

How pdfTEX can improve your pages

typographic extensions

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- marginal kerning
- composing with font expansion

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Marginal kerning

- we want the margins of text to look even
- text without marginal kerning looks ragged rather than justified
- certain marginal characters can make a line look shorter, especially hyphen characters, punctuation and dashes
- letters from an italic font can make a line look longer
- hanging punctuation can be done at the macro level, but only with great difficulties
- font metrics changes are needed for hanging the hyphen character
- not only punctuation and hyphens need marginal kerning, certain letters also do
- a good typesetting engine should have this feature

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Composing with font expansion

- we want to get better interword spacing
- currently the only variable factor to justify lines is the interword glue
- we want to change other parameters to justify a line like
 - glyph scaling
 - interletter spacing
- such manipulations can impair readability and harmony of text
- such techniques are widely used; however they are often misused
- therefore they are considered awful
- with careful use it can help to improve interword spacing

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- after all we want to examine whether such techniques are useable to not
- even if this feature is not up to our expectations, by implementing it we can at least investigate it

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Design and implementation of marginal kerning

- the concept of character protruding
- integration to paragraph building
- choosing appropriate parameters

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The concept of character protruding

- each character from a font is associated with a left character protruding factor
- the factor gives the amount by which the character should ‘protrude’ out to the left margin
- similarly, the right character protruding factor is used for the right margin
- these parameters only affect characters positioned at the margins
- one unit of character protruding factor corresponds to one thousandth of the character width

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Level 1 character protruding

- is applied after line breaking
- does not count the protruding amount in badness calculation
- thus does not affect the choice of final breakpoints
- provided for backward compatibility
- can slightly impair interword spacing

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Level 2 character protruding

- is applied during line breaking
- counts the protruding amount into badness calculation
- can change the choice of final breakpoints
- gives better interword spacing than level 1

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Choosing appropriate parameters

- step by step elimination of ‘raggedness’ of various samples
- common cases that need marginal adjustment:
 - hyphen char, en dash, em dash
 - punctuation characters
 - quotes
 - characters with a lot of white area in the side bearing

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A father had two sons, of whom the eldest was clever and bright, and always knew what he was about; but the youngest was stupid, and couldn't learn or understand anything. So much so that those who saw him exclaimed: "What a burden he'll be to his father!" Now when there was anything to be done, the eldest had always to do it; but if something was required later or in the night-time, and the way led through the churchyard or some such ghostly place, he always replied: "Oh! no, father: nothing will induce me to go there, it makes me shudder!" for he was afraid. Or, when they sat of an evening around the fire telling stories which made one's flesh creep, the listeners sometimes said: "Oh! it makes one shudder," the youngest sat in a corner, heard the exclamation, and could not understand what it meant. "They are always saying it makes one shudder! it makes one shudder! Nothing makes me shudder. It's probably an art quite beyond me."

Now it happened that his father said to him one day: "Hearken, you there in the corner; you are growing big and strong, and you must learn to earn your own bread. Look at your brother, what pains he takes; but all the money I've spent on your education is thrown away." "My dear father," he replied, "I will gladly learn—in fact, if it were possible I should like to learn to shudder; I don't understand that a bit yet." The eldest laughed when he heard this, and thought to himself: "Good heavens! what a ninny my brother is! he'll never come to any good; as the twig is bent, so is the tree inclined." The father sighed, and answered him: "You'll soon learn to shudder; but that won't help you to make a living."

Shortly after this, when the sexton came to pay them a visit, the father broke out to him, and told him what a bad hand his youngest son was at everything; he knew nothing and learned nothing. "Only think!

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Minion at 12pt. Left: normal TeX output. Right: with marginal kerning.

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Composing using font expansion

- the concept of font expansion in pdf_TE_X
- integration to paragraph building
 - level 1 font expansion
 - level 2 font expansion
- making expanded fonts
- choosing appropriate parameters
- interletter spacing
- selective use of multiple glyphs

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The concept of font expansion in pdf $\text{T}_{\text{E}}\text{X}$

- each font (TFM) can have an associated set of extra fonts, called expanded fonts
- each expanded font corresponds to an expansion amount, given in expansion units
- condensing is treated as expansion by a negative amount
- font stretchability: the maximum expansion amount
- font shrinkability: the minimum expansion amount
- to limit the number of expanded fonts, each expansion amount must be a multiple of an expansion step
- expanded fonts have the same (TFM) name as the base font, followed by the expansion amount
- a character can be ‘stretched’ using a wider variant or ‘shrunk’ using a narrower variant
- ‘character stretchability’: the variance of the character width between the base and the widest variant
- character shrinkability is defined in a similar way

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Examples

- font: cmr10
- stretchability: 20
- shrinkability: 10
- expansion step: 5
- expanded fonts: cmr10+20, cmr10+15, cmr10+10, cmr10+5, cmr10-5, cmr10-10
- character stretchability: variance of the character width between cmr10 and cmr10+20
- character shrinkability: variance of the character width between cmr10 and cmr10-10

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Level 1 font expansion

- is applied after line breaking
- does not count character stretchability and shrinkability into choosing breakpoints
- before line justification is done, font expansion is applied to minimize the amount that a line should be stretched or shrunk by
- thus does not affect the choice of final breakpoints
- can slightly improve interword spacing

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Level 2 font expansion

- is applied during line breaking
- considers character stretchability and shrinkability while choosing breakpoints
- can give completely different final breakpoints
- can considerably improve interword spacing

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Making expanded fonts

- by convention, one expansion unit corresponds to one thousandth of the character width
- the distortion of character shapes must be as small as possible
- the most important factor is to keep the stroke width of letterforms unchanged
- tested with fonts: CM (from METAFONT source), Type 1, and MM

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CM fonts

- increase the unit width in the mf source by the desired amount
- cmr10+10.mf is created from cmr10.mf as follows:

```
u# := 20/36pt# ;      % unit width
u# := u#+10/1000u# ;
```

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MM fonts with width axis

- create the new instance with the width value increased by the required amount
- pmnr8a12.pfb (Regular Minion at 12pt) used in the sample was generated as follows:

```
mmpfb
--width=535
--weight=400
--optical-size=12
-o pmnr8a12.pfb MinionMM.pfb
```

- the width value used is 535, thus expansion by 10 units corresponds to $535 \times (1 + 10/1000) = 540.35$.
- thus pmnr8a12+10.pfb would be generated as follows:

```
mmpfb
--width=540.35
--weight=400
--optical-size=12
-o pmnr8a12+10.pfb MinionMM.pfb
```

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Type 1 fonts

- use horizontal scaling to expand a font by the required amount
- uplr8a+10 (Palatino expanded by 10 units) will have a map entry like follows:

```
uplr8a+10
  "1.010 ExtendFont"
  <uplr8a.pfb
  <8a.enc
```

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The effect of font expansion on character width

- CM and Type 1 fonts: all characters are expanded by approximately the required amount
- MM fonts: depends rather on character shapes, the variance in character width is often much smaller than the required amount

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Choosing appropriate parameters

- the higher limit of expansion, the better word spacing
- but too much expansion impairs readability
- reasonable limits:
 - 20 units for CM/Type 1 fonts
 - 40 units for MM fonts

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Expansion of selected characters

- certain characters are more sensitive to font expansion
- we want to expand such characters by a smaller amount
- character expansion factor: how much a character can be expanded
 - full expansion: 1000
 - no expansion: 0
 - 50% expansion: 500
- this can help to increase the limit of font expansion
- 30 for CM/Type 1 fonts and 60 for MM fonts

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Interletter spacing

- we use the expanded font metrics but do not expand the character shapes
- thus the amount gained by font expansion is distributed to space between letters.
- the effect on readability is not changed much in comparison with font expansion
- very sensitive eye can find that letter spacing causes a little bit more distortion of type than font expansion

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Selective use of multiple glyphs

- we apply font expansion only to several characters
- some letters have their wider counterparts
- these wider variants can be used according to the need to justify a line
- such wider glyphs should exist in the font for this purpose
- their appearance should be different from the base letterform, and should fit well with all other characters

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Conclusions

- marginal kerning:
 - turned out to be a very good thing to have
 - easy to use, no extra setup, no intervention to font metrics
 - the improvement is substantial
 - strongly recommended to regular use
- composing with font expansion
 - less desirable than marginal kerning
 - difficult to use (complicated font setup)
 - the improvement is not so substantial
 - misuse can heavily damage readability
 - not recommended for normal use
 - can be helpful in some rare applications where special care of interword spacing is desired
 - 2% of variance in character width is the limit

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