

# 1 Typography

## 1.1 Introduction

Throughout the millennia humans have developed and adapted methods for storing facts and thoughts on a variety of different mediums. A very efficient way of doing this is using logograms, like Chinese have done for ages. Another method is to represent each syllable in a word by a symbol, like the Japanese do when writing telegrams. However, the most common way of storing characters is by using a limited set of shapes representing basic sounds (a.k.a. phonemes). Such a collection is called an *alphabet*, and the shapes are called *letters*.

T<sub>E</sub>X is primarily meant for typesetting languages that use this third method. The other two methods can also be dealt with, but some extra effort is needed. In this chapter we will focus on languages that use alphabets, the other methods will be explained in later chapters.

The shapes representing the characters that make up an alphabet are more or less standardized, and thereby can be recognized by readers even if their details differ. A collection of pictures matching character shapes is called a *font*, and the pictures in a font are called *glyphs*.

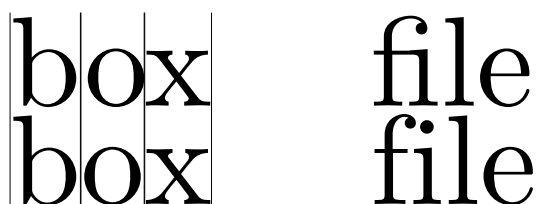


From left to right you see a Computer Modern font, a Helvetica lookalike, a Times Roman lookalike and the Antiqua Torunska font, all scaled to 60pt. As you can see, quite some variation is possible and when intermixed, the result is not always pleasing to look at. The term *fonts collection* refers to a set of fonts combined together in such a way that the overall appearance on a page looks good and reading is as comfortable as possible.



Even within a single font design there can be variations. In the example above there are a light, a bold, an italic, and a bold italic *alternative* of a single font. Such a set of fonts with the same basic design is known as a *font family*.

The distance between the individual glyphs in a word and the actual glyphs that are used depends on the combinations of these glyphs. In the top line of the next sample, the gap between the b and the o as well as the distance between the o and the x is slightly altered. This is called  *Kerning*. Further, the separate glyphs for the f and the i have been combined into a single one. This is called *ligaturing*.



The font shown here is Computer Modern, the default T<sub>E</sub>X font. This font is designed by Donald Knuth. The Computer Modern has many kerning pairs, while the Palatino-like font that is used for most of the text in this manual has only a few, while both have essentially the same list of ligatures.

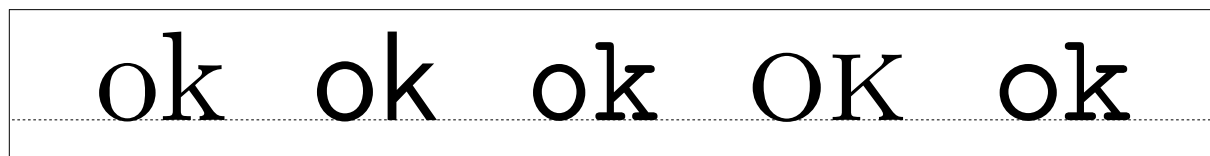
Micro-typography like kerning pairs and ligatures are not to be altered by the user, they are part of the font design and the required data is stored inside the font file, together with the drawing routines for the actual pictures. It *is* possible for the user to alter fonts and interline spacing and some more aspects on the level of macro-typography. The choice of font is the main topic of this chapter.

There are many different methods that can be used to classify fonts. There are classification systems based on the period in which the style was first developed; on the characteristics of the font; or the font application, like a newspaper or a book. Often, classification systems mix these characteristics up to some point.

For example, the Computer Modern family can be classified as a ‘modern’ font. This is a classification that primarily indicates a period (late 18<sup>th</sup> century), but it also implies a particular shape: ‘modern’ fonts have a high contrast between thick and thin strokes, and their stress axis is perfectly vertical.

At the same time, specific fonts in the Computer Modern family can be classified as ‘serif’ (glyphs strokes have embellishments at the end), ‘sans serif’ (shapes end abruptly), or ‘mono-spaced’ (all glyphs have the same width).

The Computer Modern family is in fact inspired by one font in particular: ‘Modern 8a’ by the Monotype corporation. Knuth implemented Computer Modern in METAFONT using parameters so that he could generate a whole collection of fonts all closely matching each other in style. In CONTEX<sub>T</sub> you will normally use a reimplementation of Computer Modern using a more modern file format (Type 1 or OpenType). This new version is called ‘Latin Modern’, and also features an extended glyph set making it usable for languages that could not be typeset with Knuth’s original fonts.



In this example you see five font styles of Latin Modern: the Roman, Sans, Typewriter, Smallcaps and Variable Typewriter. Computer Modern is one of the few font families that comes with dedicated design sizes. The example below shows the differences of a 5, 7, 9, 12 and 17 point design scaled up to 48 points. Such nuances in font size are seldom seen these days.



As explained earlier, the general appearance of a font style can be classified according to many schemes. In table 1.1 you can see some examples of the naming of font styles that are often found together in a single document.

Serif	Sans	Mono
Regular	Support	TeLeType
Roman	Sans	Type

**Table 1.1** Some ways of classifying the styles in a font.

The top two series are normally used by typographers, the bottom series is what was traditionally used in plain T<sub>E</sub>X. In C<sub>ON</sub>T<sub>E</sub>X<sub>T</sub> all three series of terms can be used because they are remapped to the same set of internal commands. As will be explained later, the command `\rm` is used to switch to a roman/serif/regular style, and `\tt` for switching to mono spaced or typewriter style, etcetera.

Text can be typeset in different font sizes. The unit pt is often used to specify the size. The availability of these font sizes are defined in definition files. Traditionally font designers used to design a glyph collection for each font size, but nowadays most fonts have a single design size of 10 points, or small set of sizes with names indicating their proposed use, like *caption*, *text*, and *display*.

The next sections will go into the details of switching of font styles and fonts in your documents. Be warned that the font switching mechanism is rather complex. This is caused by the different modes like math mode and text mode in C<sub>ON</sub>T<sub>E</sub>X<sub>T</sub>. If you want to be understand the mechanism fully, you will have to acquaint yourself with the concept of encoding vectors and obtain some knowledge on fonts and their peculiarities.

## 1.2 The mechanism

Font switching is one of the eldest features of C<sub>ON</sub>T<sub>E</sub>X<sub>T</sub> because font switching is indispensable in a macro package. During the years extensions to the font switching mechanism were inevitable. The following starting points have been chosen during the development of this mechanism:

- To change a *style* must be easy, this means switching to: roman (serif, regular), sans serif (support), teletype (monospaced) etc. (`\rm`, `\ss`, `\tt` etc.)
- More than one *alternative* set of glyphs shapes must be available like slanted and bold (`\sl` and `\bf`).

- Different font *families* like Latin Modern Roman and Lucida Bright must be supported.
- It must be possible to combine different families into font *collections*.
- Different sub- and superscripts must be available. These script sizes have to be retained across the switching of family, style and alternative.
- It should be possible to combine all of these requirements into a single definition unit called a *body font*.
- Changing the global font collection as well as the size must also be easy, and so sizes between 8pt and 14.4pt must be available by default.

Before reading further, please stop for a moment to make sure you thoroughly comprehend the above paragraphs. CONTEX's terminology probably differs from what you are accustomed to, especially if you were previously a L<sup>A</sup>T<sub>E</sub>X user.

## 1.3 Font switching

The mechanism to switch from one style to another is somewhat complex, not in the least because the terminology is a bit fuzzy. A quick recap: we call a collection of fonts, like Lucida or Computer Modern Roman, a *family*. Within such a family, the members can be grouped according to characteristics. Such a group is called a *style*. Examples of styles within a family are: 'roman', 'sans serif' and 'teletype'. We saw already that there can be alternative classifications, but they all refer to the presence of serifs and the glyphs having equal widths. Within a style there can be *alternatives*, like 'boldface' and 'slanted'.

There are different ways to change into a new a style or alternative. You can use `\ss` to switch to a sans serif font style and `\bf` to get a bold alternative. When a different style is chosen, the alternatives adapt themselves to this style. Often a document will be typeset using just one combination of family and style. This is called the *bodyfont*.

Consistent use of commands like `\bf` and `\sl` in the text will automatically result in the desired bold and slanted alternatives when you change the family or style in the setup area of your input file.

### 1.3.1 Font style switching

Switching to another font style is done by one of five two-letter commands that are listed in table 1.2.

<code>\rm</code>	serif, regular, roman, rm
<code>\ss</code>	sans, support, sansserif, ss
<code>\tt</code>	mono, type, teletype, tt
<code>\hw</code>	handwritten, hw
<code>\cg</code>	calligraphic, cg
<code>-</code>	mm

**Table 1.2** Font style switching commands

The 'handwritten' and 'calligraphic' font styles are sometimes useful when dealing with very elaborate document layout definitions. In the CONTEX distribution, only the Lucida font family

uses these styles, in any other font set they are simply ignored. You could use them in your own font setups if you so desire (see the next chapter for font setup definitions).

There is a sixth internal style that is only ever referenced as ‘mm’. This style handles math fonts. It does not make sense to use this style directly so there is no command attached to it, but it is quite important internally so it makes sense to introduce it right away.

### 1.3.2 Font alternative switching

The alternatives within a style are given in table 1.3. Not all fonts have both italic and slanted or the bold alternatives of each. Some other fonts do not have small caps or only one set of digits. When an alternative is not known, CONTEX<sub>T</sub> will attempt to choose a suitable replacement automatically. For instance, the italic alternative may be used for if slanted is not available or vice versa.

<code>\bf</code>	bold
<code>\sl</code>	slanted
<code>\it</code>	italic
<code>\bs</code>	boldslanted, slantedbold
<code>\bi</code>	bolditalic, italicbold
<code>\sc</code>	smallcaps
<code>\os</code>	mediaeval (from <i>oldstyle</i> )
<code>\tf</code>	normal (from <i>typeface</i> )

**Table 1.3** Font alternative switching commands and their keyword equivalents. With `\os` you tell CONTEX<sub>T</sub> that you prefer mediaeval or old–style numbers as in 139 over 139.

Besides these two-letter commands, there is a series of font selector commands with a suffix attached. Some examples of that are:

```
\tfx \bfx \slx \itx
\tfa \tfb \tfc \tfd \tfxx
```

Each of the ordered alphabetic suffixes a, b, ... select a somewhat larger actual font than the previous one. The x and xx suffixes select smaller and yet smaller versions.

<code>\bfx</code>	smallbold
<code>\slx</code>	smallslanted
<code>\itx</code>	smallitalic
<code>\bsx</code>	smallboldslanted, smallslantedbold
<code>\bix</code>	smallbolditalic, smallitalicbold
<code>\tfx</code>	small, smallnormal

**Table 1.4** Small alternative switching commands and their keyword equivalents.

Besides the ‘small’ switches that are mentioned in table 1.4, it depends on the completeness of the font definition files whether commands like `\ita`, `\bfxx`, `\bfc`, etc. are available. For

the core `CONTEX`T fonts, you can count on at least `\tfa`, `\tfb`, `\tfc`, `\tfd`, and `\tfxx` being defined. For the others, just try and see what happens.

When you have chosen a larger charactersize, for example `\tfb`, then `\tf` equals `\tfb`, `\bf` equals `\bfb`, etc. This method is almost always preferable over returning to the original character size, but it may catch you off-guard.

More generic font scaling commands are also available:

```
\tx \txx
\setsmallbodyfont \setbigbodyfont
```

The command `\tx` adapts itself to both the style and the alternative. This command is rather handy when one wants to write macros that act like a chameleon. Going one more step smaller, is possible too: `\txx`. Using `\tx` when `\tx` is already given, is equivalent to `\txx`.

The commands `\setsmallbodyfont` and `\setbigbodyfont` switch to the ‘small’ and ‘big’ body font sizes. These relative sizes are defined via the ‘body font environment’, see section 1.8.

The various commands will adapt themselves to the actual setup of font and size. For example:

```
{\rm test {\sl test} {\bf test} \tfc test {\tx test} {\bf test}}
{\ss test {\sl test \tx test} {\bf test \tx test}}
```

will result in:

```
test test test test test test
test test test test test
```

When the `\rm` style is active, `CONTEX`T will interpret the command `\tfd` as if it was `\rmd`, when the style `\ss` is active, `\tfd` as is treated as `\ssd`. All default font setups use `tf`-setups so they will automatically adapt to the current font style.

The remainder of this paragraph is for completeness’ sake only. Use of the following commands in new documents is discouraged.

Frequent font switching leads to longer processing times. When no sub- or superscripts are used and you are very certain what font you want to use, you can perform fast font switches with: `\rmsl`, `\ssbf`, `\tttf`, etc.

The plain `TEX` compatible font switches `\vi`, `\vii`, `\viii`, `\ix`, `\x`, and `\xii` are also defined, these have local effects like `\tfx` and `\tfa`.

### 1.3.3 Switching font styles in setup commands

A number of `CONTEX`T commands use the parameter `style` to set the used font. The parameter mechanism is rather flexible so that within the parameter `style` you can use any of the font switching commands like `or` `bf` or `\switchtobodyfont`, but also a number of keywords like

```
normal bold slanted boldslanted italic bolditalic type
small smallbold smallslanted ... smallitalic ... smalltype
capital
```

Most of these keywords have already been listed in the tables 1.3 and 1.4, but a few predefined ones are still missing. These are displayed in table 1.5, together with the commands they execute. As is normal in `CONTEX`T, you can extend the list of accepted keywords by defining your own. This will be explained in section ?? in the next chapter.

<code>\tt</code>	type, mono
<code>\ttx</code>	smalltype
<code>\ss</code>	sans, sansserif
<code>\ss \bf</code>	sansbold
<code>\setsmallbodyfont</code>	smallbodyfont
<code>\setbigbodyfont</code>	bigbodyfont
<code>\smallcapped</code>	cap, capital
<code>\WORD</code>	WORD

Table 1.5 Remaining font alternative keywords.

## 1.4 Line spacing

In  $\text{\TeX}$  linespacing is determined by a number of variable dimensions like `\topskip`, `\parskip` and `\baselineskip`. However, in  $\text{\CONTEXT}$  these variables are related to the bodyfont size.

A line has a height and a depth. The distance between two lines is normally equal to the sum of the maximum height and maximum depth:

$$\blacksquare + \blacksquare = \blacksquare$$

This sum is in  $\text{\CONTEXT}$  equal to  $2.8ex$ , so almost three times the height of an  $x$ . This is about  $1.2\times$  the bodyfont height. The proportion between maximum height and depth is default  $.72 : .28$ . Linespacing alters when a new bodyfont is used or when linespacing is defined explicitly by:

`\bfd \setupinterlinespace` Now, the interline spacing is larger ... `\par`

One has to consider the fact that  $\text{\TeX}$  operates on paragraphs and within a group one has to close the paragraph explicitly with an empty line or `\par`. However, in most cases  $\text{\CONTEXT}$  will take care of this.

Sometimes a line does not have the maximum height or depth. The next example illustrates this:

`\bf The height and depth of lines differs.`

It says:

The height and depth of lines differs.

When we put two of these lines above each other we will get:

`\bf The height and depth of lines differs.`  
`\bf The height and depth of lines differs.`

You can see that the distance is somewhat bigger than the sum of the height and depth of each separate line. This distance is called the baseline distance (`\baselineskip`) and is in this document  $14.4452pt$ . If we add some extra height to the line we see this:

`\bf The height and depth of lines differs.`  
`\bf The height and depth of lines differs.`

To prevent the lines from touching  $\text{\TeX}$  adds a  $\text{\lineskip}$ , in our example 1.0pt. In a similar way  $\text{\TeX}$  is taking care of the first line of a page to have at least a height of  $\text{\topskip}$  (here 11.0pt plus 55.0pt).

Linespacing is set up by:

```
\setupinterlinespace [...]  
                        OPTIONAL  
*   reset  small  medium  auto  big  on  off
```

Linespacing adapts to the size of the actual bodyfont automatically. This means that the user can leave this command untouched, unless a different linespacing is wanted. Instead of a factor one of the predetermined values `small` (1.0), `medium` (1.25) or `big` (1.5) can be given. Below an example is given of a text with a linespacing of 1.25:  $\text{\setupinterlinespace[medium]}$ .

Whenever it comes to my mind that “everything that comes in quantities, will somehow survive”, I also got the feeling that in a few hundred years people will draw the saddening conclusion that all those top–ten hits produced by computers represent the summum of todays musical and instrumental abilities. Isn’t it true that archeologists can spend a lifetime on speculating about some old coins from the first century? On the other hand, the mere fact that one can have success with this type of non–music success of some top–hit musicians demonstrates both the listeners inability to rate the product and the lack of self criticism of the performers. In principle the future archeologist will therefore draw the right conclusion.

When you make a fontswitch the linespacing is adapted when you give the command  $\text{\setupinterlinespace}$  without any setup parameters and also when you add the key `reset`, for example

```
\setupinterlinespace[reset,medium]
```

The text below is typeset in the fontsize  $\text{\tfa}$ , using the following input:

```
\start \tfa \setupinterlinespace  
In books meant for children we often find  
a somewhat ... when needed. \par \stop
```

In this example the  $\text{\par}$  is necessary because otherwise  $\text{\TeX}$  will have forgotten the linespacing before the paragraph is finished (in that case, the paragraph is ended by the empty line after the  $\text{\stop}$ ).

In books meant for children we often find a somewhat bigger typeface, for instance because we are convinced that this enables them to read the book themselves. On the other hand, I can also imagine that it is a cheap way to increase the number of pages. Unfortunately scaling up will also uncover the lack of quality of the typesetting used and/or the lack of



typographic knowledge of the user of such a system. The interline space sometimes differs on a line by line basis, and depends on the **height** of the current line. Therefore, when changing the style, something that should only be done on purpose, also change the baseline distance when needed.

Instead of a keyword, one can pass a key–value pair to define the characteristics of a line.

*unknown setup 'setupinterlinespace2'*

The default settings are:

```
\setupinterlinespace
  [height=.72,
   depth=.28,
   top=1.0,
   bottom=0.4,
   line=2.8ex]
```

The `height` and `depth` determine the ratio between the height and depth of a line. The baseline distance is set to 2.8ex. The parameters `top` and `bottom` specify the relation between the bodyfont size and the height of the first line and the depth of the last line on a page. The last two quantities are related to T<sub>E</sub>X's `\topskip` and `\maxdepth`.

We will see later that instead of setting the spacing at the document level, i.e. for each font, you can set the spacing per body font environment:

```
\setupbodyfontenvironment
  [modern] [12pt]
  [interlinespace=14pt]
```

## 1.5 Emphasize

Within most macropackages the command `\em` is available. This command behaves like a chameleon which means that it will adapt to the actual typeface. In CON<sub>T</sub>E<sub>X</sub>T `\em` has the following characteristics:

- a switch to *slanted* or *italic* is possible
- a switch within `\bf` results in ***slanted*** or ***italic*** (when available)
- a so called *italic correction* is performed automatically (`\/`)

The bold italic or bold slanted characters are supported only when `\bs` and `\bi` are available.

The mnemonic `{\em em}` means `{\em emphasis}`.

`{\em The mnemonic {\em em} means {\em emphasis}.}`

`{\bf The mnemonic {\em em} means {\em emphasis}.}`

`{\em \bf The mnemonic {\em em} {\em emphasis}.}`

`{\it The mnemonic em {\em means \bf emphasis}.}`

`{\sl The mnemonic em {\em means \bf emphasis}.}`

This results in:

The mnemonic *em* means *emphasis*.

The *mnemonic em* means emphasis.

**The mnemonic *em* means *emphasis*.**

**The *mnemonic em* emphasis.**

The *mnemonic em* means **emphasis**.

The *mnemonic em* means **emphasis**.

The advantage of the use of `\em` over `\it` and/or `\sl` is that consistent typesetting is enforced.

By default emphasis is set at *slanted*, but in this text it is set at *italic*. This setting is made via `\setupbodyfontenvironment`, see section 1.8 for more details:

```
\setupbodyfontenvironment
  [default]
  [em=italic]
```

## 1.6 Capitals

Words and abbreviations can be typeset in capitals. Both small and big characters are converted into capitals. When `\cap` is used to typeset a capital the size is that of an `\tx`. When you switch to slanted (`\sl`), bold (`\bf`), etc. the capital letter will also change. Since `\cap` has a specific meaning in math mode, the formal implementation is called `\smallcapped`. However in text mode one can use `\cap`.

```
\cap {...}
```

```
* TEXT
```

```
\Cap {...}
```

```
* TEXT
```

```
\CAP {...}
```

```
* TEXT
```

```
\Caps {... ..}
```

```
* WORD
```

The first command converts all letters to a capital. You are advised not to type capital letters in your source file because real small caps distinguishes between small and big letters.

Capitals for `\cap {UK}` are `\cap {OK}` and capitals for `\cap {USA}` are okay. But what about capitals in `\cap {Y2K}`.

this results in:

Capitals for UK are OK and capitals for USA are okay. But what about capitals in Y2K.

A `\cap` within a `\cap` will not lead to any problems:

`\cap {People that have gathered their \cap {capital} at the cost of other people are not seldom \nocap {decapitated} in revolutionary times.}`

or:

PEOPLE THAT HAVE GATHERED THEIR CAPITAL AT THE COST OF OTHER PEOPLE ARE NOT SELDOM decapitated IN REVOLUTIONARY TIMES.

In this example you can see that `\cap` can be temporarily revoked by `\nocap`.

```
\nocap {...}
```

```
* TEXT
```

The command `\Cap` changes the first character of a word into a capital and `\CAP` changes letters that are preceded by `\\` into capital letters. With `\Caps` you can change the first character of several words into a capital letter.

```
\setupcapitals [...,*=,...]
```

```
* title = yes no
  sc     = yes no
```

With this command the capital mechanism can be set up. The key `sc=yes` switches to real SMALL CAPS. The key `title` determines whether capitals in titles are changed.

Next to the former `\cap`-commands there are also:

```
\Word {...}
```

```
* WORD
```

and

```
\Words {...*...}
```

```
* WORD
```

These commands switch the first characters of a word or words into capitals. All characters in a word are changed with:

```
\WORD {...}
```

```
* WORD
```

Let's end this section with real small capitals. When these are available the real small caps `\sc` are preferred over the pseudo-capital in abbreviations and logos.

In a manual on `\TeX` and `Con\TeX t` there is always the question whether to type `\cap{\TeX}` and `\cap{Con\TeX t}` or `{\sc \TeX}` and `{\sc Con\TeX t}`. Both are defined as a logo in the style definition so we type `\type {\TeX}` and `\type {\CONTEXT}`, which come out as `\TeX` and `\CONTEXT`.

Results in:

In a manual on `TEX` and `ConTEXt` there is always the question whether to type `TEX` and `CONTEXT` or `TEX` and `CONTEXT`. Both are defined as a logo in the style definition so we type `\TeX` and `\CONTEXT`, which come out as `TEX` and `CONTEXT`.

IT IS ALWAYS POSSIBLE TO TYPESET TEXT IN SMALL CAPITALS. HOWEVER, REALIZE THAT LOWER CASE CHARACTERS DISCRIMINATE MORE AND MAKE FOR AN EASIER READ.

An important difference between `\cap` and `\sc` is that the last command is used for a specific designed font type. The command `\cap` on the other hand adapts itself to the actual typeface: *KAP*, **KAP**, *KAP*, etc.

Some typesetting packages stretch words (inter character spacing) to reach an acceptable alignment. In `CONTEXT` this not supported. On purpose! Words in titles can be stretched by:

```
\stretched {...}
```

```
* WORD
```

```
\hbox to \hsize {\stretched{there\\is\\much\\stretch\\in ...}}
\hbox to 20em   {\stretched{... and\\here\\somewhat\\less}}
```

With `\\` you can enforce a space (`{}` is also allowed).

```
t h e r e   i s   m u c h   s t r e t c h   i n   . . .
. . . a n d   h e r e   s o m e w h a t   l e s s
```

These typographically non permitted actions are only allowed in heads. The macros that take care of stretching do this by processing the text character by character.

This chapter will not go into the details of underlining because using underlining for typographical purposes is a bad practice. Instead, the commands related to under- and overlining are discussed in section ?? ("???").

## 1.7 Selecting bodyfonts

The bodyfont (main font), font style and size is set up with:

```
\setupbodyfont [...,*,...]

*   IDENTIFIER serif regular roman sans support sansserif mono type teletype
    handwritten calligraphic 5pt ... 12pt
```

In a running text a temporary font switch is done with the command:

```
\switchtobodyfont [...,*,...]

*
```

This command doesn't change the bodyfont in headers and footers. With `small` and `big` you switch to a smaller or larger font.

In most cases, the command `\setupbodyfont` is only used once: in the style definition, and font switching inside the document is done with `\switchtobodyfont`. Don't confuse these two because that may lead to some rather strange but legitimate effects.

### 1.7.1 Body font sizes

Body font sizes actually consist of two components. Of course if you specify a size it directly specifies the size at which the main font is loaded, but a number of indirect parameters have to taken care of as well. Think of things like the font size used in headers, footers, footnotes, sub- and superscripts, as well as the interline space and a few others.

This is why in `CONTEXT` there is the concept of a *body font environment* (expressed as a dimension), and that is what you pass as an argument to `\setupbodyfont` or `\switchtobodyfont`. The definitions as presented above use the indication `5pt ... 12pt` for the body font environment, but actually any dimension is acceptable.

The most frequently used sizes are predefined as body font environments: `4pt ... 12pt`, `14.4pt`, and `17.3pt`. But when you use a different, not-yet-defined size specification —for example for a titlepage— `CONTEXT` will define a body font environment for that size automatically. While doing so, `CONTEXT` normally works with a precision of 1 decimal to prevent unnecessary loading of font sizes with only small size differences.

Be warned that in this case, the results may be a less than ideal. The reason is that `CONTEXT` not just has to load the actual font, but it also has to guess at the various other settings like the relative font sizes and the interline space. It does so by using the values from the nearest smaller body font environment that is already defined.

You can extend the list of predefined body font environments and even alter the precision in body font matching. See the section 1.8 for detailed information about how to tweak or define your own body font sizes.

To end this section, the example below demonstrates how the interline space is adapted automatically, when changing the size of the bodyfont. Consider this input:

```
{\switchtobodyfont[14.4pt] with these commands \par}
{\switchtobodyfont[12pt] for font switching \par}
```

```
{\switchtobodyfont[10pt] it is possible to \par}
{\switchtobodyfont[8pt] produce an eyetest: \par}
{\switchtobodyfont[6pt] a x c e u i w m q p \par}
```

The actual `CONTEXT` behaviour is shown below on the left. On the right you can see what would have happened if the interline space were not automatically adapted.

with these commands

for font switching

it is possible to  
produce an eyetest:  
a x c e u i w m q p

with these commands

for font switching

it is possible to  
produce an eyetest:  
a x c e u i w m q p

## 1.7.2 Body font identifiers

In the definition block of `setupbodyfont` there was a list of words given besides the special marker `IDENTIFIER`. These words are the symbolic `CONTEXT` names for the font styles that we ran into earlier, with a few aliases so that you do not have to worry about the actual naming convention used. The symbolic names are mapped to two-letter internal style abbreviations that are used internally, see table 1.2 for an overview.

Although the macro syntax does not say so, you can use two-letter internal style abbreviations (`ss`, `rm`) as well as the longer names, if you prefer.

We have seen already that there are other and easier ways to switch the font style, so if `\setupbodyfont` could only be used for this purpose it would not be all that useful. But luckily there is more: the optional `IDENTIFIER` can be a ‘body font name’ (aka ‘typeface’). Such names have to be predefined, perhaps in a font support file, or simply on earlier lines in the style definition.

A ‘typeface’ is a symbolic name that links a single font style to actual font families. Such symbolic names are typically grouped together in a definition block that sets up values that link the four styles `\rm`, `\ss`, `\tt` and `\mm` to fonts in a ‘font collection’, and such definition blocks are called ‘typescripts’.

`CONTEXT` expects you to define your own font setups, but there are quite a few examples predefined in various typescript files. Not all of those are perpetually loaded, so you usually have to execute a typescript explicitly to get the typeface names predefined. To this end, typescripts *themselves* also have names.

Executing a typescript is done by `\usetypescript`. We will get back to `\usetypescript` later because it is in fact a very flexible command, but let’s discuss simple usage first.

```
\usetypescript [.1.] [.2.]
                  OPTIONAL
1 IDENTIFIER
2 IDENTIFIER
```

A typical input sequence for selecting the predefined ‘palatino’ set of typefaces in `MkII` will look like this:

```
\usetypescript[palatino][ec]
\setupbodyfont[palatino,12pt]
```

In this example the typescript named `palatino` is asked for in the `ec` font encoding, and that defines a set of typefaces under the name `palatino`. These are then used by `\setupbodyfont` and eventually this makes `PDFTEX` load the free Type 1 font URW Palladio in the correct encoding. URW Palladio is a font that looks a lot like the commercial font Linotype Palatino by Hermann Zapf, which explains the name of the typescript and typefaces.

Font encodings will be handled fully in the section 1.14. For now, please take for granted the fact that `PDFTEX` needs a second argument to `\usetypescript` that specifies an encoding name, and that there is a fixed set of acceptable names that depends on the typescript that is being requested.

In `XYTEX` and `MKIV` the situation is a little bit different because fonts are reencoded to match Unicode whenever that is possible. That in turn means that `XYTEX` and `MKIV` prefer to use OpenType fonts over Type 1 fonts, so different typescript definitions are used behind the scenes, and the second argument to `\usetypescript` becomes optional.

For example,

```
\usetypescript[palatino]
\setupbodyfont[palatino,12pt]
```

will make `XYTEX` and `LUATEX` load the OpenType font Pagella. This is a free font from the `TEX` Gyre project, that also looks just like the commercial font Linotype Palatino. You may as well leave the second argument in place: while it will always be ignored by `LUATEX`, `XYTEX` will actually use that encoding if the typescript uses Type 1 fonts instead of the more modern OpenType or TrueType font formats.

All predefined typescripts attach meaning to (at least) the three basic text font styles, so you can e.g. do this:

```
\usetypescript[times][ec]
\setupbodyfont[times,sans,12pt]
```

and end up using the OpenType font `TEX` Gyre Heros or the Type 1 font URW Nimbus Sans L. Both fonts are very similar in appearance to Linotype Helvetica, by the way.

The typescripts that come with the `CONTEXT` distribution are placed in source files that have names that start with `type-`. Some of these files are automatically loaded when needed, but most have to be loaded explicitly. There is a list in table 1.6

Some of the internal building blocks for typescripts are themselves located in yet other files (font size and font map file information, for example). Normally, when `CONTEXT` has to load typescript information from files, it will try to save memory by only executing the typescript it needs at that moment and discarding all other information. If you have enough memory at your disposal, you can speed up typescript use considerably by adding

```
\preloadtypescripts
```

in your preamble or your `cont-usr.tex`. This will make `CONTEXT` store all the typescript information in internal token registers the first (and therefore only) time it loads the actual files.

File	Loaded by PDF $\TeX$	Loaded by $\LaTeX$	Loaded by MkIV	Description
type-akb	no	no	no	PostScript fonts using psnfss names (Type 1)
type-buy	no	no	no	Various commercial fonts (Type 1)
type-cbg	no	no	no	Greek free fonts (Type 1)
type-cow	no	no	no	The CON $\TeX$ T cow font (Type 1)
type-exp	no	no	no	Commercial Zapf fonts (OpenType)
type-fsf	no	no	no	Commercial Fontsite 500 fonts (Type 1)
type-ghz	no	no	no	Commercial Zapf fonts (Type 1)
type-gyr	no	no	no	The $\TeX$ Gyre project fonts (Type 1)
type-hgz	no	no	no	Commercial Zapf fonts (OpenType)
type-msw	no	no	no	Fonts that come with Microsoft Windows (Type 1)
type-omg	no	no	no	Omega free fonts (Type 1)
type-one	yes	no	no	Various free fonts (Type 1)
type-otf	no	yes	yes	Various free fonts (OpenType)
type-xtx	no	yes	no	Fonts that come with MacOSX (OpenType)

**Table 1.6** The typescript source files that are part of CON $\TeX$ T.

Explicit loading one of those files is done via the macro `\usetypescriptfile`.

The predefined typescripts, the typefaces they define, the files they are contained in inside the CON $\TeX$ T distribution, and the encodings they support in MkII mode are listed in table 1.7. In the following section there is a table (1.8) that explains for each typescript what font set it attaches to each of the font styles.

```
\usetypescriptfile [...]
```

```
* IDENTIFIER
```

For example, the following

```
\usetypescriptfile[type-buy]
\usetypescript[lucida][texnansi]
\setupbodyfont[lucida,12pt]
```

will make PDF $\TeX$  use the Lucida Bright font family. Because this is a commercial font, this only works correctly if you have actually bought and installed the fonts. This uses the `texnansi` encoding because that is the preferred encoding of the actual fonts.

This is a good moment to explain a little trick: because the various `type-xxx` files define the building blocks for typescripts as well as the actual typescripts, it is sometimes possible to alter the effect of a typescript by loading an extra typescript file. For example,

```
\usetypescriptfile[type-gyr]
\usetypescript[palatino][ec]
\setupbodyfont[palatino,12pt]
```

will result in PDF $\TeX$  using the Type 1 font Pagella from the  $\TeX$  Gyre project instead of the older and less complete URW Palladio, because the definition of the building blocks for the `palatino` typescript that is in the `type-gyr` file overwrites the preloaded definition from the `type-one` file.



Typescript	Typeface	File	Encodings
OmegaLGC	omlgc	type-omg	(unspecified)
antykwa-torunska	antykwa	type-one, type-otf	texnansi,ec,8r,t2a
cbgreek	cbgreek	type-cbg	(unspecified)
cbgreek-all	cbgreek-all	type-cbg	(unspecified)
cbgreek-medium	cbgreek-medium	type-cbg	(unspecified)
cow	cow	type-cow	default
fourier	fourier	type-one	ec
iwona	iwona	type-one, type-otf	texnansi,ec,8r,t2a
iwona-heavy	iwona-heavy	type-one, type-otf	texnansi,ec,8r,t2a
iwona-light	iwona-light	type-one, type-otf	texnansi,ec,8r,t2a
iwona-medium	iwona-medium	type-one, type-otf	texnansi,ec,8r,t2a
<b>lucida</b>	lucida	type-buy	texnansi,ec,8r
<b>lucidabfm</b>	lucida	type-buy	texnansi,ec,8r
<b>lucidabfm</b>	lucidabfm	type-buy	texnansi,ec,8r
<b>lucidaboldmath</b>	lucida	type-buy	texnansi,ec,8r
<b>lucidaboldmath</b>	lucidaboldmath	type-buy	texnansi,ec,8r
modern	modern	type-one, type-otf	texnansi,ec,qx,t5,default
modern-base	modern	type-one, type-otf	texnansi,ec,qx,t5,default,t2a/b/c
modernvariable	modernvariable	type-one, type-otf	texnansi,ec,qx,8r,t5
<b>optima</b>	optima	type-one	texnansi,ec,qx
<b>optima</b>	optima	type-ghz	texnansi,ec,qx
<b>optima-nova</b>	optima	type-ghz, type-hgz	texnansi,ec
<b>optima-nova-os</b>	optima-os	type-ghz, type-hgz	texnansi,ec
<b>palatino</b>	palatino	type-hgz	(cannot be used in MkII)
<b>palatino</b>	palatino	type-one, type-otf	texnansi,ec,qx,8r,t5
<b>palatino-informal</b>	palatino-informal	type-hgz	(cannot be used in MkII)
<b>palatino-light</b>	palatino-light	type-exp	(cannot be used in MkII)
<b>palatino-medium</b>	palatino-medium	type-exp	(cannot be used in MkII)
<b>palatino-normal</b>	palatino-normal	type-exp	(cannot be used in MkII)
<b>palatino-nova</b>	palatino	type-hgz	(cannot be used in MkII)
<b>palatino-sans</b>	palatino	type-hgz	(cannot be used in MkII)
postscript	postscript	type-one, type-otf	texnansi,ec,qx,8r,t5
sheep	sheep	type-cow	default
times	times	type-one, type-otf	texnansi,ec,qx,8r,t5

**Table 1.7** The typescripts. Typescripts that use commercial fonts are typeset in bold.

Two of the files in the CON<sub>T</sub>E<sub>X</sub>T distribution exist precisely for this reason:

`type-gyr.tex`

maps the typical PostScript font names for the free URW fonts to the T<sub>E</sub>X Gyre set;

`type-akb.tex`

maps the same names to the commercial Adobe fonts.

For the definitions in the second file to work, you also need to execute an extra typescript:

```
\usetypescriptfile [type-akb]
\usetypescript [adobekb] [ec]

\usetypescript [palatino] [ec]
\setupbodyfont [palatino,12pt]
```

### 1.7.3 Typeface definitions

Defining a typeface goes like this:

```
\starttypescript [palatino] [texnansi,ec,qx,t5,default]
\definetypeface[palatino] [rm] [serif][palatino] [default]
\definetypeface[palatino] [ss] [sans] [modern] [default] [rscale=1.075]
\definetypeface[palatino] [tt] [mono] [modern] [default] [rscale=1.075]
\definetypeface[palatino] [mm] [math] [palatino] [default]
\stoptypescript
```

This defines a typescript named `palatino` in five different encodings. When this typescript is executed via `\usetypescript`, it will define four typefaces, one of each of the four basic styles `rm`, `ss`, `tt`, and `mm`.

```
\definetypeface [.1.] [.2.] [.3.] [.4.] [.5.] [.6.]
                                OPTIONAL OPTIONAL
1  TEXT
2  rm ss tt mm hw cg
3  IDENTIFIER
4  IDENTIFIER
5  IDENTIFIER
6  features = IDENTIFIER
    rscale  = NUMBER
    encoding = IDENTIFIER
    text    = IDENTIFIER
```

The third and fourth arguments to `\definetypeface` are pointers to already declared font sets, these are defined elsewhere. Table 1.8 gives the full list of predefined typescripts (the first argument of `\starttypescript`) and font sets that are attached to the styles (the third and fourth argument of each `\definetypeface`).

The names in the third argument (like `serif` and `sans`) do *not* have the same meaning as the names used in `\setupbodyfont`. Inside `\setupbodyfont`, they were keywords that were internally remapped to one of the two-letter internal styles. Inside `\definetypeface`, they are nothing more than convenience names that are attached to a group of fonts by the person that wrote the font definition. They only reflect a grouping that the person believed that could be a single font style. Oftentimes, these names are identical to the official style keywords, just as the typescript and typeface names are often the same, but there can be (and are) different names altogether.

How to define your own font sets will be explained in the next chapter, but there are quite a few predefined font sets that come with `CONTEX`T; these are all listed in the four tables 1.9, 1.10, 1.11, and 1.12.

For everything to work properly in MKII, the predefined font sets also have to have an encoding attached, you can look those up in the relevant tables as well.

Typescript	Style <b>rm</b>	Style <b>ss</b>	Style <b>tt</b>	Style <b>mm</b>
OmegaLGC	omega	–	omega	–
antykwa-torunska	antykwa-torunska	modern	modern	antykwa-torunska
cbgreek	cbgreek	cbgreek	cbgreek	–
cbgreek-all	cbgreek	cbgreek	cbgreek	–
cbgreek-medium	cbgreek	cbgreek	cbgreek	–
cow	cow	cow serif	modern	cow
fallback	modern	modern	modern	modern
fourier	fourier	modern	modern	fourier
iwona	modern	iwona	modern	iwona
iwona-heavy	modern	iwona-heavy	modern	iwona-heavy
iwona-light	modern	iwona-light	modern	iwona-light
iwona-medium	modern	iwona-medium	modern	iwona-medium
lucida	lucida	lucida	lucida	lucida
lucidabfm	lucida	lucida	lucida	lucida bfm
lucidaboldmath	lucida	lucida	lucida	lucida boldmath
modern	modern	modern	modern	modern
modern-base	(computer-)modern	(computer-)modern	(computer-)modern	(computer-)modern
modernvariable	simple	modern	modern	modern
optima	palatino	optima-nova	modern	palatino
optima-nova	optima-nova sans	optima-nova	latin-modern	latin-modern
optima-nova-os	optima-nova-os sans	optima-nova-os	latin-modern	latin-modern
palatino	palatino-nova	palatino-sans	latin-modern	latin-modern
palatino	palatino	modern	modern	palatino
palatino-informal	palatino-nova	palatino-informal	latin-modern	latin-modern
palatino-light	palatino-nova	palatino-sans-light	latin-modern	latin-modern
palatino-medium	palatino-nova	palatino-sans-medium	latin-modern	latin-modern
palatino-normal	palatino-nova	palatino-sans-normal	latin-modern	latin-modern
palatino-nova	palatino-nova	palatino-sans	latin-modern	latin-modern
palatino-sans	palatino-nova	palatino-sans	latin-modern	latin-modern
postscript	times	helvetica	courier	times
sheep	sheep	sheep serif	modern	sheep
times	times	helvetica	modern	times

**Table 1.8** The typescripts.

Unless stated otherwise, style **rm** uses a group named serif, style **ss** uses sans, style **tt** uses mono, and style **mm** uses math. A single dash in a cell means that the typescript does not define that style, you should refrain from using the style. The lucida, lucidabfm, and lucidaboldmath typescripts also define **hw** and **cg** as ‘lucida handwriting’ and ‘lucida calligraphy’. The modern-base typescript switches back to computer-modern for a few legacy encodings: t2a, t2b, and t2c.

The fifth argument to `\definetypface` specifies specific font size setups (if any), these will be covered in section ?? in the next chapter. Almost always, specifying `default` will suffice.

The optional sixth argument is used for tweaking font settings like the specification of font features or adjusting parameters. In this case, the two `modern` font sets are loaded with a small magnification, this evens out the visual heights of the font styles.

A note for the lazy: if the sixth argument is not given and the fifth argument happens to be `default`, then the fifth argument can be omitted as well.

There are four possible keys in the sixth argument:

Identifier	file	Encodings	Supported styles
modern	type-one	ec, qx, texnansi, t5	serif, sans, mono, math, boldmath, bfmath
latin-modern	type-one	ec, qx, texnansi, t5	serif, sans, mono, math, boldmath, bfmath
computer-modern	type-one	t2a/b/c	serif, sans, mono, math, boldmath, bfmath
simple	type-one	– synonyms only –	serif
concrete	type-one	– hardcoded –	serif
euler	type-one	– hardcoded –	math, boldmath, bfmath
ams	type-one	– hardcoded –	math
fourier	type-one	ec	math, serif
courier	type-one	8r, ec, qx, texnansi, t5	mono
helvetica	type-one	8r, ec, qx, texnansi, t5	sans
times	type-one	8r, ec, qx, texnansi, t5	serif, math
palatino	type-one	8r, ec, qx, texnansi, t5	serif, math
bookman	type-one	8r, ec, qx, texnansi, t5	serif
schoolbook	type-one	8r, ec, texnansi, t5	serif
chancery	type-one	8r, ec, qx, texnansi	calligraphy
charter	type-one	8r, ec, texnansi	serif
utopia	type-one	ec, texnansi	serif
antykwa-torunska	type-one	ec, qx, texnansi, t5, t2a/b/c, greek	serif, math
antykwa-torunska-light	type-one	ec, qx, texnansi, t5, t2a/b/c, greek	serif, math
antykwa-torunska-cond	type-one	ec, qx, texnansi, t5, t2a/b/c, greek	serif, math
antykwa-torunska-lightcond	type-one	ec, qx, texnansi, t5, t2a/b/c, greek	serif, math
antykwa-poltawskiego	type-one	8r, ec, texnansi	serif
iwona	type-one	ec, qx, texnansi, t5	sans, math
iwona-light	type-one	ec, qx, texnansi, t5	sans, math
iwona-medium	type-one	ec, qx, texnansi, t5	sans, math
iwona-heavy	type-one	ec, qx, texnansi, t5	sans, math
iwona-cond	type-one	ec, qx, texnansi, t5	sans
iwona-light-cond	type-one	ec, qx, texnansi, t5	sans
iwona-medium-cond	type-one	ec, qx, texnansi, t5	sans
iwona-heavy-cond	type-one	ec, qx, texnansi, t5	sans
kurier	type-one	ec, qx, texnansi, t5	sans, math
kurier-light	type-one	ec, qx, texnansi, t5	sans, math
kurier-medium	type-one	ec, qx, texnansi, t5	sans, math
pagella	type-gyr	ec, qx, texnansi, t5, t2a/b/c	serif
palatino	type-gyr	ec, qx, texnansi, t5, t2a/b/c	serif
termes	type-gyr	ec, qx, texnansi, t5, t2a/b/c	serif
times	type-gyr	ec, qx, texnansi, t5, t2a/b/c	serif
bonum	type-gyr	ec, qx, texnansi, t5, t2a/b/c	serif
bookman	type-gyr	ec, qx, texnansi, t5, t2a/b/c	serif
schola	type-gyr	ec, qx, texnansi, t5, t2a/b/c	serif
schoolbook	type-gyr	ec, qx, texnansi, t5, t2a/b/c	serif
heros	type-gyr	ec, qx, texnansi, t5, t2a/b/c	sans
helvetica	type-gyr	ec, qx, texnansi, t5, t2a/b/c	sans
adventor	type-gyr	ec, qx, texnansi, t5, t2a/b/c	sans
cursor	type-gyr	ec, qx, texnansi, t5, t2a/b/c	mono
courier	type-gyr	ec, qx, texnansi, t5, t2a/b/c	mono
omega	type-omg	– hardcoded –	naskh, serif, mono
cbgreek	type-cbg	– hardcoded –	serif, sans, mono
cbgreek-medium	type-cbg	– hardcoded –	serif, sans, mono
cbgreek-all	type-cbg	– hardcoded –	serif, sans, mono
cow	type-cow	– hardcoded –	math, serif
sheep	type-cow	– hardcoded –	math, serif

**Table 1.9** The predefined body font identifiers for free Type 1 and METAFONT fonts

Selecting bodyfonts

Identifier	file	Encodings	Supported styles
lucida	type-buy	8r, ec, texnansi	serif, sans, mono, handwriting, calligraphy, math, boldmath, bfmath, casual, fax
informal	type-buy	– hardcoded –	casual, math
officina	type-buy	8r, ec, texnansi	serif, sans
meta	type-buy	8r, ec, texnansi	serif, sans, expert
meta-medium	type-buy	8r, ec, texnansi	sans
meta-lf	type-buy	8r, ec, texnansi	sans
meta-book	type-buy	8r, ec, texnansi	sans
meta-book-lf	type-buy	8r, ec, texnansi	sans
meta-bold	type-buy	8r, ec, texnansi	sans
meta-bold-lf	type-buy	8r, ec, texnansi	sans
meta-normal	type-buy	8r, ec, texnansi	sans
meta-normal-lf	type-buy	8r, ec, texnansi	sans
meta-medium	type-buy	8r, ec, texnansi	sans
meta-medium-lf	type-buy	8r, ec, texnansi	sans
meta-black	type-buy	8r, ec, texnansi	sans
meta-black-lf	type-buy	8r, ec, texnansi	sans
univers	type-buy	8r, ec, texnansi	sans
univers-light	type-buy	8r, ec, texnansi	sans
univers-black	type-buy	8r, ec, texnansi	sans
mendoza	type-buy	8r, ec, texnansi	serif
frutiger	type-buy	8r, ec, texnansi	sans
kabel	type-buy	8r, ec, texnansi	sans
thesans	type-buy	8r, ec, texnansi	sans, mono, expert
sabon	type-buy	8r, ec, texnansi	serif
stone	type-buy	ec, texnansi	serif, sans
stone-oldstyle	type-buy	– synonyms only –	serif, sans
industria	type-buy	ec, texnansi	sans
bauhaus	type-buy	ec, texnansi	sans
swift	type-buy	ec, texnansi	serif
swift-light	type-buy	– synonyms only –	serif
syntax	type-buy	ec, texnansi	sans
linoletter	type-buy	ec, texnansi	serif
zapfino	type-ghz	8r, ec, texnansi	serif, handwriting
palatino-sans-light	type-exp	texnansi, ec	sans
palatino-sans-normal	type-exp	texnansi, ec	sans
palatino-sans-medium	type-exp	texnansi, ec	sans
opus	type-fsf	8r, ec, texnansi	sans
typewriter	type-fsf	8r, ec, texnansi	mono
garamond	type-fsf	8r, ec, texnansi	serif
optima	type-ghz	8r, ec, texnansi	sans
optima-nova	type-ghz	8r, ec, texnansi	sans
optima-nova-os	type-ghz	8r, ec, texnansi	sans
optima-nova-light	type-ghz	8r, ec, texnansi	sans
optima-nova-medium	type-ghz	8r, ec, texnansi	sans
palatino	type-ghz	8r, ec, texnansi	serif
palatino-nova	type-ghz	8r, ec, texnansi	serif
palatino-nova-os	type-ghz	8r, ec, texnansi	serif
palatino-nova-light	type-ghz	8r, ec, texnansi	serif
palatino-nova-medium	type-ghz	8r, ec, texnansi	serif
aldus-nova	type-ghz	8r, ec, texnansi	serif
melior	type-ghz	8r, ec, texnansi	serif
verdana	type-msw	texnansi	sans
arial	type-msw	texnansi	sans

**Table 1.10** The predefined body font identifiers for commercial Type 1 fonts

Identifier	file	Supported styles	Identifier	file	Supported styles
modern	type-otf	serif, sans, mono, math, boldmath, bfmath	palatino	type-otf	serif, math
			times	type-otf	serif, math
			bookman	type-otf	serif
latin-modern	type-otf	serif, sans, mono, math, boldmath, bfmath	schoolbook	type-otf	serif
			chancery	type-otf	calligraphy
			helvetica	type-otf	sans
modern-vari	type-otf	mono	courier	type-otf	mono
latin-modern-vari	type-otf	mono	antykwa-torunska	type-otf	serif, math
modern-cond	type-otf	mono	antykwa-torunska-light	type-otf	serif, math
latin-modern-cond	type-otf	mono	antykwa-torunska-cond	type-otf	serif, math
computer-modern	type-otf	serif, sans, mono, math, boldmath, bfmath	antykwa-torunska-lightcond	type-otf	serif, math
			antykwa-poltawskiego	type-otf	serif
			iwona-light	type-otf	sans, math
concrete	type-otf	serif	iwona	type-otf	sans, math
euler	type-otf	math, boldmath, bfmath	iwona-medium	type-otf	sans, math
			iwona-heavy	type-otf	sans, math
			iwona-cond	type-otf	sans
ams	type-otf	math	iwona-light-cond	type-otf	sans
pagella	type-otf	serif	iwona-medium-cond	type-otf	sans
termes	type-otf	serif	iwona-heavy-cond	type-otf	sans
bonum	type-otf	serif	kurier	type-otf	sans, math
schola	type-otf	serif	kurier-light	type-otf	sans, math
chorus	type-otf	serif	kurier-medium	type-otf	sans, math
heros	type-otf	sans	charter	type-otf	serif
adventor	type-otf	sans	gentium	type-xtx	serif
cursor	type-otf	sans			

**Table 1.11** The predefined body font identifiers for free Unicode (Opentype) fonts

Identifier	file	Supported styles	Identifier	file	Supported styles
zapfino	type-hgz	serif, handwriting	times	type-xtx	serif
optima-nova	type-hgz	sans	palatino	type-xtx	serif
optima-nova-os	type-hgz	sans	helvetica	type-xtx	sans
optima-nova-light	type-hgz	sans	courier	type-xtx	mono
optima-nova-medium	type-hgz	sans	hoefler	type-xtx	serif
palatino-nova	type-hgz	serif	lucida grande	type-xtx	sans
palatino-nova-os	type-hgz	serif	optima	type-xtx	sans
palatino-nova-light	type-hgz	serif	gillsans	type-xtx	sans
palatino-nova-medium	type-hgz	serif	gillsanslt	type-xtx	sans
palatino-sans	type-hgz	sans	zapfino	type-xtx	handwriting, serif
palatino-informal	type-hgz	sans	applechancery	type-xtx	calligraphy, serif
melior	type-hgz	serif	timesnewroman	type-xtx	serif
– all four-variant fonts –	type-xtx	Xserif	arial	type-xtx	sans
– all four-variant fonts –	type-xtx	Xsans	lucida	type-xtx	serif, sans, mono, handwriting, fax, calligraphy
– all four-variant fonts –	type-xtx	Xmono			

**Table 1.12** The predefined body font identifiers for commercial Unicode (Open-type) fonts

key	default value	explanation
<code>rscale</code>	<code>1</code>	a scaling factor for this typescript relative to the selected body font size
<code>encoding</code>	<code>\defaultencoding</code>	the encoding for the typeface, normally inherited from the typescript automatically
<code>features</code>		this applies a predefined font feature set (see section 1.9)
<code>text</code>		sets up the forced math text style

If you look closely, in table 1.12 you will notice three very special items: `Xserif`, `Xsans` and `Xmono`. These belong to a special  $\TeX$ -only trick called ‘wildcard typescripts’.

$\TeX$  offers some nice features in terms of automatically finding related fonts in a family, namely the italic, bold, and bolditalic alternatives. To take advantage of that, there’s a set of wildcard typescripts that take an arbitrary Macintosh font name as input, and provide as many of the alternatives it can find. To set these typescripts (and the calling conventions) apart from the familiar ones, the typescripts are identified with `Xserif`, `Xsans`, and `Xmono`.

To call the typescripts, it’s most convenient to define a typeface that uses these features. The named font slot should contain the display name of the Regular alternative (not the family name) of the font in question. For example, you could have the following mix:

```
\starttypescript[myface]
\definetypeface[myface][rm][Xserif][Baskerville][default]
\definetypeface[myface][tt][Xmono][Courier][default][rscale=.87]
\definetypeface[myface][ss][Xsans][Optima Regular][default]
\stoptypescript
```

As you can see, you can activate relative scaling of face sizes. The above definitions look very much like any other typeface definition, except that the serif/sans/mono identifier is preceded with `X`, and that there is no underlying “Optima Regular” defined anywhere. Those missing bits of the definitions are handled by typescript and  $\TeX$  magic.

## 1.8 Body font environments

Earlier we have seen that within a font family there are different font sizes. The relations between these sizes are defined by *body font environments*.

For all regular font sizes, environments are predefined that fulfill their purpose adequately. However when you want to do some extra defining yourself there is:

```

\definebodyfontenvironment [...] [...] [...]
                                OPTIONAL      OPTIONAL
1  IDENTIFIER
2  5pt ... 12pt default
3  text          = DIMENSION
   script        = DIMENSION
   scriptscript  = DIMENSION
   x             = DIMENSION
   xx            = DIMENSION
   small         = DIMENSION
   big           = DIMENSION
   interlinespace = DIMENSION
   em            =

```

The first argument is optional, and specifies the typeface identifier that this particular body font environment setup is for. It defaults to the current typeface.

The second argument is the size of the body font environment that is being defined. This argument is not really optional, the macro syntax description is a little misleading.

The third argument once again is optional, and contains the actual settings as key-value pairs. If it is missing, defaults will be guessed at by `CONTEXT` itself.

<code>text</code>	Math text size
<code>script</code>	Math script size
<code>scriptscript</code>	Math scriptscript size
<code>x</code>	The size used for the <code>\tfx</code> etc. commands
<code>xx</code>	The size used for the <code>\tfxx</code> command
<code>big</code>	The ‘larger’ font size
<code>small</code>	The ‘smaller’ font size
<code>interlinespace</code>	Distance between lines in a paragraph, can be ignored because a reasonable default is always set up
<code>em</code>	The style to use for emphasis (default is slanted)

So, when you want to have a somewhat bigger fontsize for just a few words (e.g. for a book title) you can type:

```

\definebodyfontenvironment [24pt]
\switchtobodyfont[24pt]

```

but longer stretches of text, you will need to set up most of the values, using something like this

```

\definebodyfontenvironment
[22pt]
[
    text=22pt,
    script=17.3pt,
    scriptscript=14.4pt,
    x=17.3pt,
    xx=14.4pt,

```



```
big=28pt,
small=17.3pt]
```

To tweak already defined sizes, there is an accompanying setup command with the same parameter conventions:

```
\setupbodyfontenvironment [...1.] [...2.] [...,3.,...]
                        OPTIONAL          OPTIONAL
1   inherits from \definebodyfontenvironment
2   inherits from \definebodyfontenvironment
3   inherits from \definebodyfontenvironment
```

## 1.9 Font feature sets

As mentioned already, some fonts contain extra information besides the actual glyph shapes. In traditional T<sub>E</sub>X fonts, the extra information is roughly limited to kerning pairs and ligature information, and both of these ‘features’ are automatically applied to the text that is being typeset. In the odd case where one of the two needs to be suppressed, a little bit of macro trickery can do the job without too many complicating factors.

But with the new OpenType font format that is used by X<sub>Y</sub>T<sub>E</sub>X and L<sup>A</sup>T<sub>E</sub>X, the list of possible features is increased enormously. OpenType fonts have not just kerning information and ligature information, but there can also be other features like optional oldstyle figures, caps and smallcaps glyphs, decorative swashes, etc. all inside a single font file.

Not only that, but some of these features are not even supposed to be active all the time. Certain features should only be activated if the user asks for it, other features depend on the script and language that is in use for the text that is being typeset.

This is a big step forward in that there are now far fewer fonts needed to achieve the same level of quality than before, all that extra font information also poses a big challenge for macro writers. And add to that the fact that at the core, the two engines (X<sub>Y</sub>T<sub>E</sub>X and L<sup>A</sup>T<sub>E</sub>X) handle OpenType fonts completely different from each other.

CON<sub>T</sub>E<sub>X</sub>T has a new subsystem called ‘font features’ to create order in this forest of features. The most important command is `\definefontfeature`. This command can be used to group various font features under a single symbolic name, that can then be used as e.g. the argument to the `features` key of `\definetypeface`.

```
\definefontfeature [.1.] [.2.] [.3.]
                        OPTIONAL
```

```
1 TEXT
2 IDENTIFIER
3 compose = no yes
  mode    = node base
  tlig     = no yes
  trep     = no yes
  script   = IDENTIFIER
  language = IDENTIFIER
  ..tag..  = no yes
```

```
\definefontfeature
  [default-base]
  [script=latn,language=dflt,liga=yes,kern=yes,tlig=yes,trep=yes]
```

As you can probably guess, the first argument is the symbolic name that is being defined. The second argument is a mix of a-hoc settings and OpenType font features.

compose	Use fallback composition in MkIV (experimental, undocumented)
protrusion	Character protrusion in MkIV (see section 1.13)
expansion	Character expansion in MkIV (see section 1.13)
script	An OpenType script identifier
language	An OpenType script language identifier
tlig	A virtual feature for legacy (T <sub>E</sub> X-style) automatic ligatures (for compatibility, there is an alias for this key called <code>texligatures</code> )
trep	A virtual feature for legacy (T <sub>E</sub> X-style) automatic ligatures (for compatibility, there is an alias for this key called <code>texquotes</code> ) (only works in MkIV)
mode	Processing mode for MkIV. <code>node</code> and <code>base</code> allowed, <code>base</code> is default
<tag>	Any OpenType feature tag is acceptable, but in MkIV only a ‘known’ subset actually has any effect, and then only in <code>node</code> mode. This list is given in table 1.13. In X <sub>Y</sub> T <sub>E</sub> X, processing depends on the internal subengine that is used by X <sub>Y</sub> T <sub>E</sub> X, and that is outside of CON <sub>T</sub> E <sub>X</sub> T’s control.

A few fontfeatures are predefined by context:

```
default    liga=yes,kern=yes,tlig=yes,trep=yes
smallcaps  liga=yes,kern=yes,tlig=yes,trep=yes,smcp=yes
oldstyle   liga=yes,kern=yes,tlig=yes,trep=yes,onum=yes
```

At the moment, `smallcaps` and `oldstyle` only work in X<sub>Y</sub>T<sub>E</sub>X (in MkIV, it would need an extra `mode=node` pair).

## 1.10 Displaying the current font setup

aalt	Access All Alternates	ital	Italics	size	Optical Size
abvf	Above-Base Forms	jalt	Justification Alternatives	smcp	Small Capitals
abvm	Above-Base Mark Positioning	jp04	JIS2004 Forms	smp1	Simplified Forms
abvs	Above-Base Substitutions	jp78	JIS78 Forms	ss01	Stylistic Set 1
afrc	Alternative Fractions	jp83	JIS83 Forms	ss02	Stylistic Set 2
akhn	Akhands	jp90	JIS90 Forms	ss03	Stylistic Set 3
blwf	Below-Base Forms	kern	Kerning	ss04	Stylistic Set 4
blwm	Below-Base Mark Positioning	lfbd	Left Bounds	ss05	Stylistic Set 5
blws	Below-Base Substitutions	liga	Standard Ligatures	ss06	Stylistic Set 6
c2pc	Petite Capitals From Capitals	ljmo	Leading Jamo Forms	ss07	Stylistic Set 7
c2sc	Small Capitals From Capitals	lnum	Lining Figures	ss08	Stylistic Set 8
calt	Contextual Alternates	loc1	Localized Forms	ss09	Stylistic Set 9
case	Case-Sensitive Forms	mark	Mark Positioning	ss10	Stylistic Set 10
ccmp	Glyph Composition/Decomposition	medi	Medial Forms	ss11	Stylistic Set 11
cjct	Conjunct Forms	med2	Medial Forms #2	ss12	Stylistic Set 12
clig	Contextual Ligatures	mgrk	Mathematical Greek	ss13	Stylistic Set 13
csp	Capital Spacing	mkmk	Mark to Mark Positioning	ss14	Stylistic Set 14
csw	Contextual Swash	msdt	Mark Positioning via Substitution	ss15	Stylistic Set 15
curs	Cursive Positioning	nalt	Alternate Annotation Forms	ss16	Stylistic Set 16
dflt	Default Processing	nlck	NLC Kanji Forms	ss17	Stylistic Set 17
dist	Distances	nukt	Nukta Forms	ss18	Stylistic Set 18
dlig	Discretionary Ligatures	numr	Numerators	ss19	Stylistic Set 19
dnom	Denominators	onum	Old Style Figures	ss20	Stylistic Set 20
expt	Expert Forms	opbd	Optical Bounds	subs	Subscript
falt	Final glyph Alternates	ordn	Ordinals	sup	Superscript
fin	Terminal Forms	ornm	Ornaments	swsh	Swash
fin2	Terminal Forms #2	palt	Proportional Alternate Width	titl	Titling
fin3	Terminal Forms #3	pcap	Petite Capitals	tjmo	Trailing Jamo Forms
frac	Fractions	pnum	Proportional Figures	tnam	Traditional Name Forms
fwid	Full Width	pref	Pre-base Forms	tnum	Tabular Figures
half	Half Forms	pres	Pre-base Substitutions	trad	Traditional Forms
haln	Halant Forms	pstf	Post-base Forms	twid	Third Widths
halt	Alternate Half Width	psts	Post-base Substitutions	unic	Unicase
hist	Historical Forms	pwid	Proportional Widths	valt	Alternate Vertical Metrics
hkna	Horizontal Kana Alternates	qwid	Quarter Widths	valu	Vattu Variants
hlig	Historical Ligatures	rand	Randomize	vert	Vertical Writing
hngl	Hangul	rkrf	Rakar Forms	vhal	Alternate Vertical Half Metrics
hojo	Hojo Kanji Forms	rlig	Required Ligatures	vjmo	Vowel Jamo Forms
hwd	Half Width	rphf	Reph Form	vkna	Vertical Kana Alternates
init	Initial Forms	rtbd	Right Bounds	vkern	Vertical Kerning
isol	Isolated Forms	rtla	Right-To-Left Alternates	vpa1	Proportional Alternate Vertical Metrics
		ruby	Ruby Notation Forms	vrt2	Vertical Rotation
		salt	Stylistic Alternates	zero	Slashed Zero
		sinf	Scientific Inferiors		

**Table 1.13** The OpenType features that are understood by MkIV in mode=node processing mode

With the command `\showbodyfont` an overview is generated of the available characters, and an overview of the different fontsizes within a family can be summoned with `\showbodyfontenvironment`.

```
\showbodyfont [...]
                OPTIONAL
*   inherits from \setupbodyfont

\showbodyfontenvironment [...]
                        OPTIONAL
*   inherits from \setupbodyfont
```

Specifiying actual IDENTIFIERS to these commands is currently unreliable because they internally are still counting on an older system of body font definitions, but you can safely use a size argument to get the information for the current font set.

Below an example of the possible output is shown, for `\showbodyfont [12pt]`

[palatino] [12pt]										\mr : Ag			
	\tf	\sc	\sl	\it	\bf	\bs	\bi	\tfx	\tfxx	\tfa	\tfb	\tfc	\tfd
\rm	Ag	AG	Ag	Ag	<b>Ag</b>	<b>Ag</b>	Ag	Ag	Ag	Ag	Ag	Ag	Ag
\ss	Ag	Ag	Ag	Ag	Ag	Ag	Ag	Ag	Ag	Ag	Ag	Ag	Ag
\tt	Ag	AG	Ag	Ag	<b>Ag</b>	<b>Ag</b>	<b>Ag</b>	Ag	Ag	Ag	Ag	Ag	Ag

And the output of `\showbodyfontenvironment [12pt]` is:

[palatino] [12pt]							
text	script	scriptscript	x	xx	small	big	interlinespace
20.7pt	14.4pt	12pt	17.3pt	14.4pt	17.3pt	20.7pt	not set
17.3pt	12.1pt	8.6pt	13.8pt	10.3pt	13.8pt	20.7pt	not set
14.4pt	10pt	7.2pt	11.5pt	8.6pt	11.5pt	17.2pt	not set
12pt	8.3pt	6pt	9.6pt	7.2pt	9.6pt	14.3pt	not set
11pt	7.6pt	5.5pt	8.8pt	6.6pt	8.8pt	13.1pt	not set
10pt	6.9pt	5pt	8pt	6pt	8pt	11.9pt	not set
9pt	6.2pt	4.5pt	7.2pt	5.4pt	7.2pt	10.7pt	not set
8pt	5.5pt	4pt	6.4pt	4.8pt	6.4pt	9.5pt	not set
7pt	4.8pt	3.5pt	5.6pt	4.2pt	5.6pt	8.3pt	not set
6pt	4.1pt	3pt	4.8pt	3.6pt	4.8pt	7.1pt	not set
5pt	3.4pt	2.5pt	4pt	3pt	4pt	5.9pt	not set
4pt	2.7pt	2pt	3.2pt	2.4pt	3.2pt	4.7pt	not set

## 1.11 Math fonts

There are only a few font families in existence that can handle math properly because such fonts have to carry a complete set of characters and symbols for mathematical typesetting. Among these, the Computer Modern Roman distinguishes itself by its many design sizes; that really pays off when typesetting complicated math formulas.

Many T<sub>E</sub>X users have chosen T<sub>E</sub>X for its superb math typesetting.

This chapter will not go into any details but in math mode, the central concept is the *math family* (not to be confused with the *font families* discussed earlier). There are math families for `\bf`, `\it`, etc. as well as for the special math symbols. Within each family, there are always exactly three member fonts: `text`, `script` and `scriptscript`, or a normal, smaller and smallest font. The normal font size is used for running text and the smaller ones for sub and superscripts. The next example will show what the members of a math family can do.

```
\tf x^2+\bf x^2+\sl x^2+\it x^2+\bs x^2+ \bi x^2 =\rm 6x^2$
\tf x^2+\bf x^2+\sl x^2+\it x^2+\bs x^2+ \bi x^2 =\tf 6x^2$
\tf x^2+\bf x^2+\sl x^2+\it x^2+\bs x^2+ \bi x^2 =\bf 6x^2$
\tf x^2+\bf x^2+\sl x^2+\it x^2+\bs x^2+ \bi x^2 =\sl 6x^2$
```

When this is typeset you see this:

$$\begin{aligned} x^2 + \mathbf{x}^2 + x^2 + x^2 + \mathbf{x}^2 + x^2 &= 6x^2 \\ x^2 + \mathbf{x}^2 + x^2 + x^2 + \mathbf{x}^2 + x^2 &= 6x^2 \\ x^2 + \mathbf{x}^2 + x^2 + x^2 + \mathbf{x}^2 + x^2 &= \mathbf{6}x^2 \\ x^2 + \mathbf{x}^2 + x^2 + x^2 + \mathbf{x}^2 + x^2 &= 6x^2 \end{aligned}$$

As you can see, the alphabetic characters adapt to the selected font family but the symbols are all typeset in the same font regardless. Technically this means that the symbols are set in the fixed font family 0 whereas the alphabetic characters are typeset using variable family numbers.

Typesetting math formulas can also be done somewhat differently, as we will see in the next example.

```
\tf\mf x^2 + x^2 + x^2 + x^2 + x^2 + x^2 = 6x^2$
\bf\mf x^2 + x^2 + x^2 + x^2 + x^2 + x^2 = 6x^2$
\sl\mf x^2 + x^2 + x^2 + x^2 + x^2 + x^2 = 6x^2$
\bs\mf x^2 + x^2 + x^2 + x^2 + x^2 + x^2 = 6x^2$
\it\mf x^2 + x^2 + x^2 + x^2 + x^2 + x^2 = 6x^2$
\bi\mf x^2 + x^2 + x^2 + x^2 + x^2 + x^2 = 6x^2$
```

A new command is used: `\mf`, which stands for *math font*. This command takes care of the symbols in such a way that they are also set in the actually selected font, just like the characters.

$$\begin{aligned} x^2 + x^2 + x^2 + x^2 + x^2 + x^2 &= 6x^2 \\ \mathbf{x}^2 + \mathbf{x}^2 + \mathbf{x}^2 + \mathbf{x}^2 + \mathbf{x}^2 + \mathbf{x}^2 &= \mathbf{6}x^2 \\ x^2 + x^2 + x^2 + x^2 + x^2 + x^2 &= 6x^2 \\ \mathbf{x}^2 + \mathbf{x}^2 + \mathbf{x}^2 + \mathbf{x}^2 + \mathbf{x}^2 + \mathbf{x}^2 &= \mathbf{6}x^2 \\ x^2 + x^2 + x^2 + x^2 + x^2 + x^2 &= 6x^2 \\ \mathbf{x}^2 + \mathbf{x}^2 + \mathbf{x}^2 + \mathbf{x}^2 + \mathbf{x}^2 + \mathbf{x}^2 &= \mathbf{6}x^2 \end{aligned}$$

You should take into account that  $\text{\TeX}$  typesets a formula as a whole. In some cases this means that setups at the end of the formula have an effect that starts already at the beginning of the fomula.

For example, the exact location of  $\text{\mf}$  is not that important. We also could have typed:

```

$$\text{\bf } x^2 + x^2 + x^2 + x^2 + x^2 + x^2 = \text{\mf } 6x^2$$

```

There is much more to be said about math, but it is better to do that in chapter ??, about math.

1.12 Em and Ex

In specifying dimensions we can distinguish physical units like `pt` and `cm` and internal units like `em` and `ex`. These last units are related to the actual fontsize. When you use these internal units in specifying for example horizontal and vertical spacing you don't have to do any recalculating when fonts are switched in the style definition.

Some insight in these units does not hurt. The width of an `em` is not the with of an `M`, but that of an `—` (an `em`-dash). When this glyph is not available in the font another value is used. Table 1.14 shows some examples. We see that the width of a digit is about `.5em`. In Computer Modern Roman a digit is exactly half an `em` wide.

<code>\tf</code>	<code>\bf</code>	<code>\sl</code>	<code>\tt</code>	<code>\ss</code>	<code>\tfx</code>
$\left  \begin{smallmatrix} 12 \\ M \\   \\   \\ \text{—} \end{smallmatrix} \right $	$\left  \begin{smallmatrix} 12 \\ \textbf{M} \\   \\   \\ \text{—} \end{smallmatrix} \right $	$\left  \begin{smallmatrix} 12 \\ M \\   \\   \\ \text{—} \end{smallmatrix} \right $	$\left  \begin{smallmatrix} 12 \\ M \\   \\   \\ \text{---} \end{smallmatrix} \right $	$\left  \begin{smallmatrix} 12 \\ M \\   \\   \\ \text{—} \end{smallmatrix} \right $	$\left  \begin{smallmatrix} 12 \\ M \\   \\   \\ \text{—} \end{smallmatrix} \right $

Table 1.14 The width of an `em`.

In most cases we use `em` for specifying width and `ex` for height. Table 1.15 shows some examples. We see that the height equals the height of a lowercase `x`.

<code>\tf</code>	<code>\bf</code>	<code>\sl</code>	<code>\tt</code>	<code>\ss</code>	<code>\tfx</code>
$\text{—} x$	$\text{—} \textbf{x}$	$\text{—} x$	$\text{—} \textbf{x}$	$\text{—} x$	$\text{—} x$

Table 1.15 The height of an `ex`.

1.13 Font handling

Almost all users of typesetting systems based on  $\text{\TeX}$  do so because of the quality of the output it produces.  $\text{\PDF\TeX}$  (and through inheritance  $\text{\LUA\TeX}$  as well) contains a few extensions to the typesetting engine that make the output even better than the results achieved by Knuth's original  $\text{\TeX}$ . Although the extensionsn are made available by  $\text{\PDF\TeX}$ , they are not limited to the PDF output, they will work with the DVI backend just as well. And when the extensions are

defined but not enabled, then the typeset output is 100% identical to when the feature is not present at all.

### 1.13.1 Character protrusion

In the following fake paragraph, you can see a hyphenation point, a secondary sentence, separated by a comma, and a last sentence, ending with a period. Miraculously, this paragraph fits into lines. Although exaggerated, these lines demonstrate that visually the hyphen and punctuation characters make the margin look ragged.



Before computers started to take over the traditional typesetter's job, it was common practice to move hyphens and punctuation into the margin, like in:



In this alternative, the margin looks less ragged, and this becomes more noticable once you get aware of this phenomenon.

Sometimes, shifting the characters completely into the margin is too much for the sensitive eye, for instance with a slanted font, where the characters already hang to the right. In such cases, we need to compromise.



PDF<sub>T</sub>E<sub>X</sub> (and L<sub>U</sub>A<sub>T</sub>E<sub>X</sub>, that has inherited this feature) has provisions to move characters into the margin when they end up at the end of a line. Such characters are called protruding characters. PDF<sub>T</sub>E<sub>X</sub> takes protruding into account when breaking a paragraph.

We will demonstrate protruding using a quote from Hermann Zapf's article "About micro-typography and the *hz-program*" in *Electronic Publishing*, vol 6 (3), 1993.

[file zapf does not exist]

After T<sub>E</sub>X has typeset this paragraph (using a specific font size and line width) it may have constructed the following lines.

Coming back to the use of typefaces in electronic publishing: many of the new typographers receive their knowledge and information about the rules of typography from books, from computer magazines or the instruction manuals which they get with the purchase of a PC or software. There is not so much basic instruction, as of now, as there was in the old days, showing the differences between good and bad typographic design. Many people are just fascinated by their PC's tricks, and think that a widely-praised program, called up on the screen, will make everything automatic from now on.

As you can see, the height and depth of the lines depend on the characters, but their width equals what  $\text{\TeX}$  calls `\hspace`. However, the natural width of the lines may differ from `\hspace`.

Coming back to the use of typefaces in electronic publishing: many of the new typographers receive their knowledge and information about the rules of typography from books, from computer magazines or the instruction manuals which they get with the purchase of a PC or software. There is not so much basic instruction, as of now, as there was in the old days, showing the differences between good and bad typographic design. Many people are just fascinated by their PC's tricks, and think that a widely-praised program, called up on the screen, will make everything automatic from now on.

Here the inter-word space is fixed to what  $\text{\TeX}$  considers to be a space. This example also demonstrates that  $\text{\TeX}$  does not have spaces, but stretches the white area between words to suit its demands. When breaking lines,  $\text{\TeX}$ 's mind is occupied by boxes, glue and penalties, or in more common language: (parts of) words, stretchable white space, and more or less preferred breakpoints.

Coming back to the use of typefaces in electronic publishing: many of the new typographers receive their knowledge and information about the rules of typography from books, from computer magazines or the in-	struction manuals which they get with the purchase of a PC or software. There is not so much basic instruction, as of now, as there was in the old days, showing the differences between good and bad typog-	raphic design. Many people are just fascinated by their PC's tricks, and think that a widely-praised program, called up on the screen, will make everything automatic from now on.
---	--	--

This time we have enabled  $\text{\PDF\TeX}$ 's protruding mechanism. The characters that stick into the margin are taken into account when breaking the paragraph into lines, but in the final result, they do not count in the width. Here we used an ugly three column layout so that we got a few more hyphens to illustrate the principle, but in the next examples we will stick to two columns.

Coming back to the use of typefaces in electronic publishing: many of the new typographers receive their knowledge and information about the rules of typography from books, from computer magazines or the instruction manuals which they get with the purchase of a PC or software. There is not so much basic instruction,	as of now, as there was in the old days, showing the differences between good and bad typographic design. Many people are just fascinated by their PC's tricks, and think that a widely-praised program, called up on the screen, will make everything automatic from now on.
---	---

In this first example the text was typeset in the traditional way. The hyphens and punctuation fit into the margin.

Coming back to the use of typefaces in electronic publishing: many of the new typographers receive their knowledge and information about the rules of typography from books, from computer magazines or the instruction manuals which they get with the purchase of a PC or software. There is not so much basic instruction,	as of now, as there was in the old days, showing the differences between good and bad typographic design. Many people are just fascinated by their PC's tricks, and think that a widely-praised program, called up on the screen, will make everything automatic from now on.
---	---

1.13.2 Font expansion

In typesetting the two characters `hz` are tightly connected to Hermann Zapf and the next couple of pages we will discuss a method for optimizing the look and feel of a paragraph using a mechanism that is inspired on his work. Although official qualified in  $\text{\PDF\TeX}$  as `font`



adjusting, we will use the short qualification `hz` since this is how it is called in the PDF $\TeX$  community.

First, here is again the same example text that was used in the previous section, typeset using normal  $\TeX$ -comptibale font settings:

Coming back to the use of typefaces in electronic publishing: many of the new typographers receive their knowledge and information about the rules of typography from books, from computer magazines or the instruction manuals which they get with the purchase of a PC or software. There is not so much basic instruction,

as of now, as there was in the old days, showing the differences between good and bad typographic design. Many people are just fascinated by their PC's tricks, and think that a widely-praised program, called up on the screen, will make everything automatic from now on.

The example below shows `hz` in action. This paragraph is typeset with `hz` enabled and has a more even spacing than the text above.

Coming back to the use of typefaces in electronic publishing: many of the new typographers receive their knowledge and information about the rules of typography from books, from computer magazines or the instruction manuals which they get with the purchase of a PC or software. There is not so much basic instruction, as of

now, as there was in the old days, showing the differences between good and bad typographic design. Many people are just fascinated by their PC's tricks, and think that a widely-praised program, called up on the screen, will make everything automatic from now on.

The average reader will not notice the trick, but those sensitive to character shapes will see that some glyphs are widened slightly and others are narrowed slightly. Ideally the programs that built the glyph should be defined in such a way that this goes unnoticed, but in practice glyph programs are not that clever and so a brute force horizontal scaling is applied. As long as the used percentage is small, the distortion will go unnoticed and the paragraph will look slightly better because the whitespace distribution is more even.

### 1.13.3 Other font handlings

In addition to the two handlings documented in the previous paragraphs (protruding and `hz`), CON $\TeX$ T also provides the `noligs` handling (handy when one processes XML), `flexspacing` and `prespacing` (meant for languages like French that need spacing around for instance : and ;). These handlings are experimental.

### 1.13.4 How to use font handlings

Before we go into the details of the actual extensions, let's see what is provided by CON $\TeX$ T as the user-level interface. The CON $\TeX$ T interface to those new features is through a subsystem called 'font handling', and at the top that subsystem is seamlessly integrated into the normal alignment macros.

For example, assuming the system is set up already to support protrusion, you can simply say `\setupalign[hanging]`

to turn protrusion on. However, this will only work correctly if a number of special setups have taken place internally. The command `\setupalign` only toggles a switch, and the required setups have to be done elsewhere.

The list of font handling-related keys for `\setupalign` is:

`hanging`      turns on character protrusion  
`nohanging`   turns off character protrusion

`hz`            turns on font expansion  
`nohz`          turns off font expansion  
`spacing`       turns on special spacing rules  
`nospacing`    turns off special spacing

Largely because of the tight connection with the font itself, the method of defining and setting font handling is a little different between PDF<sub>T</sub>E<sub>X</sub> and MKIV.

### 1.13.5 Setting up font handlings in MKII

Now, let's move on to how to set up the system for font handling properly. Most of the underlying features of PDF<sub>T</sub>E<sub>X</sub> can not *just* be turned on or off, it is possible to tweak the machinery on the font as well as on the individual glyph level. You can define those settings all on your own, but CON<sub>T</sub>E<sub>X</sub>T comes with a handy set of predefined values.

name	\setupalign	description
pure	hanging	full protrusion of only selected punctuation
normal	hanging	partial protrusion of punctuation and some asymmetrical letters
hz	hz	variable correction of character widths
quality	hanging,hz	combination of hz and pure
highquality	hanging,hz	combination of hz and normal
flexspacing	spacing	automatic extra spacing around various punctuation characters
prespacing	spacing	like flexspacing, but ignoring . and , and with smaller effects
noligs	--	suppresses ligatures; because this is irreversible it is not controlled via \setupalign

You need to be aware of the fact that at the moment that you actually define a font, you need to tell what handling you want to apply.

Note: setting up font handling involves a few low-level font definition commands, so you may want to read the chapter about font definitions first.

Say that we want to hang only the serif fonts and say that we use Palatino as main typeface.

```

\setupfontsynonym [Serif] [handling=pure]
\definetypeface [palatino] [rm] [serif] [palatino] [default]

```

In the above example, the font loader is instructed to treat fonts with the virtual name `Serif` in a special way by applying the font handling named `pure`. After that, the typeface collection `palatino` is (re)defined and by that process the font tagged as `Serif` will get the 'hanging' settings attached it.

Now enable this typeface collection can be enabled by:

```
\setupbodyfont [palatino]
```

and finally, don't forget to turn on hanging by:

```
\setupalign [hanging]
```

However, this only takes care of the `Serif` font. Normally, that is the virtual name for the combination. If you also want the bold variants to hang, you have to add an extra line:

```
\setupfontsynonym [SerifBold] [handling=pure]
```

And so on for all the alternatives. This is tedious, so `CONTEX`T provides a shortcut. If you want to set all serif weights at once, you can call on a predefined typescript component before defining the typeface:

```
\usetypescript [serif] [handling] [pure]
```

for hanging punctuation, or for all characters:

```
\usetypescript [serif] [handling] [normal]
```

The full example then becomes:

```
\usetypescript [serif] [handling] [pure]
\definetypescript [palatino] [rm] [serif] [palatino] [default]
\setupbodyfont [palatino]
\setupalign [hanging]
```

The first argument can be one of three named typescript groups: `serif` (for the virtual font synonyms whose names begin with `Serif`), `sans` (for `Sans`), or `mono` (for `Mono`). The second argument should always be `handling`. The third argument has to be one of named font handlings that are listed in the table at the start of this section.

The typescripts that are used in these examples work by altering the font synonyms for virtualized symbolic font names like `Serif` and `SerifBold` en block. They will even work with your own typescripts if (but only if) these typescripts use the same font naming conventions as the `CONTEX`T core.

The definition of font handlings is actually a two-step process. A named font handling consists of one or more handling vectors that have to be defined first, those are then combined under a single name.

This is not the right place to describe how to define the low-level vector definitions in detail, for that you are referred to the documented source of the main handling definition file `hand-def.tex`. But to give you an idea of what it looks like, here is a small excerpt of that file. The pure handling vector is defined as:

```
\startfonthandling [pure]
  \defineprotrudefactor , 0 1
  \defineprotrudefactor . 0 1
  \defineprotrudefactor : 0 1
  \defineprotrudefactor ; 0 1
  \defineprotrudefactor - 0 1

  \defineprotrudefactor hyphen 0 1
  \defineprotrudefactor endash 0 .5
  \defineprotrudefactor emdash 0 .33 % .5
\stopfonthandling
```

The pure font handling itself is then defined as follows:

```
\definefonthandling [pure] [pure] [type=hanging]
```

The hz setup runs along the same lines. First here is a vector:

```
\startfonthandling [hz]
  \defineadjustfactor A .5
  \defineadjustfactor B .7
  \defineadjustfactor C .7
  ...
\stopfonthandling
```

And then the definition of the hz handling is as follows:

```
\definefonthandling [hz] [hz,extended] [type=hz]
```

To wrap this up, here is the macro syntax for the font handling definition and setup.

```
\definefonthandling [.1.] [.2.] [.3.]

1 IDENTIFIER
2 IDENTIFIER
3 type      = hanging hz spacing tag
  right     = NUMBER
  left      = NUMBER
  factor    = NUMBER
  min       = NUMBER
  max       = NUMBER
  step      = NUMBER
```

As you can see, the `\definefonthandling` command accepts three arguments. The first is the handling to be defined, the second is a list of handling vectors to be used, and the third sets up a number of settings.

<code>type</code>	the type of this font handling feature, for use by <code>\setupalign</code>
<code>right</code>	used by <code>type=hanging</code> , default 1
<code>left</code>	used by <code>type=hanging</code> , default 1
<code>factor</code>	used by <code>type=spacing</code> , default 1
<code>min</code>	used by <code>type=hz</code> , default 20
<code>max</code>	used by <code>type=hz</code> , default 20
<code>step</code>	used by <code>type=hz</code> , default 5

On top of the list at the beginning of this paragraph, a few more elaborate font handlings are also predefined:

```
\definefonthandling [purebold] [pure] [type=hanging]
\definefonthandling [pureslanted] [pure] [type=hanging,right=1.5]
\definefonthandling [pureitalic] [pure] [type=hanging,right=1.5]
\definefonthandling [pureboldslanted] [pure] [type=hanging,right=1.5]
\definefonthandling [purebolditalic] [pure] [type=hanging,right=1.5]
```

The `right` parameter (there is also `left`) is a multiplication factor that is applied to the values in the associated vector. Such definitions can be more extensive, like:

```
\definefonthandling
  [normalitalic]
  [punctuation,alpha,extended]
  [type=hanging,right=1.5]
```

Here we have combined three vectors into one handling. For these extended font handlings, there are no predefined typescripts, so you either have to use the font synonyms directly, or define your own typescripts. Now, if you think this is overly complicated, you are probably right. Normally you will just invoke protruding handlings defined previously, but the mechanisms are there to fine-tune the handlings to your precise wishes.

In case you want to alter some of the settings of an already defined font handling, there is

```
\setupfonthandling [.1.] [.2.]

1 IDENTIFIER
2 inherits from \definefonthandling
```

The first argument is the handling to be altered, the second sets up the settings.

### 1.13.6 Setting up font handlings in MKIV

In MKIV, font handling is merged with the font features (because these already have a low-level connection to the font), so you can set up the font-side of things with the sixth argument of `\definetypesface`, like so:

```
\definefontfeature
  [hz] [default]
  [protrusion=pure, mode=node, script=latn]
\definetypesface [palatino] [rm] [serif] [palatino] [default] [features=hz]
\setupbodyfont [palatino]
\setupalign [hanging]
```

or by redefining the feature set that is used by the typescript you are using and then (re-)executing the typescript, like so:

```
\definefontfeature
  [default] [default]
  [protrusion=pure, expansion=quality, mode=node, script=latn]
\usetypescript[palatino]
\setupbodyfont [palatino]
\setupalign [hanging]
```

There is a list of predefined font handling feature values that you can use:

For protrusion, there is:

name	\setupalign	description
pure	hanging	full protrusion of only selected punctuation

punctuation	hanging	partial protrusion of punctuation
alpha	hanging	partial of some asymmetrical letters
quality	hanging	the combination of punctuation and alpha

For expansion, there is:

name	\setupalign	description
quality	hz	variable correction of character widths

These are defined in the file `font-ext.lua`. The low-level definitions look like

```

fonts.protrusions.vectors['pure'] = {
  [0x002C] = { 0, 1 }, -- comma
  [0x002E] = { 0, 1 }, -- period
  [0x003A] = { 0, 1 }, -- colon
  [0x003B] = { 0, 1 }, -- semicolon
  [0x002D] = { 0, 1 }, -- hyphen
  [0x2013] = { 0, 0.50 }, -- endash
  [0x2014] = { 0, 0.33 }, -- emdash
}
fonts.protrusions.classes['pure'] = {
  vector = 'pure', factor = 1
}

```

That was the complete definition of `protrusion=pure`. The key `classes` has the same function as the macro call `\definefonthandling` in MkII. It references the named vector `pure` and sets up a parameter.

For protrusion, there is only the one parameter `factor`, but for expansion there are a few more:

```

fonts.expansions.classes['quality'] = {
  stretch = 2, shrink = 2, step = .5, vector = 'default', factor = 1
}
fonts.expansions.vectors['default'] = {
  [byte('A')] = 0.5,
  [byte('B')] = 0.7,
  ... -- many more characters follow
}

```

As you can see, the definition order of vector vs. class is not important, and the format of the vector is a little different. The use of `byte()` is just so that that keying in hex numbers can be avoided. The values are bare numbers instead of hashes because there is only one per-character parameter involved with character expansion.

Also note that the values for the parameters `stretch`, `shrink` and `step` are divided by a factor 10 compared to the MkII definition.

IN MkIV, there is no support for the `spacing` key to `\setupalign` yet. That is because the low-level features in PDF<sub>T</sub>E<sub>X</sub> are not present in L<sub>U</sub>A<sub>T</sub>E<sub>X</sub>, and there is no replacement yet. The

font handling `noligs` is, of course, replaced by the OpenType font feature tags for ligatures: simply leave all of the relevant font features turned off.

## 1.14 Encodings and mappings

This paragraph only applies to PDF $\TeX$ . If you are exclusively using  $\XeTeX$  or  $\text{MkIV}$ , you can safely ignore the following text.

Not every language uses the (western) latin alphabet. Although in most languages the basic 26 characters are somehow used, they can be combined with a broad range of accents placed in any place.

In order to get a character representation, also called glyph, in the resulting output, you have to encode it in the input. This is no problem for `a..z`, but other characters are accessed by name, for instance `\eacute`. The glyph `é` can be present in the font but when it's not there,  $\TeX$  has to compose the character from a letter `e` and an accent ```.

In practice this means that the meaning of `\eacute` depends on the font and font encoding used. There are many such encodings, each suited for a subset of languages.

encoding	usage	status
<code>8r</code>	a (strange) mixture of encodings	useless
<code>default</code>	the 7 bit ASCII encoding as used by plain $\TeX$	obsolete
<code>ec</code>	the preferred encoding of $\TeX$ distributions	okay
<code>greek</code>	an encoding for modern greek	okay
<code>qx</code>	an encoding that covers most eastern european languages	okay
<code>t2a</code>	a cyrillic $\TeX$ font encoding	?
<code>t2b</code>	another cyrillic $\TeX$ font encoding	?
<code>t2c</code>	another another cyrillic $\TeX$ font encoding	?
<code>t5</code>	an encoding dedicated to vietnamese (many (double) accents)	okay
<code>texnansi</code>	a combination of $\TeX$ and Adobe standard encoding	okay

These encodings are font related as is demonstrated in figure 1.1, 1.2, 1.3, and 1.4. Here we used the `\showfont` command.

The situation is even more complicated than it looks, since the font may be virtual, that is, built from several fonts.

The advantage of using specific encodings is that you can let  $\TeX$  hyphenate words in the appropriate way. The hyphenation patterns are applied to the internal data structures that represent the sequence of glyphs. In spite of what you may expect, they are font-dependent! Even more confusing: they not only depend on the font encoding, but also on the mapping from lower to uppercase characters, or more precise, on the existence of such a mapping.

Unless you want to play with these encodings and mappings, in most cases you can forget their details and rely on what other  $\TeX$  experts tell you to do. Normally switching from one to another encoding and/or mapping takes place with the change in fonts or when some special output encoding is needed, for instance in PDF annotations and/or unicode vectors that enable

000	001	002	003	004	005	006	007	010	011	012	0a013	0b014	0c015	0d016	0e017	0f018
020	10021	11022	12023	13024	14025	15026	16027	17030	18031	19032	1a033	1b034	1c035	1d036	1e037	1f038
040	20041	21042	22043	23044	24045	25046	26047	27050	28051	29052	2a053	2b054	2c055	2d056	2e057	2f058
060	30061	31062	32063	33064	34065	35066	36067	37070	38071	39072	3a073	3b074	3c075	3d076	3e077	3f078
100	40101	41102	42103	43104	44105	45106	46107	47110	48111	49112	4a113	4b114	4c115	4d116	4e117	4f118
120	50121	51122	52123	53124	54125	55126	56127	57130	58131	59132	5a133	5b134	5c135	5d136	5e137	5f138
140	60141	61142	62143	63144	64145	65146	66147	67150	68151	69152	6a153	6b154	6c155	6d156	6e157	6f158
160	70161	71162	72163	73164	74165	75166	76167	77170	78171	79172	7a173	7b174	7c175	7d176	7e177	7f178
200	80201	81202	82203	83204	84205	85206	86207	87210	88211	89212	8a213	8b214	8c215	8d216	8e217	8f218
220	90221	91222	92223	93224	94225	95226	96227	97230	98231	99232	9a233	9b234	9c235	9d236	9e237	9f238
240	a0241	a1242	a2243	a3244	a4245	a5246	a6247	a7250	a8251	a9252	aa253	ab254	ac255	ad256	ae257	af258
260	b0261	b1262	b2263	b3264	b4265	b5266	b6267	b7270	b8271	b9272	ba273	bb274	bc275	bd276	be277	bf278
300	c0301	c1302	c2303	c3304	c4305	c5306	c6307	c7310	c8311	c9312	ca313	cb314	cc315	cd316	ce317	cf318
320	d0321	d1322	d2323	d3324	d4325	d5326	d6327	d7330	d8331	d9332	da333	db334	dc335	dd336	de337	df338
340	e0341	e1342	e2343	e3344	e4345	e5346	e6347	e7350	e8351	e9352	ea353	eb354	ec355	ed356	ee357	ef358
360	f0361	f1362	f2363	f3364	f4365	f5366	f6367	f7370	f8371	f9372	fa373	fb374	fc375	fd376	fe377	ff378

**Figure 1.1** The Latin Modern Roman font in ec encoding.

searching in documents. So, to summarize this: encodings and mappings depend on the fonts used as well have consequences for the language specific hyphenation patterns. Fortunately `CONTEXT` handles this for you automatically.

If you want to know to what extent a font is complete and characters need to be composed on the fly, you can typeset a couple of tables. The (current) composition is shown by `\showaccents`:

[illegible]



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
000	000001	01002	02003	03004	04005	05006	06007	07010	08011	09012	0a013	0b014	0c015	0d016	0e017	0f018
020	10021	11022	12023	13024	14025	15026	16027	17030	18031	19032	1a033	1b034	1c035	1d036	1e037	1f038
040	20041	21042	22043	23044	24045	25046	26047	27050	28051	29052	2a053	2b054	2c055	2d056	2e057	2f058
060	30061	31062	32063	33064	34065	35066	36067	37070	38071	39072	3a073	3b074	3c075	3d076	3e077	3f078
080	40081	41082	42083	43084	44085	45086	46087	47090	48091	49092	4a093	4b094	4c095	4d096	4e097	4f098
100	50099	51100	52101	53102	54103	55104	56105	57106	58107	59108	5a109	5b110	5c111	5d112	5e113	5f114
120	60115	61116	62117	63118	64119	65120	66121	67122	68123	69124	6a125	6b126	6c127	6d128	6e129	6f130
140	70131	71132	72133	73134	74135	75136	76137	77138	78139	79140	7a141	7b142	7c143	7d144	7e145	7f146
160	80147	81148	82149	83150	84151	85152	86153	87154	88155	89156	8a157	8b158	8c159	8d160	8e161	8f162
180	90163	91164	92165	93166	94167	95168	96169	97170	98171	99172	9a173	9b174	9c175	9d176	9e177	9f178
200	a0179	a1180	a2181	a3182	a4183	a5184	a6185	a7186	a8187	a9188	aa189	ab190	ac191	ad192	ae193	af194
220	b0195	b1196	b2197	b3198	b4199	b5200	b6201	b7202	b8203	b9204	ba205	bb206	bc207	bd208	be209	bf210
240	c0211	c1212	c2213	c3214	c4215	c5216	c6217	c7218	c8219	c9220	ca221	cb222	cc223	cd224	ce225	cf226
260	d0227	d1228	d2229	d3230	d4231	d5232	d6233	d7234	d8235	d9236	da237	db238	dc239	dd240	de241	df242
280	e0243	e1244	e2245	e3246	e4247	e5248	e6249	e7250	e8251	e9252	ea253	eb254	ec255	ed256	ee257	ef258
300	f0259	f1260	f2261	f3262	f4263	f5264	f6265	f7266	f8267	f9268	fa269	fb270	fc271	fd272	fe273	ff274

name: texnansi-lmr10 at 11.0pt encoding: texnansi mapping: texnansi handling: default

Figure 1.2 The Latin Modern Roman font in texnansi encoding.

	À	Á	Â	Ã	Ä	Å	Æ	Ç	È	É	Ê	Ë	Ì	Í	Î	Ï
\~	â	á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î	ï
\~	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā
\"	ä	ä	ä	ä	ä	ä	ä	ä	ä	ä	ä	ä	ä	ä	ä	ä
\H	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā
\r	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā	ā

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15															
000	000001	01	002	02	003	03	004	04	005	05	006	06	007	07	010	08	011	09	012	0a	013	0b	014	0c	015	0d	016	0e	017	0f	
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31																
020	10	021	11	022	12	023	13	024	14	025	15	026	16	027	17	030	18	031	19	032	1a	033	1b	034	1c	035	1d	036	1e	037	1f
32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47																
040	20	041	21	042	22	043	23	044	24	045	25	046	26	047	27	050	28	051	29	052	2a	053	2b	054	2c	055	2d	056	2e	057	2f
48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63																
060	30	061	31	062	32	063	33	064	34	065	35	066	36	067	37	070	38	071	39	072	3a	073	3b	074	3c	075	3d	076	3e	077	3f
64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79																
100	40	101	41	102	42	103	43	104	44	105	45	106	46	107	47	110	48	111	49	112	4a	113	4b	114	4c	115	4d	116	4e	117	4f
80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95																
120	50	121	51	122	52	123	53	124	54	125	55	126	56	127	57	130	58	131	59	132	5a	133	5b	134	5c	135	5d	136	5e	137	5f
96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111																
140	60	141	61	142	62	143	63	144	64	145	65	146	66	147	67	150	68	151	69	152	6a	153	6b	154	6c	155	6d	156	6e	157	6f
112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127																
160	70	161	71	162	72	163	73	164	74	165	75	166	76	167	77	170	78	171	79	172	7a	173	7b	174	7c	175	7d	176	7e	177	7f
128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143																
200	80	201	81	202	82	203	83	204	84	205	85	206	86	207	87	210	88	211	89	212	8a	213	8b	214	8c	215	8d	216	8e	217	8f
144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159																
220	90	221	91	222	92	223	93	224	94	225	95	226	96	227	97	230	98	231	99	232	9a	233	9b	234	9c	235	9d	236	9e	237	9f
160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175																
240	a0	241	a1	242	a2	243	a3	244	a4	245	a5	246	a6	247	a7	250	a8	251	a9	252	aa	253	ab	254	ac	255	ad	256	ae	257	af
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191																
260	b0	261	b1	262	b2	263	b3	264	b4	265	b5	266	b6	267	b7	270	b8	271	b9	272	ba	273	bb	274	bc	275	bd	276	be	277	bf
192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207																
300	c0	301	c1	302	c2	303	c3	304	c4	305	c5	306	c6	307	c7	310	c8	311	c9	312	ca	313	cb	314	cc	315	cd	316	ce	317	cf
208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223																
320	d0	321	d1	322	d2	323	d3	324	d4	325	d5	326	d6	327	d7	330	d8	331	d9	332	da	333	db	334	dc	335	dd	336	de	337	df
224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239																
340	e0	341	e1	342	e2	343	e3	344	e4	345	e5	346	e6	347	e7	350	e8	351	e9	352	ea	353	eb	354	ec	355	ed	356	ee	357	ef
240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255																
360	f0	361	f1	362	f2	363	f3	364	f4	365	f5	366	f6	367	f7	370	f8	371	f9	372	fa	373	fb	374	fc	375	fd	376	fe	377	ff

name: qx-lmr10 at 11.Opt encoding: qx mapping: qx handling: default

**Figure 1.3** The Latin Modern Roman font in qx encoding.

[illegible]

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
000	001	002	003	004	005	006	007	008	009	010	011	012	013	014	015
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
020	021	022	023	024	025	026	027	028	029	030	031	032	033	034	035
32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
040	041	042	043	044	045	046	047	048	049	050	051	052	053	054	055
48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
060	061	062	063	064	065	066	067	068	069	070	071	072	073	074	075
64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115
80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155
112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215
144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235
160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275
192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315
208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335
224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355
240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255
360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375
260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275
380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395
280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295
400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415
300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315
420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435
320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335
440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455
360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375
460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475
380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395
500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515
400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415
520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535
440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455
560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575
480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495
600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615
520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535
640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655
560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575
680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695
600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615
720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735
640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655
760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775
700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715
740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755
780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795
720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735
800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815
740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755
840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855
780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795
820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835
860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875
800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815
880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895
820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835
900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915
840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855
940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955
880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895
960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975
900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915
980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995
920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935
940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955
960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975
980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995
996	997	998	999												

name: t5-lmr10 at 11.0pt encoding: t5 mapping: t5 handling: default

Figure 1.4 The Latin Modern Roman font in t5 encoding.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
\d	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
\k	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
\c	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

with `\showcharacters`, you get a list of named characters (and glyphs) as known to the system.

ec ec-uplr8a at 11.0pt:			composed	bottom	char	raw
,	textcomma	¼	onequarter		„	quotedblbase
.	textperiod	½	onehalf		“	quotedblleft
´	textacute	¾	threequarter		”	quotedblright
.	textbottomdot	1	onesuperior		‘	quotesingle
˘	textbreve	2	twosuperior		,	quotesinglebase
ˇ	textcaron	3	threesuperior		’	quoteleft
¸	textcedilla	¢	textcent		’	quoteright
^	textcircumflex	■	textcurrency		<	guilsingleleft
¨	textdiaeresis	\$	textdollar		>	guilsingleright
˙	textdotaccent	€	texteuro		«	leftguillemot
`	textgrave	f	textflorin		»	rightguillemot
ˆ	texthungarumlaut	£	textsterling		Â	Acircumflex
ˉ	textmacron	Y	textyen		â	acircumflex
˚	textogonek	ª	ordfeminine		Ĉ	Ccircumflex
˚	textring	º	ordmasculine		ĉ	ccircumflex
~	texttilde	%	percent		Ê	Ecircumflex
,	textbottomcomma	‰	perthousand		ê	ecircumflex
ı	dotlessi	-	softhyphen		Ĝ	Gcircumflex
	dotlessj	.	periodcentered		ĝ	gcircumflex
I	dotlessI		compoundwordmark		Ĥ	Hcircumflex
J	dotlessJ	^	textasciicircum		ĥ	hcircumflex
-	endash	~	textasciitilde		Î	Icircumflex
—	emdash	/	textslash		î	icircumflex
æ	aeligature	\	textbackslash		Ĵ	Jcircumflex
Æ	AEligature	{	textbraceleft		ˆ	jcircumflex
	ijligature	}	textbraceright		Ô	Ocircumflex
	IJligature	_	textunderscore		ô	ocircumflex
œ	oeligature	ˆ	textvisiblespace		Ŝ	Scircumflex
Œ	OEligature		textbrokenbar		ŝ	scircumflex
ß	ssharp	•	textbullet		Û	Ucircumflex
	Ssharp	†	textdag		û	ucircumflex
þ	thorn	‡	textddag		Ŵ	Wcircumflex
Þ	Thorn	°	textdegree		ŵ	wcircumflex
ð	eth	÷	textdiv		Ŷ	Ycircumflex
Ð	Eth	…	textellipsis		ŷ	ycircumflex
ı	exclamdown	/	textfraction		À	Agrave
¿	questiondown	¬	textlognot		à	agrave
©	copyright	-	textminus		È	Egrave
®	registered	μ	textmu		è	egrave
™	trademark	×	textmultiply		Ì	Igrave
§	sectionmark	±	textpm		ì	igrave
¶	paragraphmark	"	quotedbl		Ò	Ograve

ò	ograve	Ś	Sacute	ș	scedilla
Ù	Ugrave	ś	sacute		Tcedilla
ù	ugrave	Ú	Uacute		tcedilla
Ỳ	Ygrave	ú	uacute	Ő	Ohungarumlaut
ỳ	ygrave	Ý	Yacute	ő	ohungarumlaut
Ã	Atilde	ý	yacute	Ű	Uhungarumlaut
ã	atilde	Ž	Zacute	ű	uhungarumlaut
İ	Itilde	ž	zacute	Ą	Aogonek
ĩ	itilde		dstroke	ą	aogonek
Ñ	Ntilde	Đ	Dstroke	Ę	Eogonek
ñ	ntilde	H	Hstroke	ę	eogonek
Ö	Otilde	h	hstroke	Į	Iogonek
õ	otilde	T	Tstroke	į	iogonek
Ũ	Utilde	t	tstroke	U	Uogonek
ũ	utilde	Ć	Cdotaccent	u	uogonek
Ỹ	Ytilde	ć	cdotaccent	Å	Aring
ỹ	ytilde	Ė	Edotaccent	å	aring
Ä	Adiaeresis	ė	edotaccent	Ů	Uring
ä	adiaeresis	Ġ	Gdotaccent	ů	uring
Ě	Ediaeresis	ġ	gdotaccent	Ǻ	Abreve
ě	ediaeresis	Į	Idotaccent	ǻ	abreve
İ	Idiaeresis	į	idotaccent	Ě	Ebreve
ï	idiaeresis	Ž	Zdotaccent	ě	ebreve
Ö	Odiaeresis	ž	zdotaccent	Ǧ	Gbreve
ö	odiaeresis	Ā	Amacron	ǧ	gbreve
Ü	Udiaeresis	ā	amacron	Ĭ	Ibreve
ü	udiaeresis	Ē	Emacron	ĩ	ibreve
Ÿ	Ydiaeresis	ē	emacron	Ŏ	Obreve
ȳ	ydiaeresis	Ī	Imacron	ǫ	obreve
Á	Aacute	ī	imacron	Ů	Ubreve
á	aacute	Ō	Omacron	ǔ	ubreve
Ć	Cacute	ō	omacron	Č	Ccaron
ć	cacute	Ū	Umacron	č	ccaron
É	Eacute	ū	umacron	Ď	Dcaron
é	eacute	Ç	Ccedilla	ď	dcaron
Í	Iacute	ç	ccedilla	Ě	Ecaron
í	iacute	Ꞥ	Kcedilla	ě	ecaron
Ĺ	Lacute	ꞥ	kcedilla	Ł	Lcaron
ĺ	lacute	Ꞧ	Lcedilla	ł	lcaron
Ň	Nacute	ꞧ	lcedilla	Ň	Ncaron
ň	ncacute	Ꞩ	Ncedilla	ň	ncaron
Ó	Oacute	ꞩ	ncedilla	Ř	Rcaron
ó	oacute	Ɦ	Rcedilla	ř	rcaron
Ř	Racute	Ɜ	rcedilla	Š	Scaron
ř	racute	Ɡ	Scedilla	š	scaron

Š	Tcaron	y	yhook	Ŏ	Odotbelow
š	tcaron	Â	Acircumflexgrave	ơ	odotbelow
Ÿ	Ycaron	Â	Acircumflexacute	Ů	Udotbelow
ŷ	ycaron	Â	Acircumflextilde	ư	udotbelow
Ž	Zcaron	Â	Acircumflexhook	Ỳ	Ydotbelow
ž	zcaron	â	acircumflexgrave	ỳ	ydotbelow
Ł	Lstroke	â	acircumflexacute	Ỗ	Ohorndotbelow
ł	lstroke	â	acircumflextilde	ơ	ohorndotbelow
Ø	Ostroke	â	acircumflexhook	Ů	Uhorndotbelow
ø	ostroke	Ê	Ecircumflexgrave	ư	uhorndotbelow
ä	aumlaut	Ê	Ecircumflexacute	Â	Acircumflexdotbelow
ë	eumlaut	Ê	Ecircumflextilde	â	acircumflexdotbelow
ï	iumlaut	Ê	Ecircumflexhook	Ê	Ecircumflexdotbelow
ö	oumlaut	ê	ecircumflexgrave	ê	ecircumflexdotbelow
ü	uumlaut	ê	ecircumflexacute	Ŏ	Ocircumflexdotbelow
Ä	Aumlaut	ê	ecircumflextilde	ơ	ocircumflexdotbelow
Ë	Eumlaut	ê	ecircumflexhook	Â	Abrevedotbelow
Ï	Iumlaut	Ô	Ocircumflexgrave	ă	abrevedotbelow
Ö	Oumlaut	Ô	Ocircumflexacute	Ŏ	Ohorn
Ü	Uumlaut	Ô	Ocircumflextilde	Ò	Ohorngrave
ș	scommaaccent	Ô	Ocircumflexhook	Ó	Ohornacute
Ș	Scommaaccent	ô	ocircumflexgrave	Õ	Ohorntilde
	tcommaaccent	ô	ocircumflexacute	Ŏ	Ohornhook
	Tcommaaccent	ô	ocircumflextilde	o	ohorn
ı	lcommaaccent	ô	ocircumflexhook	ò	ohorngrave
Ł	Lcommaaccent	Ă	Abrevegrave	ó	ohornacute
Ě	Etilde	Ă	Abreveacute	õ	ohorntilde
ě	etilde	Ă	Abrevetilde	o	ohornhook
À	Ahook	Ă	Abrevehook	U	Uhorn
á	ahook	ă	abrevegrave	Ù	Uhorngrave
É	Ehook	ă	abreveacute	Ú	Uhornacute
é	ehook	ă	abrevetilde	Û	Uhorntilde
Î	Ihook	ă	abrevehook	U	Uhornhook
î	ihook	Ạ	Adotbelow	u	uhorn
Ō	Ohook	ạ	adotbelow	ù	uhorngrave
o	ohook	Ẹ	Edotbelow	ú	uhornacute
U	Uhook	ẹ	edotbelow	û	uhorntilde
u	uhook	Ị	Idotbelow	u	uhornhook
Y	Yhook	ị	idotbelow		

---

If you want to know what patterns are used, you can try to hyphenate a word with `\showhyphenations`.

```
language : en (internal code:23)
font      : ec-uplr8a at 11.0pt
encoding  : ec
mapping   : not set
handling  : not set
sample    : abra-cadabra
```

