
     ... ]
```

Note that XeTeX and LuaTeX are able to load the font without giving an extension, but fontspec must know to search for the file; this can be indicated by using the `Path` feature without an argument:

```
\setmainfont{texgyrepagella-regular}[
     Path, BoldFont = texgyrepagella-bold,
     ... ]
```

My preference is to always be explicit and include the extension; this also allows fontspec to automatically identify that the font should be loaded by filename.

In previous versions of the package, the `Path` feature was also provided under the alias `ExternalLocation`, but this latter name is now deprecated and should not be used for new documents.

2.3 By custom file name using a `.fontspec` file

When fontspec is first asked to load a font, a font settings file is searched for with the name '⟨*fontname*⟩`.fontspec`'.[1] If you want to *disable* this feature on a per-font basis, use the `IgnoreFontspecFile` font option.

The contents of this file can be used to specify font shapes and font features without having to have this information present within each document. Therefore, it can be more flexible than the alternatives listed above.

When searching for this `.fontspec` file, ⟨*fontname*⟩ is stripped of spaces and file extensions are omitted. For example, given `\setmainfont{TeX Gyre Adventor}`, the `.fontspec` file would be called `TeXGyreAdventor.fontspec`. If you wanted to transparently load options for `\setmainfont{texgyreadventor-regular.otf}`, the configuration file would be `texgyreadventor-regular.fontspec`.

N.B. that while spaces are stripped, the lettercase of the names should match.

This mechanism can be used to define custom names or aliases for your font collections. The syntax within this file follows from the `\defaultfontfeatures`, defined in more detail later but mirroring the standard fontspec font loading syntax. As an example, suppose we're defining a font family to be loaded with `\setmainfont{My Charis}`. The corresponding `MyCharis.fontspec` file would contain, say,

```
\defaultfontfeatures[My Charis]
  {
    Extension = .ttf ,
    UprightFont    = CharisSILR,
    BoldFont       = CharisSILB,
    ItalicFont     = CharisSILI,
    BoldItalicFont = CharisSILBI,
    % <any other desired options>
  }
```

The optional argument to `\defaultfontfeatures` must exactly match that requested by the font loading command (`\setmainfont`, etc.) — in particular note that spaces are significant here, so `\setmainfont{MyCharis}` will not 'see' the default font feature setting within the `.fontspec` file.

[1] Located in the current folder or within a standard `texmf` location.

Finally, note that options for individual font faces can also be defined in this way. To continue the example above, here we colour the different faces:

```
\defaultfontfeatures[CharisSILR]{Color=blue}
\defaultfontfeatures[CharisSILB]{Color=red}
```

Such configuration lines could be stored either inline inside `My Charis.fontspec` or within their own `.fontspec` files; in this way, fontspec is designed to handle 'nested' configuration options.

Where `\defaultfontfeatures` is being used to specify font faces by a custom name, the `Font` feature is used to set the filename of the font face. For example:

```
\defaultfontfeatures[charis]
  {
    UprightFont = charis-regular,
    % <other desired options for all font faces in the family>
  }

\defaultfontfeatures[charis-regular]
  {
    Font = CharisSILR
    % <other desired options just for the `upright' font>
  }
```

The fontspec interface here is designed to be flexible to accomodate a variety of use cases; there is more than one way to achieve the same outcome when font faces are collected together into a larger font family.

2.4 Querying whether a font 'exists'

`\IfFontExistsTF{`⟨*font name*⟩`}{`⟨*true branch*⟩`}{`⟨*false branch*⟩`}`

The conditional `\IfFontExistsTF` is provided to test whether the ⟨*font name*⟩ exists or is loadable. If it is, the ⟨*true branch*⟩ code is executed; otherwise, the ⟨*false branch*⟩ code is.

This command can be slow since the engine may resort to scanning the filesystem for a missing font. Nonetheless, it has been a popular request for users who wish to define 'fallback fonts' for their documents for greater portability.

In this command, the syntax for the ⟨*font name*⟩ is a restricted/simplified version of the font loading syntax used for `\fontspec` and so on. Fonts to be loaded by filename are detected by the presence of an appropriate extension (`.otf`, etc.), and paths should be included inline. E.g.:

```
\IfFontExistsTF{cmr10}{T}{F}
\IfFontExistsTF{Times New Roman}{T}{F}
\IfFontExistsTF{texgyrepagella-regular.otf}{T}{F}
\IfFontExistsTF{/Users/will/Library/Fonts/CODE2000.TTF}{T}{F}
```

The `\IfFontExistsTF` command is a synonym for the programming interface function `\fontspec_font_if_exist:nTF` (Section 5 on page 63).

3 Commands to select font families

For cases when a specific font with a specific feature set is going to be re-used many times in a document, it is inefficient to keep calling `\fontspec` for every use. While the `\fontspec` command does not define a new font instance after the first call, the feature options must still be parsed and processed.

For this reason, new commands can be created for loading a particular font family with the `\newfontfamily` command and variants, outlined in Section 1 on page 8 and demonstrated in Example 2. This macro should be used to create commands that would be used in the same way as `\rmfamily`, for example. If you would like to create a command that only changes the font inside its argument (i.e., the same behaviour as `\emph`) define it using regular LaTeX commands:

```
\newcommand\textnote[1]{{\notefont #1}}
\textnote{This is a note.}
```

Note that the double braces are intentional; the inner pair is used to delimit the scope of the font change.

Comment for advanced users: The commands defined by `\newfontfamily` (and `\newfontface`; see next section) include their encoding information, so even if the document is set to use a legacy TeX encoding, such commands will still work correctly. For example,

```
\documentclass{article}
\usepackage{fontspec}
\newfontfamily\unicodefont{Lucida Grande}
\usepackage{mathpazo}
\usepackage[T1]{fontenc}
\begin{document}
A legacy \TeX\ font. {\unicodefont A unicode font.}
\end{document}
```

4 Commands to select single font faces

`\newfontface`⟨*cmd*⟩`{`⟨*font*⟩`}[`⟨*font features*⟩`]`
`\setfontface`⟨*cmd*⟩`{`⟨*font*⟩`}[`⟨*font features*⟩`]`
`\renewfontface`⟨*cmd*⟩`{`⟨*font*⟩`}[`⟨*font features*⟩`]`
`\providefontface`⟨*cmd*⟩`{`⟨*font*⟩`}[`⟨*font features*⟩`]`

Sometimes only a specific font face is desired, without accompanying italic or bold variants being automatically selected. This is common when selecting a fancy italic font, say, that has swash features unavailable in the upright forms. `\newfontface` is used for this purpose, shown in Example 3, which is repeated in Section 3.4 on page 59.

Example 2: Defining new font families.

This is a *note*.

```
\newfontfamily\notefont{Kurier}
\notefont This is a \emph{note}.
```

Example 3: Defining a single font face.

where is all the vegemite

```
\newfontface\fancy{Hoefler Text Italic}%
    [Contextuals={WordInitial,WordFinal}]
\fancy where is all the vegemite
% \emph, \textbf, etc., all don't work
```

4.1 More control over font shape selection

`BoldFont` = ⟨*font name*⟩
`ItalicFont` = ⟨*font name*⟩
`BoldItalicFont` = ⟨*font name*⟩
`SlantedFont` = ⟨*font name*⟩
`BoldSlantedFont` = ⟨*font name*⟩
`SmallCapsFont` = ⟨*font name*⟩
`UprightFont` = ⟨*font name*⟩

The automatic bold, italic, and bold italic font selections will not be adequate for the needs of every font: while some fonts mayn't even have bold or italic shapes, in which case a skilled (or lucky) designer may be able to chose well-matching accompanying shapes from a different font altogether, others can have a range of bold and italic fonts to chose among. The `BoldFont` and `ItalicFont` features are provided for these situations. If only one of these is used, the bold italic font is requested as the default from the *new* font. See Example 4.

If a bold italic shape is not defined, or you want to specify *both* custom bold and italic shapes, the `BoldItalicFont` feature is provided.

4.1.1 Small caps and slanted font shapes

When a font family has both slanted *and* italic shapes, these may be specified separately using the analogous features `SlantedFont` and `BoldSlantedFont`. Without these, however, the LaTeX font switches for slanted (`\textsl`, `\slshape`) will default to the italic shape.

For modern OpenType fonts, small caps glyphs are included within a fontface and fontspec will automatically detect them for use with the `\textsc` and `\scshape` commands. Pre-OpenType, it was common for font families to be distributed with small caps glyphs in separate fonts, due to the limitations on the number of glyphs allowed in the PostScript Type 1 format. Such fonts may be used by declaring the `SmallCapsFont` of the family you are specifying:

Example 4: Explicit selection of the bold font.

Helvetica Neue UltraLight
Helvetica Neue UltraLight Italic
Helvetica Neue
Helvetica Neue Italic

```
\fontspec{Helvetica Neue UltraLight}%
         [BoldFont={Helvetica Neue}]
              Helvetica Neue UltraLight         \\
{\itshape     Helvetica Neue UltraLight Italic} \\
{\bfseries                Helvetica Neue       } \\
{\bfseries\itshape        Helvetica Neue Italic} \\
```

```
\setmainfont{Minion MM Roman}[
  SmallCapsFont={Minion MM Small Caps & Oldstyle Figures}
]
Roman 123 \\ \textsc{Small caps 456}
```

In fact, this example is overly simplistic since it does not cover the other shapes in a font family. You should specify the small caps font for each individual bold and italic shape as in

```
\setmainfont{ <upright> }[
  UprightFeatures    = { SmallCapsFont={ <sc> } } ,
  BoldFeatures       = { SmallCapsFont={ <bf sc> } } ,
  ItalicFeatures     = { SmallCapsFont={ <it sc> } } ,
  BoldItalicFeatures = { SmallCapsFont={ <bf it sc> } } ,
]
Roman 123 \\ \textsc{Small caps 456}
```

For most modern fonts that have small caps as a font feature, this level of control isn't generally necessary.

All of the bold, italic, and small caps fonts can be loaded with different font features from the main font. See Section 3 for details. When an OpenType font is selected for `SmallCapsFont`, the small caps font feature is *not* automatically enabled. In this case, users should write instead, if necessary,

```
\setmainfont{...}[
  SmallCapsFont={...},
  SmallCapsFeatures={Letters=SmallCaps},
]
```

4.2 Specifically choosing the NFSS family

In LaTeX's NFSS, font families are defined with names such as '`ppl`' (Palatino), '`lmr`' (Latin Modern Roman), and so on, which are selected with the `\fontfamily` command:

```
\fontfamily{ppl}\selectfont
```

In fontspec, the family names are auto-generated based on the fontname of the font; for example, writing `\fontspec{Times New Roman}` for the first time would generate an internal font family name of '`TimesNewRoman(1)`'. Please note that you should not rely on the name that is generated.

In certain cases it is desirable to be able to choose this internal font family name so it can be re-used elsewhere for interacting with other packages that use the LaTeX's font selection interface; an example might be

```
\usepackage{fancyvrb}
\fvset{fontfamily=myverbatimfont}
```

To select a font for use in this way in fontspec use the `NFSSFamily` feature:[2]

```
\newfontfamily\verbatimfont{Inconsolata}[NFSSFamily=myverbatimfont]
```

[2] Thanks to Luca Fascione for the example and motivation for finally implementing this feature.

It is then possible to write commands such as:

```
\fontfamily{myverbatimfont}\selectfont
```

which is essentially the same as writing `\verbatimfont`, or to go back to the orginal example:

```
\fvset{fontfamily=myverbatimfont}
```

Only use this feature when necessary; the in-built font switching commands that fontspec generates (such as `\verbatimfont` in the example above) are recommended in all other cases.

If you don't wish to explicitly set the NFSS family but you would like to know what it is, an alternative mechanism for package writers is introduced as part of the fontspec programming interface; see the function `\fontspec_set_family:Nnn` for details (Section 5 on page 63).

4.3 Choosing additional NFSS font faces

LaTeX's font selection scheme (NFSS) is more flexible than the fontspec interface discussed up until this point. It assigns to each font face a *family* (discussed above), a *series* such as bold or light or condensed, and a *shape* such as italic or slanted or small caps. The fontspec features such as `BoldFont` and so on all assign faces for the default series and shapes of the NFSS, but it's not uncommon to have font families that have multiple weights and shapes and so on.

If you set up a regular font family with the 'standard four' (upright, bold, italic, and bold italic) shapes and then want to use, say, a light font for a certain document element, many users will be perfectly happy to use `\newfontface\`⟨*switch*⟩ and use the resulting font `\`⟨*switch*⟩. In other cases, however, it is more convenient or even necessary to load additional fonts using additional NFSS specifiers.

```
FontFace = {⟨series⟩}{⟨shape⟩} { Font = ⟨font name⟩ , ⟨features⟩ }
FontFace = {⟨series⟩}{⟨shape⟩}{⟨font name⟩}
```

The font thus specified will inherit the font features of the main font, with optional additional ⟨*features*⟩ as requested. (Note that the optional `{`⟨*features*⟩`}` argument is still surrounded with curly braces.) Multiple `FontFace` commands may be used in a single declaration to specify multiple fonts. As an example:

```
\setmainfont{font1.otf}[
   FontFace = {c}{\shapedefault}{ font2.otf } ,
   FontFace = {c}{m}{ Font = font3.otf , Color = red }
  ]
```

Writing `\fontseries{c}\selectfont` will result in `font2` being selected, which then followed by `\fontshape{m}\selectfont` will result in `font3` being selected (in red). A font face that is defined in terms of a different series but an upright shape (`\shapedefault`, as shown above) will attempt to find a matching small caps feature and define that face as well. Conversely, a font face defined in terms of a non-standard font shape will not.

There are some standards for choosing shape and series codes; the LaTeX 2_ε font selection guide[3] has a comprehensive listing.

The `FontFace` command also interacts properly with the `SizeFeatures` command as follows: (nonsense set of font selection choices)

[3] `texdoc fntguide`

```
  FontFace = {c}{n}{
    Font = Times ,
    SizeFeatures = {
      { Size =   -10 , Font = Georgia } ,
      { Size = 10-15}                 , % default "Font = Times"
      { Size = 15-   , Font = Cochin  } ,
    },
  },
```

Note that if the first `Font` feature is omitted then each size needs its own inner `Font` declaration.

4.3.1 An example for `\strong`

If you wanted to set up a font family to allow nesting of the `\strong` to easily access increasing font weights, you might use a declaration along the following lines:

```
\setmonofont{SourceCodePro}[
  Extension = .otf ,
  UprightFont = *-Light ,
  BoldFont = *-Regular ,
  FontFace = {k}{n}{*-Black} ,
]
\strongfontdeclare{\bfseries,\fontseries{k}\selectfont}
```

Further 'syntactic sugar' is planned to make this process somewhat easier.

4.4 Math(s) fonts

When `\setmainfont`, `\setsansfont` and `\setmonofont` are used in the preamble, they also define the fonts to be used in maths mode inside the `\mathrm`-type commands. This only occurs in the preamble because LaTeX freezes the maths fonts after this stage of the processing. The fontspec package must also be loaded after any maths font packages (*e.g.*, euler) to be successful. (Actually, it is *only* euler that is the problem.[4])

Note that fontspec will not change the font for general mathematics; only the upright and bold shapes will be affected. To change the font used for the mathematical symbols, see either the mathspec package or the unicode-math package.

Note that you may find that loading some maths packages won't be as smooth as you expect since fontspec (and XeTeX in general) breaks many of the assumptions of TeX as to where maths characters and accents can be found. Contact me if you have troubles, but I can't guarantee to be able to fix any incompatibilities. The Lucida and Euler maths fonts should be fine; for all others keep an eye out for problems.

`\setmathrm{`⟨*font name*⟩`}[`⟨*font features*⟩`]`
`\setmathsf{`⟨*font name*⟩`}[`⟨*font features*⟩`]`
`\setmathtt{`⟨*font name*⟩`}[`⟨*font features*⟩`]`
`\setboldmathrm{`⟨*font name*⟩`}[`⟨*font features*⟩`]`

[4] Speaking of euler, if you want to use its `[mathbf]` option, it won't work, and you'll need to put this after fontspec is loaded instead: `\AtBeginDocument{\DeclareMathAlphabet\mathbf{U}{eur}{b}{n}}`

However, the default text fonts may not necessarily be the ones you wish to use when typesetting maths (especially with the use of fancy ligatures and so on). For this reason, you may optionally use the commands above (in the same way as our other `\fontspec`-like commands) to explicitly state which fonts to use inside such commands as `\mathrm`. Additionally, the `\setboldmathrm` command allows you define the font used for `\mathrm` when in bold maths mode (which is activated with, among others, `\boldmath`).

For example, if you were using Optima with the Euler maths font, you might have this in your preamble:

```
\usepackage{mathpazo}
\usepackage{fontspec}
\setmainfont{Optima}
\setmathrm{Optima}
\setboldmathrm[BoldFont={Optima ExtraBlack}]{Optima Bold}
```

These commands are compatible with the unicode-math package. Having said that, unicode-math also defines a more general way of defining fonts to use in maths mode, so you can ignore this subsection if you're already using that package.

5 Miscellaneous font selecting details

The optional argument — from v2.4 For the first decade of fontspec's life, optional font features were selected with a bracketed argument before the font name, as in:

```
\setmainfont[
  lots and lots ,
  and more and more ,
  an excessive number really ,
  of font features could go here
]{myfont.otf}
```

This always looked like ugly syntax to me, because the most important detail — the name of the font — was tucked away at the end. The order of these arguments has now been reversed:

```
\setmainfont{myfont.otf}[
  lots and lots ,
  and more and more ,
  an excessive number really ,
  of font features could go here
]
```

I hope this doesn't cause any problems.

1. Backwards compatibility has been preserved, so either input method works.
2. In fact, you can write

   ```
   \fontspec[Ligatures=Rare]{myfont.otf}[Color=red]
   ```

   if you really felt like it and both sets of features would be applied.

Spaces `\fontspec` and `\addfontfeatures` ignore trailing spaces as if it were a 'naked' control sequence; *e.g.*, '`M. \fontspec{...} N`' and '`M. \fontspec{...}N`' are the same.

Part III
Selecting font features

The commands discussed so far such as `\fontspec` each take an optional argument for accessing the font features of the requested font. Commands are provided to set default features to be applied for all fonts, and even to change the features that a font is presently loaded with. Different font shapes can be loaded with separate features, and different features can even be selected for different sizes that the font appears in. This part discusses these options.

1 Default settings

`\defaultfontfeatures{`⟨*font features*⟩`}`

It is sometimes useful to define font features that are applied to every subsequent font selection command. This may be defined with the `\defaultfontfeatures` command, shown in Example 5. New calls of `\defaultfontfeatures` overwrite previous ones, and defaults can be reset by calling the command with an empty argument.

`\defaultfontfeatures[`⟨*font name*⟩`]{`⟨*font features*⟩`}`

Default font features can be specified on a per-font and per-face basis by using the optional argument to `\defaultfontfeatures` as shown.

```
\defaultfontfeatures[texgyreadventor-regular.otf]{Color=blue}
\setmainfont{texgyreadventor-regular.otf}% will be blue
```

Multiple fonts may be affected by using a comma separated list of font names.

`\defaultfontfeatures[`⟨`\font-switch`⟩`]{`⟨*font features*⟩`}`

New in v2.4. Defaults can also be applied to symbolic families such as those created with the `\newfontfamily` command and for `\rmfamily`, `\sffamily`, and `\ttfamily`:

```
\defaultfontfeatures[\rmfamily,\sffamily]{Ligatures=TeX}
\setmainfont{texgyreadventor-regular.otf}% will use standard TeX ligatures
```

Example 5: A demonstration of the `\defaultfontfeatures` command.

```
\fontspec{texgyreadventor-regular.otf}
Some default text 0123456789 \\
\defaultfontfeatures{
   Numbers=OldStyle, Color=888888
}
\fontspec{texgyreadventor-regular.otf}
Now grey, with old-style figures:
0123456789
```

Some default text 0123456789
Now grey, with old-style figures: 0123456789

The line above to set TEX-like ligatures is now activated by *default* in `fontspec.cfg`. To reset default font features, simply call the command with an empty argument:

```
\defaultfontfeatures[\rmfamily,\sffamily]{}
\setmainfont{texgyreadventor-regular.otf}% will no longer use standard TeX ligatures
```

`\defaultfontfeatures+{`⟨*font features*⟩`}`
`\defaultfontfeatures+[`⟨*font name*⟩`]{`⟨*font features*⟩`}`

New in v2.4. Using the `+` form of the command appends the ⟨*font features*⟩ to any already-selected defaults.

2 Working with the currently selected features

`\IfFontFeatureActiveTF{`⟨*font feature*⟩`}{`⟨*true code*⟩`}{`⟨*false code*⟩`}`

This command queries the currently selected font face and executes the appropriate branch based on whether the ⟨*font feature*⟩ as specified by fontspec is currently active.

For example, the following will print 'True':

```
\setmainfont{texgyrepagella-regular.otf}[Numbers=OldStyle]
\IfFontFeatureActiveTF{Numbers=OldStyle}{True}{False}
```

Note that there is no way for fontspec to know what the default features of a font will be. For example, by default the `texgyrepagella` fonts use lining numbers. But in the following example, querying for lining numbers returns false since they have not been explicitly requested:

```
\setmainfont{texgyrepagella-regular.otf}
\IfFontFeatureActiveTF{Numbers=Lining}{True}{False}
```

Please note: At time of writing this function only supports OpenType fonts; AAT/Graphite fonts under the XƎTEX engine are not supported.

`\addfontfeatures{`⟨*font features*⟩`}`

This command allows font features in an entire font family to be changed without knowing what features are currently selected or even what font family is being used. A good example of this could be to add a hook to all tabular material to use monospaced numbers, as shown in Example 6. If you attempt to *change* an already-selected feature, fontspec will try to de-activate any features that clash with the new ones. *E.g.*, the following two invocations are mutually exclusive:

```
\addfontfeature{Numbers=OldStyle}...
\addfontfeature{Numbers=Lining}...
123
```

Since `Numbers=Lining` comes last, it takes precedence and deactivates the call `Numbers=OldStyle`.

If you wish to apply the change to only one of the fonts of a family (say, italics only) you can write

```
\addfontfeature{ItalicFeatures={Numbers=Lowercase}}
```

`\addfontfeature` This command may also be executed under the alias `\addfontfeature`.

Example 6: A demonstration of the `\addfontfeatures` command.

`In 1842, 999 people sailed 97 miles in 13 boats. In 1923, 111 people sailed 54 miles in 56 boats.'

Year	People	Miles	Boats
1842	999	75	13
1923	111	54	56

```
\fontspec{texgyreadventor-regular.otf}%
         [Numbers={Proportional,OldStyle}]
`In 1842, 999 people sailed 97 miles in
 13 boats. In 1923, 111 people sailed 54
 miles in 56 boats.'            \bigskip

{\addfontfeatures{Numbers={Monospaced,Lining}}
\begin{tabular}{@{} cccc @{}}
          Year & People & Miles & Boats \\
  \hline  1842 &  999   &  75   &  13   \\
          1923 &  111   &  54   &  56
\end{tabular}}
```

2.1 Priority of feature selection

Features defined with `\addfontfeatures` override features specified by `\fontspec`, which in turn override features specified by `\defaultfontfeatures`. If in doubt, whenever a new font is chosen for the first time, an entry is made in the transcript (`.log`) file displaying the font name and the features requested.

3 Different features for different font shapes

`BoldFeatures={`⟨*features*⟩`}`
`ItalicFeatures={`⟨*features*⟩`}`
`BoldItalicFeatures={`⟨*features*⟩`}`
`SlantedFeatures={`⟨*features*⟩`}`
`BoldSlantedFeatures={`⟨*features*⟩`}`
`SmallCapsFeatures={`⟨*features*⟩`}`
`UprightFeatures={`⟨*features*⟩`}`

It is entirely possible that separate fonts in a family will require separate options; *e.g.*, Hoefler Text Italic contains various swash feature options that are completely unavailable in the upright shapes.

The font features defined at the top level of the optional `\fontspec` argument are applied to *all* shapes of the family. Using `Upright-`, `SmallCaps-`, `Bold-`, `Italic-`, and `BoldItalicFeatures`, separate font features may be defined to their respective shapes *in addition* to, and with precedence over, the 'global' font features. See Example 7.

Note that because most fonts include their small caps glyphs within the main font, features specified with `SmallCapsFeatures` are applied *in addition* to any other shape-specific features as defined above, and hence `SmallCapsFeatures` can be nested within `ItalicFeatures` and friends. Every combination of upright, italic, bold and small caps can thus be assigned individual features, as shown in the somewhat ludicrous Example 8.

Example 7: Features for, say, just italics.

Don't Ask Victoria!
Don't Ask Victoria!

```
\fontspec{EBGaramond-Regular.otf}%
  [ItalicFont=EBGaramond-Italic.otf]
\itshape Don't Ask Victoria! \\
\addfontfeature{ItalicFeatures={Style=Swash}}
Don't Ask Victoria! \\
```

Example 8: An example of setting the `SmallCapsFeatures` separately for each font shape.

Upright Small Caps
Italic Italic Small Caps
Bold Bold Small Caps
Bold Italic Bold Italic Small Caps

```
\fontspec{texgyretermes}[
    Extension = {.otf},
    UprightFont = {*-regular}, ItalicFont = {*-italic},
    BoldFont = {*-bold}, BoldItalicFont = {*-bolditalic},
    UprightFeatures={Color = 2200022,
         SmallCapsFeatures = {Color=115511}},
     ItalicFeatures={Color = 2244FF,
         SmallCapsFeatures = {Color=112299}},
       BoldFeatures={Color = FF4422,
         SmallCapsFeatures = {Color=992211}},
 BoldItalicFeatures={Color = 888844,
         SmallCapsFeatures = {Color=444422}},
         ]
Upright {\scshape Small Caps}\\
\itshape Italic {\scshape Italic Small Caps}\\
\upshape\bfseries Bold {\scshape Bold Small Caps}\\
\itshape Bold Italic {\scshape Bold Italic Small Caps}
```

4 Selecting fonts from TrueType Collections (TTC files)

TrueType Collections are multiple fonts contained within a single file. Each font within a collection must be explicitly chosen using the `FontIndex` command. Since TrueType Collections are often used to contain the italic/bold shapes in a family, fontspec automatically selects the italic, bold, and bold italic fontfaces from the same file. For example, to load the macOS system font Optima:

```
\setmainfont{Optima.ttc}[
  Path = /System/Library/Fonts/ ,
  UprightFeatures    = {FontIndex=0} ,
  BoldFeatures       = {FontIndex=1} ,
  ItalicFeatures     = {FontIndex=2} ,
  BoldItalicFeatures = {FontIndex=3} ,
]
```

Support for TrueType Collections has only been tested in XeTeX, but should also work with an up-to-date version of LuaTeX and the luaotfload package.

5 Different features for different font sizes

```
SizeFeatures = {
  ...
  { Size = ⟨size range⟩, ⟨font features⟩ },
  { Size = ⟨size range⟩, Font = ⟨font name⟩, ⟨font features⟩ },
  ...
}
```

The `SizeFeature` feature is a little more complicated than the previous features discussed. It allows different fonts and different font features to be selected for a given font family as the point size varies.

It takes a comma separated list of braced, comma separated lists of features for each size range. Each sub-list must contain the `Size` option to declare the size range, and optionally `Font` to change the font based on size. Other (regular) fontspec features that are added are used on top of the font features that would be used anyway. A demonstration to clarify these details is shown in Example 9. A less trivial example is shown in the context of optical font sizes in Section 6.6 on page 28.

To be precise, the `Size` sub-feature accepts arguments in the form shown in Table 1 on the next page. Braces around the size range are optional. For an exact font size (`Size=X`) font sizes chosen near that size will 'snap'. For example, for size definitions at exactly 11pt and 14pt, if a 12pt font is requested *actually* the 11pt font will be selected. This is a remnant of the past when fonts were designed in metal (at obviously rigid sizes) and later when bitmap fonts were similarly designed for fixed sizes.

If additional features are only required for a single size, the other sizes must still be specified. As in:

```
SizeFeatures={
   {Size=-10,Numbers=Uppercase},
   {Size=10-}}
```

Example 9: An example of specifying different font features for different sizes of font with `SizeFeatures`.

Small
Normal size
Large

```
\fontspec{texgyrechorus-mediumitalic.otf}[
  SizeFeatures={
    {Size={-8}, Font=texgyrebonum-italic.otf, Color=AA0000},
    {Size={8-14}, Color=00AA00},
    {Size={14-}, Color=0000AA}} ]

{\scriptsize Small\par} Normal size\par {\Large Large\par}
```

Otherwise, the font sizes greater than 10 won't be defined at all!

Interaction with other features For `SizeFeatures` to work with `ItalicFeatures`, `BoldFeatures`, etc., and `SmallCapsFeatures`, a strict heirarchy is required:

```
UprightFeatures =
 {
  SizeFeatures =
   {
    {
     Size = -10,
     Font = ..., % if necessary
     SmallCapsFeatures = {...},
     ... % other features for this size range
    },
    ... % other size ranges
   }
 }
```

Suggestions on simplifying this interface welcome.

6 Font independent options

Features introduced in this section may be used with any font.

Table 1: Syntax for specifying the size to apply custom font features.

Input	Font size, s
`Size = X-`	$s \geq$ `X`
`Size = -Y`	$s <$ `Y`
`Size = X-Y`	`X` $\leq s <$ `Y`
`Size = X`	$s =$ `X`

6.1 Colour

`Color` (or `Colour`) uses font specifications to set the colour of the text. You should think of this as the literal glyphs of the font being coloured in a certain way. Notably, this mechanism is different to that of the color/xcolor/hyperref/etc. packages, and in fact using fontspec commands to set colour will prevent your text from changing colour using those packages at all! For example, if you set the colour in a `\setmainfont` command, `\color{...}` and related commands, including hyperlink colouring, will no longer have any effect on text in this font.) Therefore, fontspec's colour commands are best used to set explicit colours in specific situations, and the xcolor package is recommended for more general colour functionality.

The colour is defined as a triplet of two-digit Hex RGB values, with optionally another value for the transparency (where `00` is completely transparent and `FF` is opaque.) Transparency is supported by LuaLaTeX; XeLaTeX with the `xdvipdfmx` driver does not support this feature.

If you load the xcolor package, you may use any named colour instead of writing the colours in hexadecimal.

```
\usepackage{xcolor}
...
\fontspec[Color=red]{Verdana} ...
\definecolor{Foo}{rgb}{0.3,0.4,0.5}
\fontspec[Color=Foo]{Verdana} ...
```

The color package is *not* supported; use xcolor instead.

You may specify the transparency with a named colour using the `Opacity` feature which takes an decimal from zero to one corresponding to transparent to opaque respectively:

```
\fontspec[Color=red,Opacity=0.7]{Verdana} ...
```

It is still possible to specify a colour in six-char hexadecimal form while defining opacity in this way, if you like.

6.2 Scale

`Scale` = ⟨*number*⟩
`Scale` = `MatchLowercase`
`Scale` = `MatchUppercase`

In its explicit form, `Scale` takes a single numeric argument for linearly scaling the font, as demonstrated in Example 1.

Example 10: Selecting colour with transparency.

```
\fontsize{48}{48}
\fontspec{texgyrebonum-bold.otf}
{\addfontfeature{Color=FF000099}W}\kern-0.4ex
{\addfontfeature{Color=0000FF99}S}\kern-0.4ex
{\addfontfeature{Color=DDBB2299}P}\kern-0.5ex
{\addfontfeature{Color=00BB3399}R}
```

As well as a numerical argument, the `Scale` feature also accepts options `MatchLowercase` and `MatchUppercase`, which will scale the font being selected to match the current default roman font to either the height of the lowercase or uppercase letters, respectively; these features are shown in Example 11. The amount of scaling used in each instance is reported in the `.log` file.

Additional calls to the `Scale` feature overwrite the settings of the former. If you want to accumulate scale factors (useful perhaps to fine-tune the settings of `MatchLowercase`), the `ScaleAgain` feature can be used as many times as necessary. For example:

```
[ Scale = 1.1 , Scale = 1.2 ]      % -> scale of 1.2
[ Scale = 1.1 , ScaleAgain = 1.2 ] % -> scale of 1.32
```

Note that when `Scale=MatchLowercase` is used with `\setmainfont`, the new 'main' font of the document will be scaled to match the old default. If you wish to automatically scale all fonts except have the main font use 'natural' scaling, you may write

```
\defaultfontfeatures{ Scale = MatchLowercase }
\defaultfontfeatures[\rmfamily]{ Scale = 1}
```

One or both of these lines may be placed into a local `fontspec.cfg` file (see Section 3.3 on page 6) for this behaviour to be effected in your own documents automatically. (Also see Section 1 on page 19 for more information on setting font defaults.)

6.3 Interword space

While the space between words can be varied on an individual basis with the TEX primitive `\spaceskip` command, it is more convenient to specify this information when the font is first defined.

The space in between words in a paragraph will be chosen automatically, and generally will not need to be adjusted. For those times when the precise details are important, the `WordSpace` feature is provided, which takes either a single scaling factor to scale the default value, or a triplet of comma-separated values to scale the nominal value, the stretch, and the shrink of the interword space by, respectively. (`WordSpace={`x`}` is the same as `WordSpace={`x`,`x`,`x`}`.)

Note that TEX's optimisations in how it loads fonts means that you cannot use this feature in `\addfontfeatures`.

Example 11: Automatically calculated scale values.

The perfect match is hard to find.
LOGOFONT

```
\setmainfont{Georgia}
\newfontfamily\lc[Scale=MatchLowercase]{Verdana}
 The perfect match {\lc is hard to find.}\\
\newfontfamily\uc[Scale=MatchUppercase]{Arial}
 L O G O \uc F O N T
```

Example 12: Scaling the default interword space. An exaggerated value has been chosen to emphasise the effects here.

```
\fontspec{texgyretermes-regular.otf}
Some text for our example to take
up some space, and to demonstrate
the default interword space.
\bigskip

\fontspec{texgyretermes-regular.otf}%
  [WordSpace = 0.3]
Some text for our example to take
up some space, and to demonstrate
the default interword space.
```

Some text for our example to take up some space, and to demonstrate the default interword space.

Some text for our example to take up some space, and to demonstrate the default interword space.

6.4 Post-punctuation space

If `\frenchspacing` is *not* in effect, TEX will allow extra space after some punctuation in its goal of justifying the lines of text. Generally, this is considered old-fashioned, but occasionally in small amounts the effect can be justified, pardon the pun.

The `PunctuationSpace` feature takes a scaling factor by which to adjust the nominal value chosen for the font; this is demonstrated in Example 13. Note that `PunctuationSpace=0` is *not* equivalent to `\frenchspacing`, although the difference will only be apparent when a line of text is under-full.

Note that TEX's optimisations in how it loads fonts means that you cannot use this feature in `\addfontfeatures`.

6.5 The hyphenation character

The letter used for hyphenation may be chosen with the `HyphenChar` feature. With one exception (`HyphenChar = None`), this is a XƎTEX-only feature since LuaTEX cannot set the hyphenation character on a per-font basis; see its `\prehyphenchar` primitive for further details.

`HyphenChar` takes three types of input, which are chosen according to some simple rules. If the input is the string `None`, then hyphenation is suppressed for this font.

Example 13: Scaling the default post-punctuation space.

```
\nonfrenchspacing
\fontspec{texgyreschola-regular.otf}
 Letters, Words. Sentences.          \par
\fontspec{texgyreschola-regular.otf}[PunctuationSpace=2]
 Letters, Words. Sentences.          \par
\fontspec{texgyreschola-regular.otf}[PunctuationSpace=0]
 Letters, Words. Sentences.
```

Letters, Words. Sentences.
Letters, Words. Sentences.
Letters, Words. Sentences.

As part of `fontspec.cfg`, the default monospaced family (e.g., `\ttfamily`) is set up to automatically set `HyphenChar = None`.

If the input is a single character, then this character is used. Finally, if the input is longer than a single character it must be the UTF-8 slot number of the hyphen character you desire.

Note that TEX's optimisations in how it loads fonts means that you cannot use this feature in `\addfontfeatures`.

6.6 Optical font sizes

Optically scaled fonts thicken out as the font size decreases in order to make the glyph shapes more robust (less prone to losing detail), which improves legibility. Conversely, at large optical sizes the serifs and other small details may be more delicately rendered.

OpenType fonts with optical scaling can exist in several discrete sizes (in separate font files). When loading fonts by name, XETEX and LuaTEX engines will attempt to *automatically* load the appropriate font as determined by the current font size. An example of this behaviour is shown in Example 15, in which some larger text is mechanically scaled down to compare the difference for equivalent font sizes.

The `OpticalSize` feature may be used to specify a different optical size. With `OpticalSize` set (Example 16) to zero, no optical size font substitution is performed.

The `SizeFeatures` feature (Section 5 on page 23) can be used to specify exactly which optical sizes will be used for ranges of font size. For example, something like:

```
\fontspec{Latin Modern Roman}[
  UprightFeatures = { SizeFeatures = {
    {Size=-10,     OpticalSize=8 },
    {Size= 10-14,  OpticalSize=10},
    {Size= 14-18,  OpticalSize=14},
    {Size=    18-, OpticalSize=18}}}
       ]
```

6.7 Font transformations

In rare situations users may want to mechanically distort the shapes of the glyphs in the current font such as shown in Example 17. Please don't overuse these features; they are *not* a good alternative to having the real shapes.

If values are omitted, their defaults are as shown above.

Example 14: Explicitly choosing the hyphenation character.

EXAMPLE
HYPHENATION

EXAMPLE
HYPHEN+
ATION

```
\def\text{\fbox{\parbox{1.55cm}{%
  EXAMPLE HYPHENATION%
}}\qquad\qquad\null\par\bigskip}

\fontspec{LinLibertine_R.otf}[HyphenChar=None]
\text
\fontspec{LinLibertine_R.otf}[HyphenChar={+}]
\text
```

Example 15: A demonstration of automatic optical size selection.

Automatic optical size
Automatic optical size

```
\fontspec{Latin Modern Roman}
 Automatic optical size                  \\
\scalebox{0.4}{\Huge
 Automatic optical size}
```

Example 16: Explicit optical size substitution for the Latin Modern Roman family.

Latin Modern optical sizes
Latin Modern optical sizes
Latin Modern optical sizes
Latin Modern optical sizes

```
\fontspec{Latin Modern Roman}[OpticalSize=5]
 Latin Modern optical sizes              \\
\fontspec{Latin Modern Roman}[OpticalSize=8]
 Latin Modern optical sizes              \\
\fontspec{Latin Modern Roman}[OpticalSize=12]
 Latin Modern optical sizes              \\
\fontspec{Latin Modern Roman}[OpticalSize=17]
 Latin Modern optical sizes
```

Example 17: Articifial font transformations.

ABCxyz *ABCxyz*
ABCxyz ABCxyz
ABCxyz **ABCxyz**

```
\fontspec{Quattrocento.otf} \emph{ABCxyz} \quad
\fontspec{Quattrocento.otf}[FakeSlant=0.2] ABCxyz

\fontspec{Quattrocento.otf}  ABCxyz \quad
\fontspec{Quattrocento.otf}[FakeStretch=1.2] ABCxyz

\fontspec{Quattrocento.otf} \textbf{ABCxyz} \quad
\fontspec{Quattrocento.otf}[FakeBold=1.5] ABCxyz
```

If you want the bold shape to be faked automatically, or the italic shape to be slanted automatically, use the `AutoFakeBold` and `AutoFakeSlant` features. For example, the following two invocations are equivalent:

```
\fontspec[AutoFakeBold=1.5]{Charis SIL}
\fontspec[BoldFeatures={FakeBold=1.5}]{Charis SIL}
```

If both of the `AutoFake...` features are used, then the bold italic font will also be faked.

6.8 Letter spacing

Letter spacing, or tracking, is the term given to adding (or subtracting) a small amount of horizontal space in between adjacent characters. It is specified with the `LetterSpace`, which takes a numeric argument, shown in Example 18.

The letter spacing parameter is a normalised additive factor (not a scaling factor); it is defined as a percentage of the font size. That is, for a 10 pt font, a letter spacing parameter of '`1.0`' will add 0.1 pt between each letter.

This functionality is not generally used for lowercase text in modern typesetting but does have historic precedent in a variety of situations. In particular, small amounts of letter spacing can be very useful, when setting small caps or all caps titles. Also see the OpenType `Uppercase` option of the `Letters` feature (3.1.7 on page 40).

Example 18: The `LetterSpace` feature.

USE TRACKING FOR DISPLAY CAPS TEXT
USE TRACKING FOR DISPLAY CAPS TEXT

```
\fontspec{Didot}
\addfontfeature{LetterSpace=0.0}
USE TRACKING FOR DISPLAY CAPS TEXT \\
\addfontfeature{LetterSpace=2.0}
USE TRACKING FOR DISPLAY CAPS TEXT
```

Part IV

OpenType

1 Introduction

OpenType fonts (and other 'smart' font technologies such as AAT and Graphite) can change the appearance of text in many different ways. These changes are referred to as font features. When the user applies a feature — for example, small capitals — to a run of text, the code inside the font makes appropriate substitutions and small capitals appear in place of lowercase letters. However, the use of such features does not affect the underlying text. In our small caps example, the lowercase letters are still stored in the document; only the appearance has been changed by the OpenType feature. This makes it possible to search and copy text without difficulty. If the user selected a different font that does not support small caps, the 'plain' lowercase letters would appear instead.

Some OpenType features are required to support particular scripts, and these features are often applied automatically. The Indic scripts, for example, often require that characters be reshaped and reordered after they are typed by the user, in order to display them in the traditional ways that readers expect. Other features can be applied to support a particular language. The Junicode font for medievalists uses by default the Old English shape of the letter thorn, while in modern Icelandic thorn has a more rounded shape. If a user tags some text as being in Icelandic, Junicode will automatically change to the Icelandic shape through an OpenType feature that localises the shapes of letters.

There are a large group of OpenType features, designed to support high quality typography a multitude of languages and writing scripts. Examples of some font features have already been shown in previous sections; the complete set of OpenType font features supported by fontspec is described below in Section 3.

The OpenType specification provides four-letter codes (e.g., `smcp` for small capitals) for each feature. The four-letter codes are given below along with the fontspec names for various features, for the benefit of people who are already familiar with OpenType. You can ignore the codes if they don't mean anything to you.

1.1 How to select font features

Font features are selected by a series of ⟨*feature*⟩=⟨*option*⟩ selections. Features are (usually) grouped logically; for example, all font features relating to ligatures are accessed by writing `Ligatures={...}` with the appropriate argument(s), which could be `TeX`, `Rare`, etc., as shown below in 3.1.8.

Multiple options may be given to any feature that accepts non-numerical input, although doing so will not always work. Some options will override others in generally obvious ways; `Numbers={OldStyle,Lining}` doesn't make much sense because the two options are mutually exclusive, and XeTeX will simply use the last option that is specified (in this case using `Lining` over `OldStyle`).

If a feature or an option is requested that the font does not have, a warning is given in the console output. As mentioned in Section 3.4 on page 6 these warnings can be suppressed by selecting the `[quiet]` package option.

1.2 How do I know what font features are supported by my fonts?

Although I've long desired to have a feature within fontspec to display the OpenType features within a font, it's never been high on my priority list. One reason for that is the existence of the document `opentype-info.tex`, which is available on CTAN or typing `kpsewhich opentype-info.tex` in a Terminal window. Make a copy of this file and place it somewhere convenient. Then open it in your regular TEX editor and change the font name to the font you'd like to query; after running through plain XETEX, the output PDF will look something like this:

OpenType Layout features found in '[Asana-Math.otf]'

script = 'DFLT'
  language = ⟨default⟩
    features = 'onum' 'salt' 'kern'

script = 'cher'
  language = ⟨default⟩
    features = 'onum' 'salt' 'kern'

script = 'grek'
  language = ⟨default⟩
    features = 'onum' 'salt' 'ssty' 'kern'

script = 'latn'
  language = ⟨default⟩
    features = 'dtls' 'onum' 'salt' 'ssty' 'kern'

script = 'math'
  language = ⟨default⟩
    features = 'dtls' 'onum' 'salt' 'ssty' 'kern'

I intentionally picked a font above that by design contains few font features; 'regular' text fonts such as Latin Modern Roman contain many more, and I didn't want to clutter up the document too much. After finding the scripts, languages, and features contained within the font, you'll then need to cross-check the OpenType tags with the 'logical' names used by fontspec.

otfinfo Alternatively, and more simply, you can use the command line tool `otfinfo`, which is distributed with TEXLive. Simply type in a Terminal window, say:

```
otfinfo -f `kpsewhich lmromandunh10-oblique.otf`
```

which results in:

```
aalt        Access All Alternates
cpsp        Capital Spacing
dlig        Discretionary Ligatures
frac        Fractions
kern        Kerning
liga        Standard Ligatures
lnum        Lining Figures
onum        Oldstyle Figures
```

pnum	Proportional Figures
size	Optical Size
tnum	Tabular Figures
zero	Slashed Zero

2 OpenType scripts and languages

Fonts that include glyphs for various scripts and languages may contain different font features for the different character sets and languages they support, and different font features may behave differently depending on the script or language chosen. When multilingual fonts are used, it is important to select which language they are being used for, and more importantly what script is being used.

The 'script' refers to the alphabet in use; for example, both English and French use the Latin script. Similarly, the Arabic script can be used to write in both the Arabic and Persian languages.

The `Script` and `Language` features are used to designate this information. The possible options are tabulated in Table 2 on the next page and Table 3 on page 35, respectively. When a script or language is requested that is not supported by the current font, a warning is printed in the console output. See Section 2 on page 62 for methods to create new `Script` or `Language` options if required.

Because these font features can change which features are able to be selected for the font, the `Script` and `Language` settings are automatically selected by fontspec before all others, and, if XeTeX is being used, will specifically select the `OpenType` renderer for this font, as described in Section 1.2 on page 56.

OpenType fonts can make available different font features depending on the Script and Language chosen. In addition, these settings can also set up their own font behaviour and glyph selection (one example is differences in style between some of the letters in the alphabet used for Bulgarian, Serbian, and Russian). The fontspec feature `LocalForms = Off` will disable some of these substitutions if desired for some reason. It is important to note that `LocalForms = On` is a default not of fontspec but of the underlying font shaping engines in both XeTeX and LuaTeX/otfload.

2.1 `Script` and `Language` examples

In the examples shown in Example 19, the Code2000 font[5] is used to typeset various input texts with and without the OpenType Script applied for various alphabets. The text is only rendered correctly in the second case; many examples of incorrect diacritic spacing as well as a lack of contextual ligatures and rearrangement can be seen. Thanks to Jonathan Kew, Yves Codet and Gildas Hamel for their contributions towards these examples.

3 OpenType font features

There are a finite set of OpenType font features, and fontspec provides an interface to around half of them. Full documentation will be presented in the following sections, including how to enable and disable individual features, and how they interact.

[5] http://www.code2000.net/

Example 19: An example of various Scripts and Languages.

العربي ي ب ر ع ال
हिन्दी हिन्दी
लेख लेख
મર્યાદા-સૂચક નિવેદન મર્યાદા-સૂચક નિવેદન
നമ്മുടെ പാരമ്പര്യ നമ്മുടെ പാരമ്പര്യ
ਆਦਿ ਸਚੁ ਜੁਗਾਦਿ ਸਚੁ ਆਦਿ ਸਚੁ ਜੁਗਾਦਿ ਸਚੁ
தமிழ் தேடி தமிழ் தேடி
רְדֻתָּה רְדֻתָּה
cấp số mỗi cấp số mỗi

```
\testfeature{Script=Arabic}{\arabictext}
\testfeature{Script=Devanagari}{\devanagaritext}
\testfeature{Script=Bengali}{\bengalitext}
\testfeature{Script=Gujarati}{\gujaratitext}
\testfeature{Script=Malayalam}{\malayalamtext}
\testfeature{Script=Gurmukhi}{\gurmukhitext}
\testfeature{Script=Tamil}{\tamiltext}
\testfeature{Script=Hebrew}{\hebrewtext}
\def\examplefont{DoulosSILR.ttf}
\testfeature{Language=Vietnamese}{\vietnamesetext}
```

Table 2: Defined `Scripts` for OpenType fonts. Aliased names are shown in adjacent positions marked with red pilcrows (¶).

Adlam
Ahom
Anatolian Hieroglyphs
Arabic
Armenian
Avestan
Balinese
Bamum
Bassa Vah
Batak
Bengali
Bhaiksuki
Bopomofo
Brahmi
Braille
Buginese
Buhid
Byzantine Music
Canadian Syllabics
Carian
Caucasian Albanian
Chakma
Cham
Cherokee
¶CJK
¶CJK Ideographic
Coptic
Cypriot Syllabary
Cyrillic
Default
Deseret
Devanagari
Duployan
Egyptian Hieroglyphs
Elbasan
Ethiopic
Georgian
Glagolitic
Gothic
Grantha
Greek
Gujarati
Gurmukhi
Hangul Jamo
Hangul
Hanunoo
Hatran
Hebrew
¶Hiragana and Katakana
¶Kana
Imperial Aramaic
Inscriptional Pahlavi
Inscriptional Parthian
Javanese
Kaithi
Kannada
Kayah Li
Kharosthi
Khmer
Khojki
Khudawadi
Lao
Latin
Lepcha
Limbu
Linear A
Linear B
Lisu
Lycian
Lydian
Mahajani
Malayalam
Mandaic
Manichaean
Marchen
¶Math
¶Maths
Meitei Mayek
Mende Kikakui
Meroitic Cursive
Meroitic Hieroglyphs
Miao
Modi
Mongolian
Mro
Multani
Musical Symbols
Myanmar
¶N'Ko
¶N'ko
Nabataean
Newa
Ogham
Ol Chiki
Old Italic
Old Hungarian
Old North Arabian
Old Permic
Old Persian Cuneiform
Old South Arabian
Old Turkic
¶Oriya
¶Odia
Osage
Osmanya
Pahawh Hmong
Palmyrene
Pau Cin Hau
Phags-pa
Phoenician
Psalter Pahlavi
Rejang
Runic
Samaritan
Saurashtra
Sharada
Shavian
Siddham
Sign Writing
Sinhala
Sora Sompeng
Sumero-Akkadian Cuneiform
Sundanese
Syloti Nagri
Syriac
Tagalog
Tagbanwa
Tai Le
Tai Lu
Tai Tham
Tai Viet
Takri
Tamil
Tangut
Telugu
Thaana
Thai
Tibetan
Tifinagh
Tirhuta
Ugaritic Cuneiform
Vai
Warang Citi
Yi

Table 3: Defined Languages for OpenType fonts. Aliased names are shown in adjacent positions marked with red pilcrows (¶).

Abaza
Abkhazian
Adyghe
Afrikaans
Afar
Agaw
Altai
Amharic
Arabic
Aari
Arakanese
Assamese
Athapaskan
Avar
Awadhi
Aymara
Azeri
Badaga
Baghelkhandi
Balkar
Baule
Berber
Bench
Bible Cree
Belarussian
Bemba
Bengali
Bulgarian
Bhili
Bhojpuri
Bikol
Bilen
Blackfoot
Balochi
Balante
Balti
Bambara
Bamileke
Breton
Brahui
Braj Bhasha
Burmese
Bashkir
Beti
Catalan
Cebuano
Chechen
Chaha Gurage
Chattisgarhi
Chichewa
Chukchi
Chipewyan
Cherokee
Chuvash
Comorian
Coptic
Cree
Carrier
Crimean Tatar
Church Slavonic
Czech
Danish
Dargwa
Woods Cree

German
Default
Dogri
Divehi
Djerma
Dangme
Dinka
Dungan
Dzongkha
Ebira
Eastern Cree
Edo
Efik
Greek
English
Erzya
Spanish
Estonian
Basque
Evenki
Even
Ewe
French Antillean
¶Farsi
¶Parsi
¶Persian
Finnish
Fijian
Flemish
Forest Nenets
Fon
Faroese
French
Frisian
Friulian
Futa
Fulani
Ga
Gaelic
Gagauz
Galician
Garshuni
Garhwali
Ge'ez
Gilyak
Gumuz
Gondi
Greenlandic
Garo
Guarani
Gujarati
Haitian
Halam
Harauti
Hausa
Hawaiin
Hammer-Banna
Hiligaynon
Hindi
High Mari
Hindko
Ho
Harari
Croatian

Hungarian
Armenian
Igbo
Ijo
Ilokano
Indonesian
Ingush
Inuktitut
Irish
Irish Traditional
Icelandic
Inari Sami
Italian
Hebrew
Javanese
Yiddish
Japanese
Judezmo
Jula
Kabardian
Kachchi
Kalenjin
Kannada
Karachay
Georgian
Kazakh
Kebena
Khutsuri Georgian
Khakass
Khanty-Kazim
Khmer
Khanty-Shurishkar
Khanty-Vakhi
Khowar
Kikuyu
Kirghiz
Kisii
Kokni
Kalmyk
Kamba
Kumaoni
Komo
Komso
Kanuri
Kodagu
Korean Old Hangul
Konkani
Kikongo
Komi-Permyak
Korean
Komi-Zyrian
Kpelle
Krio
Karakalpak
Karelian
Karaim
Karen
Koorete
Kashmiri
Khasi
Kildin Sami
Kui
Kulvi
Kumyk

Kurdish
Kurukh
Kuy
Koryak
Ladin
Lahuli
Lak
Lambani
Lao
Latin
Laz
L-Cree
Ladakhi
Lezgi
Lingala
Low Mari
Limbu
Lomwe
Lower Sorbian
Lule Sami
Lithuanian
Luba
Luganda
Luhya
Luo
Latvian
Majang
Makua
Malayalam Traditional
Mansi
Marathi
Marwari
Mbundu
Manchu
Moose Cree
Mende
Me'en
Mizo
Macedonian
Male
Malagasy
Malinke
Malayalam Reformed
Malay
Mandinka
Mongolian
Manipuri
Maninka
Manx Gaelic
Moksha
Moldavian
Mon
Moroccan
Maori
Maithili
Maltese
Mundari
Naga-Assamese
Nanai
Naskapi
N-Cree
Ndebele
Ndonga
Nepali

Newari
Nagari
Norway House Cree
Nisi
Niuean
Nkole
N'ko
Dutch
Nogai
Norwegian
Northern Sami
Northern Tai
Esperanto
Nynorsk
Oji-Cree
Ojibway
Oriya
Oromo
Ossetian
Palestinian Aramaic
Pali
Punjabi
Palpa
Pashto
Polytonic Greek
Pilipino
Palaung
Polish
Provencal
Portuguese
Chin
Rajasthani
R-Cree
Russian Buriat
Riang
Rhaeto-Romanic
Romanian
Romany
Rusyn
Ruanda
Russian
Sadri
Sanskrit
Santali
Sayisi
Sekota
Selkup
Sango
Shan
Sibe
Sidamo
Silte Gurage
Skolt Sami
Slovak
Slavey
Slovenian
Somali
Samoan
Sena
Sindhi
Sinhalese
Soninke
Sodo Gurage
Sotho

Albanian
Serbian
Saraiki
Serer
South Slavey
Southern Sami
Suri
Svan
Swedish
Swadaya Aramaic
Swahili
Swazi
Sutu
Syriac
Tabasaran
Tajiki
Tamil
Tatar
TH-Cree
Telugu
Tongan
Tigre
Tigrinya
Thai
Tahitian
Tibetan
Turkmen
Temne
Tswana
Tundra Nenets
Tonga
Todo
Turkish
Tsonga
Turoyo Aramaic
Tulu
Tuvin
Twi
Udmurt
Ukrainian
Urdu
Upper Sorbian
Uyghur
Uzbek
Venda
Vietnamese
Wa
Wagdi
West-Cree
Welsh
Wolof
Tai Lue
Xhosa
Yakut
Yoruba
Y-Cree
Yi Classic
Yi Modern
Chinese Hong Kong
Chinese Phonetic
Chinese Simplified
Chinese Traditional
Zande
Zulu

A brief reference is provided (Table 4 on the next page) but note that this is an incomplete listing — only the 'enable' keys are shown, and where alternative interfaces are provided for convenience only the first is shown. (E.g., `Numbers=OldStyle` is the same as `Numbers=Lowercase`.)

For completeness, the complete list of OpenType features *not* provided with a fontspec interface is shown in Table 5 on page 38. Features omitted are partially by design and partially by oversight; for example, the `aalt` feature is largely useless in TEX since it is designed for providing a GUI interface for selecting 'all alternates' of a glyph. Others, such as optical bounds for example, simply haven't yet been considered due to a lack of fonts available for testing. Suggestions welcome for how/where to add these missing features to the package.

3.1 Tag-based features

3.1.1 Alternates — `salt`

The `Alternate` feature, alias `StylisticAlternates`, is used to access alternate font glyphs when variations exist in the font, such as in Example 20. It uses a numerical selection, starting from zero, that will be different for each font. Note that the `Style=Alternate` option is equivalent to `Alternate=0` to access the default case.

Note that the indexing starts from zero. With the LuaTEX engine, `Alternate=Random` selects a random alternate.

See Section 1 on page 61 for a way to assign names to alternates if desired.

3.1.2 Character Variants — `cvNN`

'Character Variations' are selected numerically to adjust the output of (usually) a single character for the particular font. These correspond to the OpenType features `cv01` to `cv99`.

For each character that can be varied, it is possible to select among possible options for that particular glyph. For example, in the hypothetical example below, variants are chosen for glyphs '4' and '5', and the trailing :⟨*n*⟩ corresponds to which variety to choose.

```
\fontspec{CV Font}[CharacterVariant={4,5:2}] \& violet
```

The numbering is entirely font-specific. Glyph '5' might be the character 'v', for example. Character variants are specifically designed not to conflict with each other, so you can enable them individually per character. (Unlike stylistic alternates, say.) Note that the indexing starts from zero.

Example 20: The `Alternate` feature.

```
\fontspec{LinLibertine_R.otf}
\textsc{a} \& h \\
\addfontfeature{Alternate=0}
\textsc{a} \& h
```

Table 4: Summary of OpenType features in fontspec, alphabetic by feature tag.

abvm	Diacritics = AboveBase	*Above-base Mark Positioning*
afrc	Fractions = Alternate	*Alternative Fractions*
blwm	Diacritics = BelowBase	*Below-base Mark Positioning*
calt	Contextuals = Alternate	*Contextual Alternates*
case	Letters = Uppercase	*Case-Sensitive Forms*
clig	Ligatures = Contextual	*Contextual Ligatures*
cpsp	Kerning = Uppercase	*Capital Spacing*
cswh	Contextuals = Swash	*Contextual Swash*
cvNN	`CharacterVariant` = $N:M$	*Character Variant N*
c2pc	`Letters` = `UppercasePetiteCaps`	*Petite Capitals From Capitals*
c2sc	`Letters` = `UppercaseSmallCaps`	*Small Capitals From Capitals*
dlig	Ligatures = Rare	*Discretionary Ligatures*
dnom	`VerticalPosition` = `Denominator`	*Denominators*
expt	CJKShape = Expert	*Expert Forms*
falt	Contextuals = LineFinal	*Final Glyph on Line Alternates*
fina	Contextuals = WordFinal	*Terminal Forms*
frac	Fractions = On	*Fractions*
fwid	CharacterWidth = Full	*Full Widths*
halt	`CharacterWidth` = `AlternateHalf`	*Alternate Half Widths*
hist	Style = Historic	*Historical Forms*
hkna	Style = HorizontalKana	*Horizontal Kana Alternates*
hlig	Ligatures = Historic	*Historical Ligatures*
hwid	CharacterWidth = Half	*Half Widths*
init	Contextuals = WordInitial	*Initial Forms*
ital	Style = Italic	*Italics*
jp78	CJKShape = JIS1978	*JIS78 Forms*
jp83	CJKShape = JIS1983	*JIS83 Forms*
jp90	CJKShape = JIS1990	*JIS90 Forms*
jp04	CJKShape = JIS2004	*JIS2004 Forms*
kern	Kerning = On	*Kerning*
liga	Ligatures = Common	*Standard Ligatures*
lnum	Numbers = Uppercase	*Lining Figures*
locl	LocalForms = On	*Localized Forms*
mark	Diacritics = MarkToBase	*Mark Positioning*
medi	Contextuals = Inner	*Medial Forms*
mkmk	Diacritics = MarkToMark	*Mark to Mark Positioning*
nalt	Annotation = N	*Alternate Annotation Forms*
nlck	CJKShape = NLC	*NLC Kanji Forms*
numr	`VerticalPosition` = `Numerator`	*Numerators*
onum	Numbers = Lowercase	*Oldstyle Figures*
ordn	`VerticalPosition` = `Ordinal`	*Ordinals*
ornm	Ornament = N	*Ornaments*
palt	`CharacterWidth` = `AlternateProportional`	*Proportional Alternate Widths*
pcap	Letters = PetiteCaps	*Petite Capitals*
pkna	Style = ProportionalKana	*Proportional Kana*
pnum	Numbers = Proportional	*Proportional Figures*
pwid	`CharacterWidth` = `Proportional`	*Proportional Widths*
qwid	CharacterWidth = Quarter	*Quarter Widths*
rand	Letters = Random	*Randomize*
rlig	Ligatures = Required	*Required Ligatures*
ruby	Style = Ruby	*Ruby Notation Forms*
salt	Alternate = N	*Stylistic Alternates*
sinf	`VerticalPosition` = `ScientificInferior`	*Scientific Inferiors*
smcp	Letters = SmallCaps	*Small Capitals*
smpl	CJKShape = Simplified	*Simplified Forms*
ssNN	StylisticSet = N	*Stylistic Set N*
ssty	Style = MathScript	*Math script style alternates*
subs	`VerticalPosition` = `Inferior`	*Subscript*
sups	`VerticalPosition` = `Superior`	*Superscript*
swsh	Style = Swash	*Swash*
titl	Style = Titling	*Titling*
tnum	Numbers = Monospaced	*Tabular Figures*
trad	CJKShape = Traditional	*Traditional Forms*
twid	CharacterWidth = Third	*Third Widths*
unic	Letters = Unicase	*Unicase*
valt	`Vertical` = `AlternateMetrics`	*Alternate Vertical Metrics*
vert	Vertical = Alternates	*Vertical Writing*
vhal	Vertical = HalfMetrics	*Alternate Vertical Half Metrics*
vkna	Style = VerticalKana	*Vertical Kana Alternates*
vkrn	Vertical = Kerning	*Vertical Kerning*
vpal	`Vertical` = `ProportionalMetrics`	*Proportional Alternate Vertical Metrics*
vrt2	Vertical = RotatedGlyphs	*Vertical Alternates and Rotation*
vrtr	`Vertical` = `AlternatesForRotation`	*Vertical Alternates for Rotation*
zero	Numbers = SlashedZero	*Slashed Zero*

Table 5: List of *unsupported* OpenType features.

AALT	*Access All Alternates*	HNGL	*Hangul*	RCLT	*Required Contextual Alternates*
ABVF	*Above-base Forms*	HOJO	*Hojo Kanji Forms*	RKRF	*Rakar Forms*
ABVS	*Above-base Substitutions*	ISOL	*Isolated Forms*	RPHF	*Reph Forms*
AKHN	*Akhands*	JALT	*Justification Alternates*	RTBD	*Right Bounds*
BLWF	*Below-base Forms*	LFBD	*Left Bounds*	RTLA	*Right-to-left alternates*
BLWS	*Below-base Substitutions*	LJMO	*Leading Jamo Forms*	RTLM	*Right-to-left mirrored forms*
CCMP	*Glyph Composition / Decomposition*	LTRA	*Left-to-right alternates*	RVRN	*Required Variation Alternates*
CFAR	*Conjunct Form After Ro*	LTRM	*Left-to-right mirrored forms*	SIZE	*Optical size*
CJCT	*Conjunct Forms*	MED2	*Medial Forms #2*	STCH	*Stretching Glyph Decomposition*
CPCT	*Centered CJK Punctuation*	MGRK	*Mathematical Greek*	TJMO	*Trailing Jamo Forms*
CURS	*Cursive Positioning*	MSET	*Mark Positioning via Substitution*	TNAM	*Traditional Name Forms*
DIST	*Distances*	NUKT	*Nukta Forms*	VATU	*Vattu Variants*
DTLS	*Dotless Forms*	OPBD	*Optical Bounds*	VJMO	*Vowel Jamo Forms*
FIN2	*Terminal Forms #2*	PREF	*Pre-Base Forms*		
FIN3	*Terminal Forms #3*	PRES	*Pre-base Substitutions*		
FLAC	*Flattened accent forms*	PSTF	*Post-base Forms*		
HALF	*Half Forms*	PSTS	*Post-base Substitutions*		
HALN	*Halant Forms*				

3.1.3 Contextuals

This feature refers to substitutions of glyphs that vary 'contextually' by their relative position in a word or string of characters; features such as contextual swashes are accessed via the options shown in Table 6.

Historic forms are accessed in OpenType fonts via the feature `Style=Historic`; this is generally *not* contextual in OpenType, which is why it is not included in this feature.

3.1.4 Diacritics

Specifies how combining diacritics should be placed. These will usually be controlled automatically according to the Script setting.

3.1.5 Fractions — `frac`

Activates the construction of 'vulgar' fractions using precomposed glyphs and/or subscript and superscript characters from within the font. Coverage will vary by font; see Example 21. Some (Asian fonts predominantly) also provide for the `Alternate` option.

3.1.6 Kerning — `kern`

Specifies how inter-glyph spacing should behave. Well-made fonts include information for how differing amounts of space should be inserted between separate character pairs. This kerning space is inserted automatically but in rare circumstances you may wish to turn it off.

Table 6: Options for the OpenType font feature 'Contextuals'.

Feature	Option	Tag
Contextuals =	Swash	`cswh` †
	Alternate	`calt` †
	WordInitial	`init` †
	WordFinal	`fina` †
	LineFinal	`falt` †
	Inner	`medi` †
	ResetAll	

† These feature options can be disabled with `..Off` variants, and reset to default state (neither explicitly on nor off) with `..Reset`.

Table 7: Options for the OpenType font feature 'Diacritics'.

Feature	Option	Tag
Diacritics =	MarkToBase	`mark` †
	MarkToMark	`mkmk` †
	AboveBase	`abvm` †
	BelowBase	`blwm` †
	ResetAll	

† These feature options can be disabled with `..Off` variants, and reset to default state (neither explicitly on nor off) with `..Reset`.

Table 8: Options for the OpenType font feature 'Fractions'.

Feature	Option	Tag
Fractions =	On	`+frac`
	Off	`-frac`
	Reset	
	Alternate	`afrc` †
	ResetAll	

† These feature options can be disabled with `..Off` variants, and reset to default state (neither explicitly on nor off) with `..Reset`.

Example 21: The `Fractions` feature.

```
\setsansfont{Lato}[Fractions=On]
\setmonofont{IBM Plex Mono}[Fractions=On]

\sffamily 1/2 47/11 1/1000 \par
\ttfamily 1/2 47/11
```

½ 47⁄11 1⁄1000
½ 47/11

Table 9: Options for the OpenType font feature 'Kerning'.

Feature	Option	Tag
Kerning =	On	`+kern`
	Off	`-kern`
	Reset	
	Uppercase	`cpsp` †
	ResetAll	

† These feature options can be disabled with `..Off` variants, and reset to default state (neither explicitly on nor off) with `..Reset`.

As briefly mentioned previously at the end of 3.1.7, the `Uppercase` option will add a small amount of tracking between uppercase letters, seen in Example 22, which uses the Romande fonts[6] (thanks to Clea F. Rees for the suggestion). The `Uppercase` option acts separately to the regular kerning controlled by the `On`/`Off` options.

3.1.7 Letters

The `Letters` feature specifies how the letters in the current font will look. OpenType fonts may contain the following options: `SmallCaps`, `PetiteCaps`, `UppercaseSmallCaps`, `UppercasePetiteCaps`, and `Unicase`.

Petite caps are smaller than small caps. `SmallCaps` and `PetiteCaps` turn lowercase letters into the smaller caps letters, whereas the `Uppercase...` options turn the *capital* letters into the smaller caps (good, *e.g.*, for applying to already uppercase acronyms like 'NASA'). This difference is shown in Example 23. 'Unicase' is a weird hybrid of upper and lower case letters.

3.1.8 Ligatures

`Ligatures` refer to the replacement of two separate characters with a specially drawn glyph for functional or æsthetic reasons. The list of options, of which multiple may be selected at one time, is shown in Table 11. A demonstration with the Linux Libertine fonts[7] is shown in Example 24.

Note the additional features accessed with `Ligatures=TeX`. These are not actually real OpenType features, but additions provided by luaotfload (i.e., LuaTEX only) to emulate TEX's behaviour for ASCII input of curly quotes and punctuation. In XETEX this is achieved with the

[6] http://arkandis.tuxfamily.org/adffonts.html
[7] http://www.linuxlibertine.org/

Example 22: Adding extra kerning for uppercase letters. (The difference is usually very small.)

UPPERCASE EXAMPLE
UPPERCASE EXAMPLE

```
\fontspec{RomandeADFStd-DemiBold.otf}
 UPPERCASE EXAMPLE \\
\addfontfeature{Kerning=Uppercase}
 UPPERCASE EXAMPLE
```

Table 10: Options for the OpenType font feature 'Letters'.

Feature	Option	Tag
Letters =	SmallCaps	`smcp` †
	PetiteCaps	`pcap` †
	UppercaseSmallCaps	`c2sc` †
	UppercasePetiteCaps	`c2pc` †
	Unicase	`unic` †
	ResetAll	

† These feature options can be disabled with `..Off` variants, and reset to default state (neither explicitly on nor off) with `..Reset`.

Example 23: Small caps from lowercase or uppercase letters.

```
\fontspec{texgyreadventor-regular.otf}[Letters=SmallCaps]
 THIS SENTENCE no verb                  \\
\fontspec{texgyreadventor-regular.otf}[Letters=UppercaseSmallCaps]
 THIS SENTENCE no verb
```

THIS SENTENCE NO VERB
THIS SENTENCE NO verb

`Mapping` feature (see Section 1.1 on page 56) but for consistency `Ligatures=TeX` will perform the same function as `Mapping=tex-text`.

3.1.9 Localised Forms — `locl`

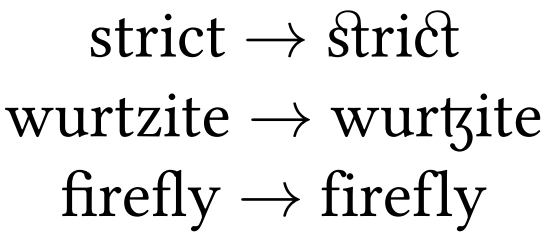
This feature enables and disables glyph substitutions, etc., that are specific to the `Language` selected in the font. This feature is automatically activated by default when present, so it should not be generally necessary to use `LocalForms = On`. In certain scenarios it may be important to turn it `Off` (although nothing specifically springs to mind).

Table 11: Options for the OpenType font feature 'Ligatures'.

Feature	Option	Tag
Ligatures =	Required	`rlig` †
	Common	`liga` †
	Contextual	`clig` †
	Rare/Discretionary	`dlig` †
	Historic	`hlig` †
	TeX	`tlig` †
	ResetAll	

† These feature options can be disabled with `..Off` variants, and reset to default state (neither explicitly on nor off) with `..Reset`.

Example 24: An example of the `Ligatures` feature.




```
\def\test#1#2{%
  #2 $\to$ {\addfontfeature{#1} #2}\\}
\fontspec{LinLibertine_R.otf}
\test{Ligatures=Historic}{strict}
\test{Ligatures=Rare}{wurtzite}
\test{Ligatures=CommonOff}{firefly}
```

Table 12: Options for the OpenType font feature 'LocalForms'.

Feature		Option	Tag
LocalForms	=	On	`+locl`
		Off	`-locl`
		Reset	

† These feature options can be disabled with `..Off` variants, and reset to default state (neither explicitly on nor off) with `..Reset`.

3.1.10 Numbers

The `Numbers` feature defines how numbers will look in the selected font, accepting options shown in Table 13.

The synonyms `Uppercase` and `Lowercase` are equivalent to `Lining` and `OldStyle`, respectively. The differences have been shown previously in Section 2 on page 20. The `Monospaced` option is useful for tabular material when digits need to be vertically aligned.

The `SlashedZero` option replaces the default zero with a slashed version to prevent confusion with an uppercase 'O', shown in Example 25.

The `Arabic` option (with tag `anum`) maps regular numerals to their Arabic script or Persian equivalents based on the current `Language` setting (see Section 2 on page 33). This option is based on a LuaTEX feature of the luaotfload package, not an OpenType feature. (Thus, this feature is unavailable in XETEX.) This feature should be considered deprecated; while there are no plans to remove it from this package, if its support is dropped from the font loader it could disappear from fontspec with little notice.

Example 25: The effect of the `SlashedZero` option.

0123456789 0123456789

```
\fontspec[Numbers=Lining]{texgyrebonum-regular.otf}
 0123456789
\fontspec[Numbers=SlashedZero]{texgyrebonum-regular.otf}
 0123456789
```

Table 13: Options for the OpenType font feature 'Numbers'.

Feature	Option	Tag
Numbers =	Uppercase	`lnum` †
	Lowercase	`onum` †
	Lining	`lnum` †
	OldStyle	`onum` †
	Proportional	`pnum` †
	Monospaced	`tnum` †
	SlashedZero	`zero` †
	Arabic	`anum` †
	ResetAll	

† These feature options can be disabled with `..Off` variants, and reset to default state (neither explicitly on nor off) with `..Reset`.

3.1.11 Ornament — `ornm`

Ornaments are selected with the `Ornament` feature (OpenType feature `ornm`), selected numerically such as for the `Annotation` feature.

3.1.12 Style

'Ruby' refers to a small optical size, used in Japanese typography for annotations. For fonts with multiple `salt` OpenType features, use the fontspec `Alternate` feature instead.

Example 26 shows an example of a font feature that involves glyph substitution for particular letters within an alphabet. Other options in these categories operate in similar ways, with the choice of how particular substitutions are organised with which feature largely up to the font designer.

The `Uppercase` option is designed to select various uppercase forms for glyphs such as accents and dashes, such as shown in Example 27; note the raised position of the hyphen to better match the surrounding letters. It will (probably) not actually map letters to uppercase.[8] This option used to be selected under the `Letters` feature, but moved here as it generally does not actually affect the letters themselves. The `Kerning` feature also contains an `Uppercase` option, which adds a small amount of spacing in between letters (see 3.1.6 on page 38).

In other features, larger breadths of changes can be seen, covering the style of an entire alphabet. See Example 28; here, the `Italic` option affects the Latin text and the `Ruby` option the Japanese.

[8] If you want automatic uppercase letters, look to LaTeX's `\MakeUppercase` command.

Example 26: Example of the `Alternate` option of the `Style` feature.

M Q W
M Q W

```
\fontspec{Quattrocento.otf}
 M Q W                      \\
\addfontfeature{Style=Alternate}
 M Q W
```

Table 14: Options for the OpenType font feature 'Style'.

Feature	Option	Tag
Style =	Alternate	`salt` †
	Italic	`ital` †
	Ruby	`ruby` †
	Swash	`swsh` †
	Cursive	`curs` †
	Historic	`hist` †
	Titling	`titl` †
	HorizontalKana	`hkna` †
	VerticalKana	`vkna` †
	ResetAll	

† These feature options can be disabled with `..Off` variants, and reset to default state (neither explicitly on nor off) with `..Reset`.

Example 27: An example of the `Uppercase` option of the `Style` feature.

UPPER-CASE example
UPPER-CASE example

```
\fontspec{LinLibertine_R.otf}
 UPPER-CASE example \\
\addfontfeature{Style=Uppercase}
 UPPER-CASE example
```

Example 28: Example of the `Italic` and `Ruby` options of the `Style` feature.

Latin ようこそ ワカヨタレソ
Latin ようこそ ワカヨタレソ

```
\fontspec{Hiragino Mincho Pro}
 Latin \kana        \\
\addfontfeature{Style={Italic, Ruby}}
 Latin \kana
```

Note the difference here between the default and the horizontal style kana in Example 29: the horizontal style is slightly wider.

3.1.13 Stylistic Set variations — ssNN

This feature selects a 'Stylistic Set' variation, which usually corresponds to an alternate glyph style for a range of characters (usually an alphabet or subset thereof). This feature is specified numerically. These correspond to OpenType features ss01, ss02, etc.

Two demonstrations from the Junicode font[9] are shown in Example 30 and Example 31; thanks to Adam Buchbinder for the suggestion.

Multiple stylistic sets may be selected simultaneously by writing, e.g., StylisticSet={1,2,3}.

The StylisticSet feature is a synonym of the Variant feature for AAT fonts. See Section 1 on page 61 for a way to assign names to stylistic sets, which should be done on a per-font basis.

3.1.14 Vertical Position

The VerticalPosition feature is used to access things like subscript (Inferior) and superscript (Superior) numbers and letters (and a small amount of punctuation, sometimes). The Ordinal option will only raise characters that are used in some languages directly after a number. The ScientificInferior feature will move glyphs further below the baseline than the Inferior feature. These are shown in Example 32

Numerator and Denominator should only be used for creating arbitrary fractions (see next section).

The realscripts package (which is also loaded by xltxtra for XeTeX) redefines the \textsubscript and \textsuperscript commands to use the above font features automatically, including for use in footnote labels. If this is the only feature of xltxtra you wish to use, consider loading realscripts on its own instead.

3.2 CJK features

This section summarises the features which are largely intending for Chinese, Korean, and Japanese typesetting.

[9] http://junicode.sf.net

Example 29: Example of the HorizontalKana and VerticalKana options of the Style feature.

ようこそ ワカヨタレソ
ようこそ ワカヨタレソ
ようこそ ワカヨタレソ

```
\fontspec{Hiragino Mincho Pro}
  \kana   \\
{\addfontfeature{Style=HorizontalKana}
  \kana } \\
{\addfontfeature{Style=VerticalKana}
  \kana }
```

Example 30: Insular letterforms, as used in medieval Northern Europe, for the Junicode font accessed with the `StylisticSet` feature.

Insular forms.
Inſulaꝛ ꝓoꝛmſ.

```
\fontspec{Junicode}
 Insular forms. \\
\addfontfeature{StylisticSet=2}
 Insular forms. \\
```

Example 31: Enlarged minuscules (capital letters remain unchanged) for the Junicode font, accessed with the `StylisticSet` feature.

ENLARGED Minuscules.
ENLARGED Minuscules.

```
\fontspec{Junicode}
 ENLARGED Minuscules. \\
\addfontfeature{StylisticSet=6}
 ENLARGED Minuscules. \\
```

Table 15: Options for the OpenType font feature 'VerticalPosition'.

Feature	Option	Tag
VerticalPosition =	Superior	`sups` †
	Inferior	`subs` †
	Numerator	`numr` †
	Denominator	`dnom` †
	ScientificInferior	`sinf` †
	Ordinal	`ordn` †
	ResetAll	

† These feature options can be disabled with `..Off` variants, and reset to default state (neither explicitly on nor off) with `..Reset`.

Example 32: The `VerticalPosition` feature.

Superior: 1234567890
Numerator: 12345
Denominator: 12345
Scientific Inferior: 12345

```
\fontspec{LibreCaslonText-Regular.otf}[VerticalPosition=Superior]
 Superior: 1234567890                                          \\
\fontspec{LibreCaslonText-Regular.otf}[VerticalPosition=Numerator]
 Numerator: 12345                                              \\
\fontspec{LibreCaslonText-Regular.otf}[VerticalPosition=Denominator]
 Denominator: 12345                                            \\
\fontspec{LibreCaslonText-Regular.otf}[VerticalPosition=ScientificInferior]
 Scientific Inferior: 12345
```

3.2.1 Annotation — `nalt`

Some fonts are equipped with an extensive range of numbers and numerals in different forms. These are accessed with the `Annotation` feature (OpenType feature `nalt`), selected numerically as shown in Example 33. Note that the indexing starts from zero.

3.2.2 Character width

Many Asian fonts are equipped with variously spaced characters for shoe-horning into their generally monospaced text. These are accessed through the `CharacterWidth` feature.

Japanese alphabetic glyphs (in Hiragana or Katakana) may be typeset proportionally, to better fit horizontal measures, or monospaced, to fit into the rigid grid imposed by ideographic typesetting. In this latter case, there are also half-width forms for squeezing more kana glyphs (which are less complex than the kanji they are amongst) into a given block of space. The same features are given to roman letters in Japanese fonts, for typesetting foreign words in the same style as the surrounding text.

The same situation occurs with numbers, which are provided in increasingly illegible compressed forms seen in Example 35.

3.2.3 CJK shape

There have been many standards for how CJK ideographic glyphs are 'supposed' to look. Some fonts will contain many alternate glyphs available in order to be able to display these gylphs correctly in whichever form is appropriate. Both AAT and OpenType fonts support the following `CJKShape` options: `Traditional`, `Simplified`, `JIS1978`, `JIS1983`, `JIS1990`, and `Expert`. OpenType also supports the `NLC` option.

3.2.4 Vertical typesetting

OpenType provides a plethora of features for accommodating the varieties of possibilities needed for vertical typesetting (CJK and others). No capabilities for achieving such vertical typesetting are provided by fontspec, however; please get in touch if there are improvements that could be made.

Table 16: Options for the OpenType font feature 'CharacterWidth'.

Feature		Option	Tag
CharacterWidth	=	Proportional	`pwid` †
		Full	`fwid` †
		Half	`hwid` †
		Third	`twid` †
		Quarter	`qwid` †
		AlternateProportional	`palt` †
		AlternateHalf	`halt` †
		ResetAll	

† These feature options can be disabled with `..Off` variants, and reset to default state (neither explicitly on nor off) with `..Reset`.

Example 33: Annotation forms for OpenType fonts.

1 2 3 4 5 6 7 8 9
⑴ ⑵ ⑶ ⑷ ⑸ ⑹ ⑺ ⑻ ⑼
⑴ ⑵ ⑶ ⑷ ⑸ ⑹ ⑺ ⑻ ⑼
1⁾ 2⁾ 3⁾ 4⁾ 5⁾ 6⁾ 7⁾ 8⁾ 9⁾
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽ ❾
🄀 🄁 🄂 🄃 🄄 🄅 🄆 🄇 🄈
🅐 🅑 🅒 🅓 🅔 🅕 🅖 🅗 🅘
🅰 🅱 🅲 🅳 🅴 🅵 🅶 🅷 🅸
1. 2. 3. 4. 5. 6. 7. 8. 9.

```
\fontspec{Hiragino Maru Gothic Pro}
 1 2 3 4 5 6 7 8 9
\def\x#1{\\{\addfontfeature{Annotation=#1}
          1 2 3 4 5 6 7 8 9 }}
\x0\x1\x2\x3\x4\x5\x6\x7\x7\x8\x9
```

Example 34: Proportional or fixed width forms.

ようこそ　ワカヨタレソ　abcdef
ようこそ　ワカヨタレソ　a b c d e f
ようこそ　ワカヨタレソ　abcdef

```
\def\test{\makebox[2cm][l]{\texta}%
          \makebox[2.5cm][l]{\textb}%
          \makebox[2.5cm][l]{abcdef}}
\fontspec{Hiragino Mincho Pro}
{\addfontfeature{CharacterWidth=Proportional}\test}\\
{\addfontfeature{CharacterWidth=Full}\test}\\
{\addfontfeature{CharacterWidth=Half}\test}
```

Example 35: Numbers can be compressed significantly.

—12321—
—1234554321—
—123456787654321—
—12345678900987654321—

```
\fontspec[Renderer=AAT]{Hiragino Mincho Pro}
{\addfontfeature{CharacterWidth=Full}
 ---12321---}\\
{\addfontfeature{CharacterWidth=Half}
 ---1234554321---}\\
{\addfontfeature{CharacterWidth=Third}
 ---123456787654321---}\\
{\addfontfeature{CharacterWidth=Quarter}
 ---12345678900987654321---}
```

Example 36: Different standards for CJK ideograph presentation.

唖噛躯 妍并訝
唖噛躯 妍幷訝
啞嚙軀 妍并訝

```
\fontspec{Hiragino Mincho Pro}
{\addfontfeature{CJKShape=Traditional}
\text }                          \\
{\addfontfeature{CJKShape=NLC}
\text }                          \\
{\addfontfeature{CJKShape=Expert}
\text }
```

Table 17: Options for the OpenType font feature 'CJKShape'.

Feature	Option	Tag
CJKShape =	Traditional	trad
	Simplified	smpl
	JIS1978	jp78
	JIS1983	jp83
	JIS1990	jp90
	Expert	expt
	NLC	nlck

† These feature options can be disabled with ..Off variants, and reset to default state (neither explicitly on nor off) with ..Reset.

Table 18: Options for the OpenType font feature 'Vertical'.

Feature	Option	Tag
Vertical =	RotatedGlyphs	vrt2 †
	AlternatesForRotation	vrtr †
	Alternates	vert †
	KanaAlternates	vkna †
	Kerning	vkrn †
	AlternateMetrics	valt †
	HalfMetrics	vhal †
	ProportionalMetrics	vpal †
	ResetAll	

† These feature options can be disabled with ..Off variants, and reset to default state (neither explicitly on nor off) with ..Reset.

Part V
Commands for accents and symbols ('encodings')

The functionality described in this section is experimental.

In the pre-Unicode era, significant work was required by LaTeX to ensure that input characters in the source could be interpreted correctly depending on file encoding, and that glyphs in the output were selected correctly depending on the font encoding. With Unicode, we have the luxury of a single file and font encoding that is used for both input and output.

While this may provide some illusion that we could get away simply with typing Unicode text and receive correct output, this is not always the case. For a start, hyphenation in particular is language-specific, so tags should be used when switch between languages in a document. The babel and polyglossia packages both provide features for this.

Multilingual documents will often use different fonts for different languages, not just for style, but for the more pragmatic reason that fonts do not all contain the same glyphs. (In fact, only test fonts such as Code2000 provide anywhere near the full Unicode coverage.) Indeed, certain fonts may be perfect for a certain application but miss a handful of necessary diacritics or accented letters. In these cases, fontspec can leverage the font encoding technology built into LaTeX2 to provide on a per-font basis either provide fallback options or error messages when a desired accent or symbol is not available. However, at present these features can only be provided for input using LaTeX commands rather than Unicode input; for example, typing `\`e` instead of è or `\textcopyright` instead of © in the source file.

The most widely-used encoding in LaTeX 2_ε was `T1` with companion '`TS1`' symbols provided by the textcomp package. These encodings provided glyphs to typeset text in a variety of western European languages. As with most legacy LaTeX 2_ε input methods, accents and symbols were input using encoding-dependent commands such as `\`e` as described above. As of 2017, in LaTeX $2_\varepsilon$ on XeTeX and LuaTeX, the default encoding is `TU`, which uses Unicode for input and output. The `TU` encoding provides appropriate encoding-dependent definitions for input commands to match the coverage of the `T1+TS1` encodings. Wider coverage is not provided by default since (a) each font will provide different glyph coverage, and (b) it is expected that most users will be writing with direct Unicode input.

For those users who do need finer-grained control, fontspec provides an interface for a more extensible system.

1 A new Unicode-based encoding from scratch

Let's say you need to provide support for a document originally written with fonts in the `OT2` encoding, which contains encoding-dependent commands for Cyrillic letters. An example from the `OT2` encoding definition file (`ot2enc.def`) reads:

```
\DeclareTextSymbol{\CYRIE}{OT2}{5}
\DeclareTextSymbol{\CYRDJE}{OT2}{6}
\DeclareTextSymbol{\CYRTSHE}{OT2}{7}
\DeclareTextSymbol{\cyrnje}{OT2}{8}
```

```
61 \DeclareTextSymbol{\cyrlje}{OT2}{9}
62 \DeclareTextSymbol{\cyrdzhe}{OT2}{1Q}
```

To recreate this encoding in a form suitable for fontspec, create a new file named, say, `fontrange-cyr.def` and populate it with

```
...
\DeclareTextSymbol{\CYRIE}  {\LastDeclaredEncoding}{"0404}
\DeclareTextSymbol{\CYRDJE} {\LastDeclaredEncoding}{"0402}
\DeclareTextSymbol{\CYRTSHE}{\LastDeclaredEncoding}{"040B}
\DeclareTextSymbol{\cyrnje} {\LastDeclaredEncoding}{"045A}
\DeclareTextSymbol{\cyrlje} {\LastDeclaredEncoding}{"0459}
\DeclareTextSymbol{\cyrdzhe}{\LastDeclaredEncoding}{"045F}
...
```

The numbers `"0404`, `"0402`, …, are the Unicode slots (in hexadecimal) of each glyph respectively. The fontspec package provides a number of shorthands to simplify this style of input; in this case, you could also write

```
\EncodingSymbol{\CYRIE}{"0404}
...
```

To use this encoding in a fontspec font, you would first add this to your preamble:

```
\DeclareUnicodeEncoding{unicyr}{
  \input{fontrange-cyr.def}
}
```

Then follow it up with a font loading call such as

```
\setmainfont{...}[NFSSEncoding=unicyr]
```

The first argument `unicyr` is the name of the 'encoding' to use in the font family. (There's nothing special about the name chosen but it must be unique.) The second argument to `\DeclareUnicodeEncoding` also allows adjustments to be made for per-font changes. We'll cover this use case in the next section.

2 Adjusting a pre-existing encoding

There are three reasons to adjust a pre-existing encoding: to add, to remove, and to redefine some symbols, letters, and/or accents.

When adding symbols, etc., simply write

```
\DeclareUnicodeEncoding{unicyr}{
  \input{tuenc.def}
  \input{fontrange-cyr.def}
  \EncodingSymbol{\textruble}{"20BD}
}
```

Of course if you consistently add a number of symbols to an encoding it would be a good idea to create a new `fontrange-XX.def` file to suit your needs.

When removing symbols, use the `\UndeclareSymbol{`⟨*cmd*⟩`}` command. For example, if you a loading a font that you know is missing, say, the interrobang (not that unusual a situation), you might write:

```
\DeclareUnicodeEncoding{nobang}{
  \input{tuenc.def}
  \UndeclareSymbol\textinterrobang
}
```

Provided that you use the command `\textinterrobang` to typeset this symbol, it will appear in fonts with the default encoding, while in any font loaded with the `nobang` encoding an attempt to access the symbol will either use the default fallback definition or return an error, depending on the symbol being undeclared.

The third use case is to redefine a symbol or accent. The most common use case in this scenario is to adjust a specific accent command to either fine-tune its placement or to 'fake' it entirely. For example, the underdot diacritic is used in typeset Sanskrit, but it is not necessarily included as an accent symbol is all fonts. By default the underdot is defined in `TU` as:

```
\EncodingAccent{\d}{"0323}
```

For fonts with a missing (or poorly-spaced) `"0323` accent glyph, the 'traditional' TEX fake accent construction could be used instead:

```
\DeclareUnicodeEncoding{fakeacc}{
  \input{tuenc.def}
  \EncodingCommand{\d}[1]{%
    \hmode@bgroup
      \o@lign{\relax#1\crcr\hidewidth\ltx@sh@ft{-1ex}.\hidewidth}%
    \egroup
  }
}
```

This would be set up in a document as such:

```
\newfontfamily\sanskitfont{CharisSIL}
\newfontfamily\titlefont{Posterama}[NFSSEncoding=fakeacc]
```

Then later in the document, no additional work is needed:

```
...{\titlefont   kalita\d m}...  % <- uses fake accent
...{\sanskitfont kalita\d m}...  % <- uses real accent
```

To reiterate from above, typing this input with Unicode text ('`kalitaṃ`') will *bypass* this encoding mechanism and you will receive only what is contained literally within the font.

3 Summary of commands

The LaTeX 2ε kernel provides the following font encoding commands suitable for Unicode encodings:

`\DeclareTextCommand{`⟨*command*⟩`}{`⟨*encoding*⟩`}[`⟨*num*⟩`][`⟨*default*⟩`]{`⟨*code*⟩`}`

`\DeclareUnicodeAccent{`⟨*command*⟩`}{`⟨*encoding*⟩`}{`⟨*slot*⟩`}`

`\DeclareTextSymbol{`⟨*command*⟩`}{`⟨*encoding*⟩`}{`⟨*slot*⟩`}`

`\DeclareTextComposite{`⟨*command*⟩`}{`⟨*encoding*⟩`}{`⟨*letter*⟩`}{`⟨*slot*⟩`}`

`\DeclareTextCompositeCommand{`⟨*command*⟩`}{`⟨*encoding*⟩`}{`⟨*letter*⟩`}{`⟨*code*⟩`}`

`\UndeclareTextCommand{`⟨*command*⟩`}{`⟨*encoding*⟩`}`

See `fntguide.pdf` for full documentation of these. As shown above, the following shorthands are provided by fontspec to simplify the process of defining Unicode font range encodings:

`\EncodingCommand{`⟨*command*⟩`}[`⟨*num*⟩`][`⟨*default*⟩`]{`⟨*code*⟩`}`

`\EncodingAccent{`⟨*command*⟩`}{`⟨*code*⟩`}`

`\EncodingSymbol{`⟨*command*⟩`}{`⟨*code*⟩`}`

`\EncodingComposite{`⟨*command*⟩`}{`⟨*letter*⟩`}{`⟨*slot*⟩`}`

`\EncodingCompositeCommand{`⟨*command*⟩`}{`⟨*letter*⟩`}{`⟨*code*⟩`}`

`\UndeclareSymbol{`⟨*command*⟩`}`

`\UndeclareAccent{`⟨*command*⟩`}`

`\UndeclareCommand{`⟨*command*⟩`}`

`\UndeclareComposite{`⟨*command*⟩`}{`⟨*letter*⟩`}`

Part VI
LuaTEX-only font features

1 Different font technologies and shapers

LuaTEX does not directly support any font rendering technologies out of the box, it requires additional functionality to be added to properly support and control technologies such as OpenType.

Using the `Renderer` feature, there are a number of options that fontspec can pass to the engine to control which font technology is being used. Pre-2019, there were two options provided by luaotfload that generally did not require user intervention.

- `Renderer` = `Node` : the default 'mode' for typesetting OpenType fonts.
- `Renderer` = `Base` : a simplified mode useful only in a limited number of situations such as mathematics typesetting.

From 2019 the possibility of using the Harfbuzz text shaping engine within LuaTEX has been developed by Khaled Hosny. When running a suitable LuaTEX engine with Harfbuzz support, fontspec provides the following options:

- `Renderer` = `Harfbuzz` : use the Harfbuzz engine without an explicit 'shaper'.
- `Renderer` = `OpenType` : use the Harfbuzz engine with the OpenType shaper.
- `Renderer` = `AAT` : use the Harfbuzz engine with the AAT shaper.
- `Renderer` = `Graphite` : use the Harfbuzz engine with the Graphite shaper.
- `Renderer` = ⟨*foo*⟩ : use the Harfbuzz engine with the ⟨*foo*⟩ shaper.

Support for the Harfbuzz renderer is preliminary and may be improved over time. Please treat the interface for Harfbuzz fonts as subject to change.

2 Custom font features

LuaTEX, via the luaotfload package, allows the definition and re-definition of custom OpenType features for a selected font. This facility is particularly useful to implement custom substitutions or to disable unwanted but not all ligatures.

Figure 1 shows an minimal example of this type of functionality. This example creates a new OpenType feature, `oneb`, which substitutes the glyph when typesetting '1' for the named glyph `one.ss01`. The glyph names are font specific and can be interrogated with third-party software such as *FontForge*.

A third-party collection of additional examples are maintained in the repository '`fonts-in-luatex`'[10]. These examples are intended to correct or adjust font features in a range of commercial fonts and provide a good introduction to some of the possibilities that LuaTEX affords.

Please refer to the LuaTEX/luaotfload documentation for more details.

[10] https://github.com/mewtant/fonts-in-luatex

Figure 1: An example of custom font features.

```
\documentclass{article}
\usepackage{fontspec}
\directlua{
    fonts.handlers.otf.addfeature {
        name = "oneb",
        type = "substitution",
        data = {
                ["1"] = "one.ss01",
        }
    }
}
\setmainfont{Vollkorn-Regular.otf}[RawFeature=+oneb]
\begin{document}
1234567890
\end{document}
```

Part VII

Fonts and features with XeTeX

1 XeTeX-only font features

The features described here are available for any font selected by fontspec.

1.1 Mapping

The `Mapping` feature enables a XeTeX text-mapping scheme, with an example shown in Example 37.

Only one mapping can be active at a time and a second call to `Mapping` will override the first. Using the `tex-text` mapping is also equivalent to writing `Ligatures=TeX`. The use of the latter syntax is recommended for better compatibility with LuaTeX documents.

1.2 Different font technologies: AAT, OpenType, and Graphite

Note that from 2020 it appears that XeTeX can no longer support AAT fonts in macOS.

XeTeX supports three rendering technologies for typesetting, selected with the `Renderer` font feature. The first, `AAT`, is that provided only by macOS. The second, `OpenType`, is an open source OpenType interpreter. It provides greater support for OpenType features, notably contextual arrangement, over `AAT`. The third is `Graphite`, which is an alternative to OpenType with particular features for less-common languages and the capability for more powerful font options. Features for `OpenType` have already been discussed in IV on page 31; `Graphite` and `AAT` features are discussed later in Section 2 on the next page and Section 3 on page 58.

Unless you have a particular need, the `Renderer` feature is rarely explicitly required: for OpenType fonts, the `OpenType` renderer is used automatically, and for AAT fonts, `AAT` is chosen by default. Some fonts, however, will contain font tables for multiple rendering technologies, such as the Hiragino Japanese fonts distributed with macOS, and in these cases one over the other may be preferred.

Among some other font features only available through a specific renderer, `OpenType` provides for the `Script` and `Language` features, which allow different font behaviour for different alphabets and languages; see Section 2 on page 33 for the description of these features. *Because these font features can change which features are able to be selected for the font instance, they are selected by fontspec before all others and will automatically and without warning select the `OpenType` renderer.*

Example 37: XeTeX's `Mapping` feature.

“¡A small amount of—text!”

```
\fontspec{texgyrepagella-regular.otf}[Mapping=tex-text]
``!`A small amount of---text!''
```

1.3 Optical font sizes

Multiple Master fonts are parameterised over orthogonal font axes, allowing continuous selection along such features as weight, width, and optical size. Whereas an OpenType font will have only a few separate optical sizes, a Multiple Master font's optical size can be specified over a continuous range. Unfortunately, this flexibility makes it harder to create an automatic interface through LaTeX, and the optical size for a Multiple Master font must always be specified explicitly.

```
\fontspec{Minion MM Roman}[OpticalSize=11]
 MM optical size test                    \\
\fontspec{Minion MM Roman}[OpticalSize=47]
 MM optical size test                    \\
\fontspec{Minion MM Roman}[OpticalSize=71]
 MM optical size test                    \\
```

1.4 Vertical typesetting

XeTeX provides for vertical typesetting simply with the ability to rotate the individual glyphs as a font is used for typesetting, as shown in Example 38.

No actual provision is made for typesetting top-to-bottom languages; for an example of how to do this, see the vertical Chinese example provided in the XeTeX documentation.

2 The Graphite renderer

Since the Graphite renderer is designed for less common scripts and languages, usually with specific or unique requirements, Graphite features are not standard across fonts.

Currently fontspec does not support a convenient interface to select Graphite font features and all selection must be done via 'raw' font feature selection.

Here's an example:

```
\fontspec{Charis SIL}[
  Renderer=Graphite,
  RawFeature={Uppercase Eng alternates=Large eng on baseline}]
D
```

Example 38: Vertical typesetting.

共産主義者は

共産主義者は

```
\fontspec{Hiragino Mincho Pro}
\verttext

\fontspec{Hiragino Mincho Pro}[Renderer=AAT,Vertical=RotatedGlyphs]
\rotatebox{-90}{\verttext}% requires the graphicx package
```

Here's another:

```
\fontspec{AwamiNastaliq-Regular.ttf}[Renderer=Graphite] ^^^^06b5
\addfontfeature{RawFeature={Lam with V=V over bowl}}    ^^^^06b5
```

3 macOS's AAT fonts

> ***Warning!*** *XeTeX's implementation on macOS is currently in a state of flux and the information contained below may well be wrong from 2013 onwards. There is a good chance that the features described in this section will not be available any more as XeTeX's completes its transition to a cross-platform–only application. All examples in this section have now been removed.*

macOS's font technology began life before the ubiquitous-OpenType era and revolved around the Apple-invented 'AAT' font format. This format had some advantages (and other disadvantages) but it never became widely popular in the font world.

Nonetheless, this is the font format that was first supported by XeTeX (due to its pedigree on macOS in the first place) and was the first font format supported by fontspec. A number of fonts distributed with macOS are still in the AAT format, such as 'Skia'.

3.1 Ligatures

`Ligatures` refer to the replacement of two separate characters with a specially drawn glyph for functional or æsthetic reasons. For AAT fonts, you may choose from any combination of `Required`, `Common`, `Rare` (or `Discretionary`), `Logos`, `Rebus`, `Diphthong`, `Squared`, `AbbrevSquared`, and `Icelandic`.

Some other Apple AAT fonts have those 'Rare' ligatures contained in the `Icelandic` feature. Notice also that the old TeX trick of splitting up a ligature with an empty brace pair does not work in XeTeX; you must use a 0 pt kern or `\hbox` (*e.g.*, `\null`) to split the characters up if you do not want a ligature to be performed (the usual examples for when this might be desired are words like 'shelffull').

3.2 Letters

The `Letters` feature specifies how the letters in the current font will look. For AAT fonts, you may choose from `Normal`, `Uppercase`, `Lowercase`, `SmallCaps`, and `InitialCaps`.

3.3 Numbers

The `Numbers` feature defines how numbers will look in the selected font. For AAT fonts, they may be a combination of `Lining` or `OldStyle` and `Proportional` or `Monospaced` (the latter is good for tabular material). The synonyms `Uppercase` and `Lowercase` are equivalent to `Lining` and `OldStyle`, respectively. The differences have been shown previously in Section 2 on page 20.

3.4 Contextuals

This feature refers to glyph substitution that vary by their position; things like contextual swashes are implemented here. The options for AAT fonts are `WordInitial`, `WordFinal` (Example ??), `LineInitial`, `LineFinal`, and `Inner` (Example ??, also called 'non-final' sometimes). As non-exclusive selectors, like the ligatures, you can turn them off by prefixing their name with `No`.

3.5 Vertical position

The `VerticalPosition` feature is used to access things like subscript (`Inferior`) and superscript (`Superior`) numbers and letters (and a small amount of punctuation, sometimes). The `Ordinal` option is (supposed to be) contextually sensitive to only raise characters that appear directly after a number.

The realscripts package redefines the `\textsubscript` and `\textsuperscript` commands to use the above font features, including for use in footnote labels.

3.6 Fractions

Many fonts come with the capability to typeset various forms of fractional material. This is accessed in fontspec with the `Fractions` feature, which may be turned `On` or `Off` in both AAT and OpenType fonts.

In AAT fonts, the 'fraction slash' or solidus character, is to be used to create fractions. When `Fractions` are turned `On`, then only pre-drawn fractions will be used.

Using the `Diagonal` option (AAT only), the font will attempt to create the fraction from superscript and subscript characters.

Some (Asian fonts predominantly) also provide for the `Alternate` feature.

3.7 Variants

The `Variant` feature takes a single numerical input for choosing different alphabetic shapes. See Section 1 on page 61 for a way to assign names to variants, which should be done on a per-font basis.

3.8 Alternates

Selection of `Alternate`s again must be done numerically. See Section 1 on page 61 for a way to assign names to alternates, which should be done on a per-font basis.

3.9 Style

The options of the `Style` feature are defined in AAT as one of the following: `Display`, `Engraved`, `IlluminatedCaps`, `Italic`, `Ruby`,[11] `TallCaps`, or `Titling`.

Typical examples for these features are shown in 3.1.12.

[11] 'Ruby' refers to a small optical size, used in Japanese typography for annotations.

3.10 CJK shape

There have been many standards for how CJK ideographic glyphs are 'supposed' to look. Some fonts will contain many alternate glyphs in order to be able to display these gylphs correctly in whichever form is appropriate. Both AAT and OpenType fonts support the following `CJKShape` options: `Traditional`, `Simplified`, `JIS1978`, `JIS1983`, `JIS1990`, and `Expert`. OpenType also supports the `NLC` option.

3.11 Character width

See 3.2.2 on page 47 for relevant examples; the features are the same between OpenType and AAT fonts. AAT also allows `CharacterWidth=Default` to return to the original font settings.

3.12 Diacritics

Diacritics are marks, such as the acute accent or the tilde, applied to letters; they usually indicate a change in pronunciation. In Arabic scripts, diacritics are used to indicate vowels. You may either choose to `Show`, `Hide` or `Decompose` them in AAT fonts. The `Hide` option is for scripts such as Arabic which may be displayed either with or without vowel markings. E.g., `\fontspec[Diacritics=Hide]{...}`

Some older fonts distributed with macOS included '`O/`' *etc.* as shorthand for writing 'Ø' under the label of the `Diacritics` feature. If you come across such fonts, you'll want to turn this feature off (imagine typing `hello/goodbye` and getting 'helløgoodbye' instead!) by decomposing the two characters in the diacritic into the ones you actually want. I recommend using the proper LaTeX input conventions for obtaining such characters instead.

3.13 Annotation

Various Asian fonts are equipped with a more extensive range of numbers and numerals in different forms. These are accessed through the `Annotation` feature with the following options: `Off`, `Box`, `RoundedBox`, `Circle`, `BlackCircle`, `Parenthesis`, `Period`, `RomanNumerals`, `Diamond`, `BlackSquare`, `BlackRoundSquare`, and `DoubleCircle`.

Part VIII
Customisation and programming interface

This chapter describes the current interfaces and hooks that use fontspec for various macro programming purposes.

1 Defining new features

This package cannot hope to contain every possible font feature. Three commands are provided for selecting font features that are not provided for out of the box. If you are using them a lot, chances are I've left something out, so please let me know.

`\newAATfeature` New AAT features may be created with this command:

`\newAATfeature{`⟨*feature*⟩`}{`⟨*option*⟩`}{`⟨*feature code*⟩`}{`⟨*selector code*⟩`}`

Use the XeTeX file `AAT-info.tex` to obtain the code numbers. See Example 39.

`\newopentypefeature` New OpenType features may be created with this command:

`\newopentypefeature{`⟨*feature*⟩`}{`⟨*option*⟩`}{`⟨*feature tag*⟩`}`

The synonym `\newICUfeature` is deprecated.

Here's what it would look like in practise:

```
\newopentypefeature{Style}{NoLocalForms}{-locl}
```

`\newfontfeature` In case the above commands do not accommodate the desired font feature (perhaps a new XeTeX feature that fontspec hasn't been updated to support), a command is provided to pass arbitrary input into the font selection string:

`\newfontfeature{`⟨*name*⟩`}{`⟨*input string*⟩`}`

For example, Zapfino used to contain an AAT feature 'Avoid d-collisions'. To access it with this package, you could do some like the following:

```
\newfontfeature{AvoidD}  {Special= Avoid d-collisions}
\newfontfeature{NoAvoidD}{Special=!Avoid d-collisions}
\fontspec{Zapfino}[AvoidD,Variant=1]
 sockdolager rubdown                \\
\fontspec{Zapfino}[NoAvoidD,Variant=1]
 sockdolager rubdown
```

Example 39: Assigning new AAT features.

This is XeTeX by Jonathan Kew.

```
\newAATfeature{Alternate}{HoeflerSwash}{17}{1}
\fontspec{Hoefler Text Italic}[Alternate=HoeflerSwash]
 This is XeTeX by Jonathan Kew.
```

The advantage to using the `\newAATfeature` and `\newopentypefeature` commands instead of `\newfontfeature` is that they check if the selected font actually contains the desired font feature at load time. By contrast, `\newfontfeature` will not give a warning for improper input.

2 Defining new scripts and languages

`\newfontscript`
`\newfontlanguage`

While the scripts and languages listed in Table 2 and Table 3 are intended to be comprehensive, there may be some missing; alternatively, you might wish to use different names to access scripts/languages that are already listed. Adding scripts and languages can be performed with the `\newfontscript` and `\newfontlanguage` commands. For example,

```
\newfontscript{Arabic}{arab}
\newfontlanguage{Zulu}{ZUL}
```

The first argument is the fontspec name, the second the OpenType tag. The advantage to using these commands rather than `\newfontfeature` (see Section 1 on the preceding page) is the error-checking that is performed when the script or language is requested.

Both commands accept a comma-separated list of OpenType tags in order of preference. This permits, for example, supporting both new and old versions of a language tag with a common user interface:

```
\newfontlanguage{Turkish}{TRK,TUR}
```

Here, a font that is requested with `Script=Turkish` will first be checked for the OpenType language tag `TRK`, which will be selected if available. If not available, the `TUR` tag will be queried and used if possible as a fallback.

3 Going behind fontspec's back

Expert users may wish not to use fontspec's feature handling at all, while still taking advantage of its LaTeX font selection conveniences. The `RawFeature` font feature allows font feature selection using a literal feature selection string if you happen to have the OpenType feature tag memorised. More importantly, this can be used to enable features for which fontspec does not yet have a user interface to.

Multiple features can either be included in a single declaration:

```
[RawFeature=+smcp;+onum]
```

or with multiple declarations:

```
[RawFeature=+smcp, RawFeature=+onum]
```

Note that there is no error-checking when using `RawFeature`. Where a fontspec interface exists to a feature it is generally better to use it. If the font lacks the feature or if it would clash with another feature, fontspec will attemmpt to warn and/or resolve the issues.

Example 40: Using raw font features directly.

Pagella small caps	`\fontspec{texgyrepagella-regular.otf}[RawFeature=+smcp]` `Pagella small caps`

4 Renaming existing features & options

\aliasfontfeature

If you don't like the name of a particular font feature, it may be aliased to another with the `\aliasfontfeature{`⟨*existing name*⟩`}{`⟨*new name*⟩`}` command, such as shown in Example 41.

Spaces in feature (and option names, see below) *are* allowed. (You may have noticed this already in the lists of OpenType scripts and languages).

\aliasfontfeatureoption

If you wish to change the name of a font feature option, it can be aliased to another with the command `\aliasfontfeatureoption{`⟨*font feature*⟩`}{`⟨*existing name*⟩`}{`⟨*new name*⟩`}`, such as shown in Example 42.

This example demonstrates an important point: when aliasing the feature options, the *original* feature name must be used when declaring to which feature the option belongs.

Only feature options that exist as sets of fixed strings may be altered in this way. That is, `Proportional` can be aliased to `Prop` in the `Letters` feature, but `550099BB` cannot be substituted for `Purple` in a `Color` specification. For this type of thing, the `\newfontfeature` command should be used to declare a new, *e.g.*, `PurpleColor` feature:

```
\newfontfeature{PurpleColor}{color=550099BB}
```

Except that this example was written before support for named colours was implemented. But you get the idea.

5 Programming interface

5.1 Variables

\l_fontspec_family_tl
\l_fontspec_font

In some cases, it is useful to know what the LaTeX font family of a specific fontspec font is. After a `\fontspec`-like command, this is stored inside the `\l_fontspec_family_tl` macro. Otherwise, LaTeX's own `\f@family` macro can be useful here, too. The raw TeX font that is defined from the 'base' font in the family is stored in `\l_fontspec_font`.

\g_fontspec_encoding_tl

Package authors who need to load fonts with legacy LaTeX NFSS commands may also need to know what the default font encoding is. Since this has changed from `EU1`/`EU2` to `TU`, it is best to use the variable `\g_fontspec_encoding_tl` instead.

5.2 Functions for loading new fonts and families

\fontspec_gset_family:Nnn
\fontspec_set_family:Nnn

`#1` : LaTeX family
`#2` : fontspec features
`#3` : font name

Defines a new NFSS family from given ⟨*features*⟩ and ⟨*font*⟩, and stores the family name in the variable ⟨*family*⟩. This font family can then be selected with standard LaTeX commands

Example 41: Renaming font features.

Roman Letters *And Swash*

```
\aliasfontfeature{ItalicFeatures}{IF}
\fontspec{Hoefler Text}[IF = {Alternate=1}]
Roman Letters \itshape And Swash
```

Example 42: Renaming font feature options.

```
\aliasfontfeature{VerticalPosition}{Vert Pos}
\aliasfontfeatureoption{VerticalPosition}{ScientificInferior}{Sci Inf}
\fontspec{LinLibertine_R.otf}[Vert Pos=Sci Inf]
 Scientific Inferior: 12345
```

S$_{\text{cientific}}$ I$_{\text{nferior}}$: $_{12345}$

`\fontfamily{`⟨*family*⟩`}\selectfont`. See the standard fontspec user commands for applications of this function.

(*End definition for* `\fontspec_gset_family:Nnn` *and* `\fontspec_set_family:Nnn`*. These functions are documented on page* ??.)

`\fontspec_gset_fontface:NNnn`
`\fontspec_set_fontface:NNnn`

`#1` : primitive font
`#2` : LaTeX family
`#3` : fontspec features
`#4` : font name

Variant of the above in which the primitive TeX font command is stored in the variable ⟨*primitive font*⟩. If a family is loaded (with bold and italic shapes) the primitive font command will only select the regular face. This feature is designed for LaTeX programmers who need to perform subsequent font-related tests on the ⟨*primitive font*⟩.

(*End definition for* `\fontspec_gset_fontface:NNnn` *and* `\fontspec_set_fontface:NNnn`*. These functions are documented on page* ??.)

5.3 Conditionals

The following functions in expl3 syntax may be used for writing code that interfaces with fontspec-loaded fonts. The following conditionals are all provided in `TF`, `T`, and `F` forms.

5.3.1 Querying font families

`\fontspec_font_if_exist:nTF` Test whether the 'font name' (`#1`) exists or is loadable. The syntax of `#1` is a restricted/simplified version of fontspec's usual font loading syntax; fonts to be loaded by filename are detected by the presence of an appropriate extension (`.otf`, etc.), and paths should be included inline. E.g.:

```
\fontspec_font_if_exist:nTF {cmr10}{T}{F}
\fontspec_font_if_exist:nTF {Times~ New~ Roman}{T}{F}
\fontspec_font_if_exist:nTF {texgyrepagella-regular.otf}{T}{F}
\fontspec_font_if_exist:nTF {/Users/will/Library/Fonts/CODE2000.TTF}{T}{F}
```

(*End definition for* `\fontspec_font_if_exist:nTF`*. This function is documented on page* ??.)

The synonym `\IfFontExistsTF` is provided for 'document authors'.

`\fontspec_if_fontspec_font:TF` Test whether the currently selected font has been loaded by fontspec.

(*End definition for* `\fontspec_if_fontspec_font:TF`*. This function is documented on page* ??.)

`\fontspec_if_opentype:TF` Test whether the currently selected font is an OpenType font. Always true for LuaTeX fonts.

(*End definition for* `\fontspec_if_opentype:TF`. *This function is documented on page* ??.)

`\fontspec_if_small_caps:TF` Test whether the currently selected font has a 'small caps' face to be selected with `\scshape` or similar. Note that testing whether the font has the `Letters=SmallCaps` font feature is sufficient but not necessary for this command to return true, since small caps can also be loaded from separate font files. The logic of this command is complicated by the fact that fontspec will merge shapes together (for italic small caps, etc.).

(*End definition for* `\fontspec_if_small_caps:TF`. *This function is documented on page* ??.)

5.3.2 Availability of features

`\fontspec_if_aat_feature:nnTF` Test whether the currently selected font contains the AAT feature (`#1`,`#2`).

(*End definition for* `\fontspec_if_aat_feature:nnTF`. *This function is documented on page* ??.)

`\fontspec_if_feature:nTF` Test whether the currently selected font contains the raw OpenType feature `#1`. E.g.: `\fontspec_if_feature:` Returns false if the font is not loaded by fontspec or is not an OpenType font.

(*End definition for* `\fontspec_if_feature:nTF`. *This function is documented on page* ??.)

`\fontspec_if_feature:nnnTF` Test whether the currently selected font with raw OpenType script tag `#1` and raw OpenType language tag `#2` contains the raw OpenType feature tag `#3`. E.g.: `\fontspec_if_feature:nnnTF {latn} {RO` Returns false if the font is not loaded by fontspec or is not an OpenType font.

(*End definition for* `\fontspec_if_feature:nnnTF`. *This function is documented on page* ??.)

`\fontspec_if_script:nTF` Test whether the currently selected font contains the raw OpenType script `#1`. E.g.: `\fontspec_if_script:nT` Returns false if the font is not loaded by fontspec or is not an OpenType font.

(*End definition for* `\fontspec_if_script:nTF`. *This function is documented on page* ??.)

`\fontspec_if_language:nTF` Test whether the currently selected font contains the raw OpenType language tag `#1`. E.g.: `\fontspec_if_language:nTF {ROM} {True} {False}`. Returns false if the font is not loaded by fontspec or is not an OpenType font.

(*End definition for* `\fontspec_if_language:nTF`. *This function is documented on page* ??.)

`\fontspec_if_language:nnTF` Test whether the currently selected font contains the raw OpenType language tag `#2` in script `#1`. E.g.: `\fontspec_if_language:nnTF {cyrl} {SRB} {True} {False}`. Returns false if the font is not loaded by fontspec or is not an OpenType font.

(*End definition for* `\fontspec_if_language:nnTF`. *This function is documented on page* ??.)

5.3.3 Currently selected features

`\fontspec_if_current_feature:nTF` Test whether the currently loaded font is using the specified raw OpenType feature tag `#1`. The tag string `#1` should be prefixed with `+` to query an active feature, and with a `-` (hyphen) to query a disabled feature.

(*End definition for* `\fontspec_if_current_feature:nTF`. *This function is documented on page* ??.)

`\fontspec_if_current_script:nTF` Test whether the currently loaded font is using the specified raw OpenType script tag `#1`.

(*End definition for* `\fontspec_if_current_script:nTF`. *This function is documented on page* ??.)

`\fontspec_if_current_language:nTF` Test whether the currently loaded font is using the specified raw OpenType language tag `#1`.

(*End definition for* `\fontspec_if_current_language:nTF`. *This function is documented on page* ??.)