Help!
The Typesetting Area

Abstract
Typesetting (large) documents presents significant challenges that have to be resolved before a satisfactory printed result is achieved; e.g. the internal structure of the document should be clear, and the document's typographical layout should match its content. This article, based on a presentation given at the NTG day in Arnhem on 13 November 2003, describes a traditional design technique known as the harmonic proportion.

Introduction
Designing a layout for a document, and specially for a book, is not an easy task. Many discussions have been dedicated to the 'best' typographical approach. There are different schools, and therefore different opinions, concerning correct page design, e.g. Ph. Taylor [5] and J. Tschichold [6]. In this article I explain what one might take into account to achieve an appealing, harmonic result based on the work of Jan Tschichold [6].

Papersizes
In earlier times the most common ratio of height to width of paper from the factory was 3 : 4. A sheet of paper which is folded once is called folio. Adding another fold will result in a quarto which turns into an octavo after the next fold. When starting with a 3 : 4 sheet the proportions in the folded format will become consecutively: 2 : 3 and 3 : 4 again. The octavo, which is a section with 16 pages, would have the proportion 2 : 3.

Nowadays in Europe the DIN (Deutsche Industrie Norm) formats are used. The characteristic of these formats is that the proportion between height and width is $1:\sqrt{2}$ – which is approximately 1 : 1.414. When folding such paper sheets the ratio always remains $1:\sqrt{2}$. The DIN formats begin with the base size of A_0 which has a surface of 1 m^2. The index number rises with each time the sheet is cut in half – see figure 1.

Grain of Paper
When designing a document, it is important to know the grain of the paper. Handmade paper has no grain because its fibers settle down in random directions. So it makes no difference which direction the paper is folded. Not so for paper produced in a continuous process. Due to the (fast) movement in the production direction, many paper fibers get arranged in the direction of the production process. The result is that paper so produced folds easier in one direction. This effect is called the grain of paper. In order to have a book which opens easily and where the pages turn softly, it is important to have the grain of the paper in the direction of the spine of the book. Concerning the DINformats even numbers have commonly the grain in the height/length of the sheet.

Choosing A Format For The Book
When designing a book one should keep in mind how the book will be used. The format of a book that is read while held in the hand is different from the format of a book that is read while laid open on a table. Hand held books should be taller than they are wide. Two traditional page formats (width : height) for tall books
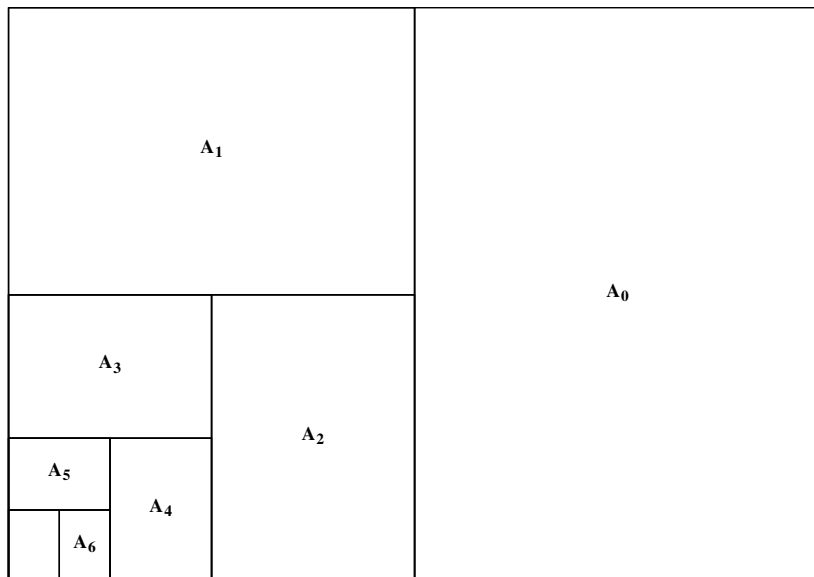
Figure 1 From A_0 to A_6

are are: 21 : 34 (golden ratio) and 2 : 3. For very small books, ratios of 1 : 1.732 (1 : $\sqrt{3}$) or 3 : 5 are fine.

Bad proportions of the page are 3 : 4 or 1 : 1.414 (1 : $\sqrt{2}$) – just try it yourself! Take an A_5 book and read it while holding it in your free hand. ...

Conversely, large books that are studied laid open on a table can have a page proportion of 3 : 4 without any problem. Oblong books, where the height is less than the width, can also be read laid open on a table.

Figure 2 shows different page proportions.
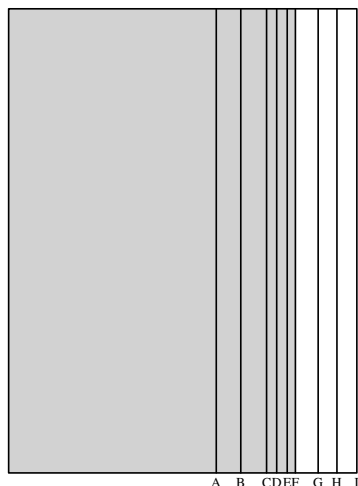
The characters in figure 2 indicate the following ratios between width and height of the page:

A : 1 : $\sqrt{5}$
B : 1 : 2
C : 5 : 9
D : 1 : $\sqrt{3}$
E : 3 : 5
F : 21 : 34 (golden ratio)
G : 2 : 3
H : 1 : $\sqrt{2}$
I : 3 : 4

Figure 2 Page proportions (the gray area indicates the golden ratio)

Managing Readability

In order to make life easier for the reader, one should try to make the average line length some 40 to 70 characters long – including spaces. The emphasis lays on the

70 characters including spaces. The 70 characters rule is applicable for different European languages such as English, Dutch and German.

In addition to the number of characters, the number of words in one line should also be considered. For the German language, a line consisting of 8 to 12 words is optimal.

Care should be taken when choosing the font. There are, of course, discussions on whether or not to use sansserif fonts for the main text. The important things are that one should restrict the number of fonts used, and that the fonts should contrast well. The less decorative elements a font has, the more legible it will be. One should avoid setting running texts in calligraphic or italic fonts.

In order to fit the 70 characters on a line, one can choose for fonts which run narrower or broader. Compare texts typeset in Times Roman, which is a narrow-running font developed for the Times newspaper, to the same text typeset in Bookman or Garamond. The examples in the TeX Font Sampler booklet [1] are quite instructive.

Another possibility to fit the line length requirement is to change the font size. Normally font sizes less than 8pts are not easily read.

Placement Of The Typesetting Area On The Paper

Now then, where to place the typesetting area on the page? Typographers did and still do differ in opinion on this subject. It is interesting to know that J. Tschichold in his young years was a promoter of the asymmetrical style of typography associated with the modernist and Bauhaus movements. Later on he started to study medieval manuscripts and printed documents from the middle ages, and completely reversed his opinion. His credo became the harmony of the spread and the page with the printed area. By measuring countless documents he discovered that often the the proportions for the size of the margins (inner, top, outer, and bottom) were: 2,3,4, and 6 respectively. Furthermore he discovered that a *page* with a ratio of 2 : 3 permits a typesetting area whose height is equal to the width of the page – see figure 3).
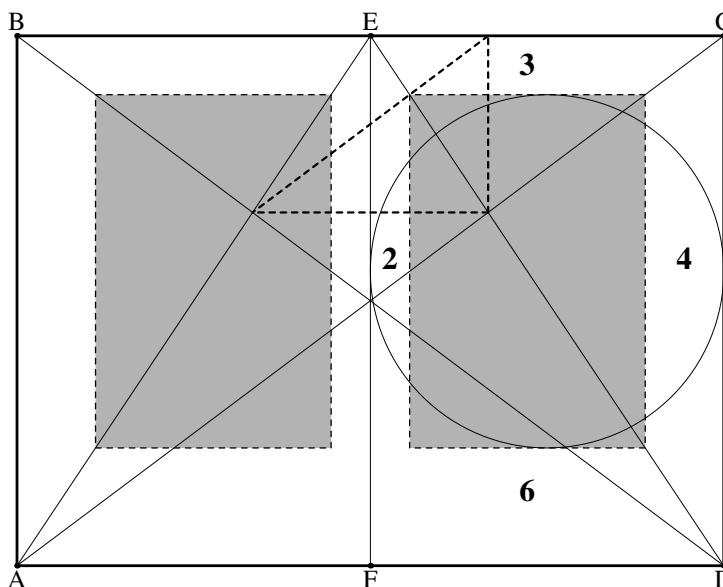

Figure 3 Page proportion 2 : 3, the text block height is equal to the page width.

These principles of book design formed a ('canon') that was used by such early printers as Gutenberg and Schöffer (calligraph).

In order to design a typesetting area that meets the requirements mentioned above, one needs to be able to divide the page width and height into ninths, since the inner top corner of each text block is one-ninth of the way across and one-ninth of the way down the page.

This division has been described by J.A. van de Graaf [7]. In 1955 Tschichold presented another approach to this using the knowledge of Villard de Honnecourt, an architect who lived in the first half of the 13th century, and the studies presented by H. Kayser [8]. The idea is that one can geometrically divide any length into thirds, fifths, and sevenths and so on. This construction was further improved by Goldenheim, Litchfield and Dietrich (GLaD-construction)[2], which yields odd and even divisions in separate diagrams. Kayser combined these methods in a single diagram. A Villard's diagram is presented in figure 4.
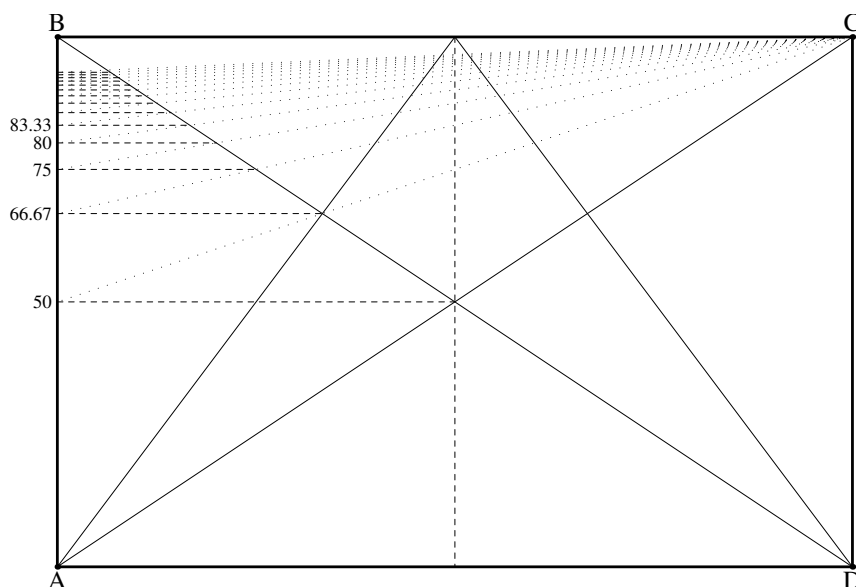
**Figure 4**   An example diagram according to Villard de Honnecourt

Tschichold applied Villard de Honnecourt's construction recursively, and since (1/3) × (1/3) = (1/9), this method ensures that the top inner corner of each text block (shown dashed in the figure 5) is located both one-ninth of the way across and down the page. Thus, the recursive Villard construction can be used to determine the size and position of the typesetting area, which have the same aspect ratio as the pages themselves.

Though Tschichold preferred a page ratio of 2 : 3, the same construction method can be applied to any page dimension and paper proportion. Moreover, one not even has to adhere to the division into ninths; other divisions like twelve (see figure 6) will also result in a harmonious proportion between the page and the typesetting area, and the portions of white space around the text block [6].

Determine Necessary Data In MetaPost

To calculate and draw harmonic ratios, the principles presented in the previous section were implemented in a MetaPost program. The program accepts the paper height, the aspect ratio of the spread, and the dividing factor of 9 or 12. Because the graphic dimensions can vary greatly, the program also accepts a scaling factor which tells MetaPost to scale the graphic, while leaving the calculated results unchanged.

Data used in figure 6:
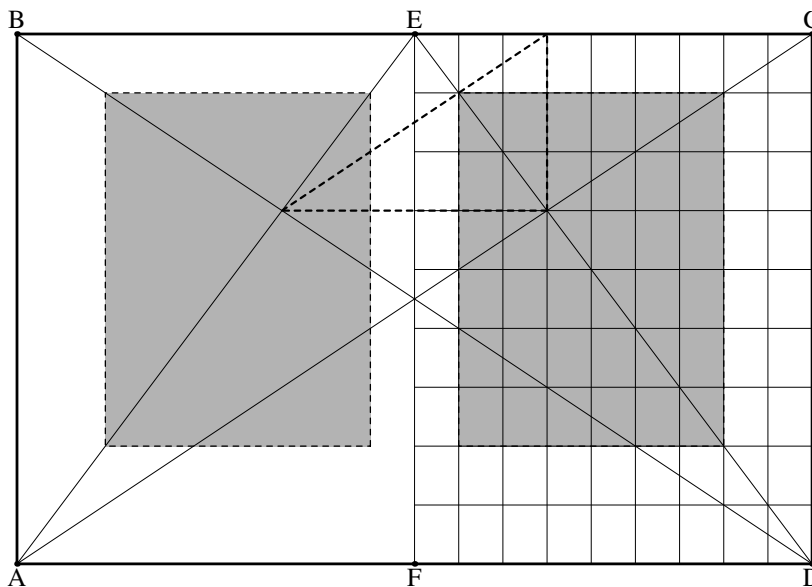
Figure 5 Finding the left upper corner of the typesetting area with the method presented by J. Tschichold (dashed) and J.A. van de Graaf
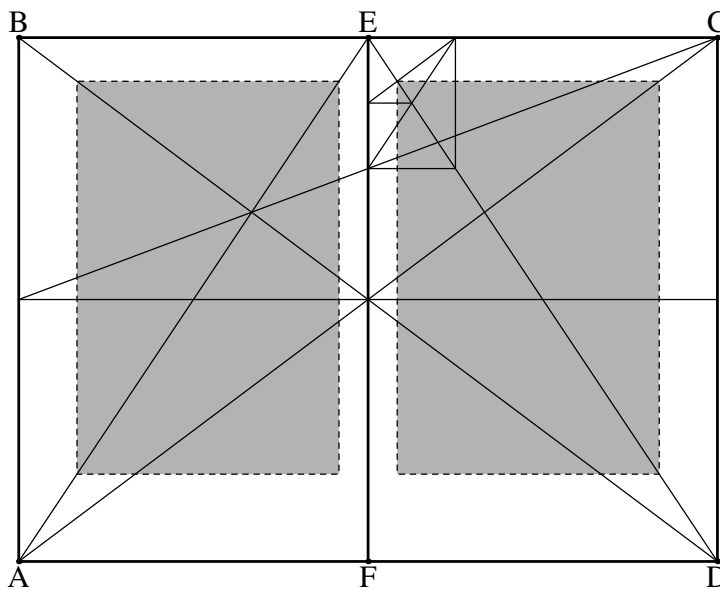
Figure 6 Finding the typesetting area with a division of 12 using the Villard de Honnecourt method

h   : 22 cm
proportion A   : 3
proportion B   : 4
dividing factor : 12

Data for the layout as calculated by MetaPost are given in table 1.

Binding Correction
So far, only a single spread was used to calculate the typesetting area and the white space around it. When the document will be bound into a book, there must be

Proportion (height : width) of paper	3 : 4
Dividing factor	12
Page height (A - B)	220 mm
Page width (A - F)	146.5 mm
Inner margin	12
Top margin	18 mm
Outer margin	24 mm
Lower margin	37 mm
Height of typesetting area	165 mm
Width of typesetting area	110 mm

Table 1   Typesetting data as calculated by MetaPost

a correction for the optical loss of white space at the binding edge. How big this correction must be is difficult to tell because it depends on the weight and thickness of the paper, the thickness of the book, and, last but not least, on the type of binding used. So the binding correction can best be discussed with the printing house and the bindery.

Setup Of A Calculated Typesetting Area In Context
When setting up a Context document following J. Tschichold's principles, the proportions can best be calculated on a separate piece of paper. Draw the actual dimensions of a spread and the single page, and use the Villard geometrical division method to find the one-third and one-ninth point.

Then measure the relevant dimensions.

Another approach is to use MetaPost to calculate the dimensions.

The following \setuplayout-command-options are used to typeset the example presented table 1 in Context

```
\setuplayout
  [topspace=18mm,            % top margin
   header=0pt,
   headerdistance=0pt,
   backspace=16mm,           % inner margin + binding correction
   leftmargin=12mm,          % inner margin
   rightmargin=24mm,         % outer margin
   footerdistance=10mm,
   footer=4mm,
   height=179mm,
   width=110mm,
   location=doublesided]
```

As you can see, not all the data presented in table 1 are used in the \setuplayout-command-options.

Option	Comment
topspace	As in the table
header / headerdistance	Header and headerdistance get positive values if these have to be included in the typesetting area (running headers)
backspace	The backspace is enlarged by 4 mm for binding correction
left / right margin	As in the table
footer / footerdistance	Empirically set
height	In Context the height always includes header and headerdistance and footer and footerdistance.

width	As in the table
location	The document will be doublesided, and centered on the paper

In the near future Context will provide several predefined page setups. The predefinitions will contain single and doublesided layouts. The doublesided layout will be based on the ninths-division. Other setups will allow the layout to take character widths into account. Since the average number of occurrences of different characters varies between languages, the adjustments will be language dependent.

Setup Of A Decent Layout In Latex

Latex users are encouraged to have a closer look at the KOMA-script package [3][1]. KOMA-script provides single- and doublesided layouts. The doublesided layout is based on the ninths-division. It is possible to have the typesetting area adjusted for the font used (70 chars width of the line). The KOMA-script also accepts a binding correction.

Conclusion

- □ If the typesetting area must be as high as the width of the page, then the ratio of the paper (spread) must be 3 : 4. In this case the page has the proportion 2 : 3.
- □ The drawing method developed by van der Graaf en Tschichold can be applied to any paper size and paper proportion.
- □ The 'canon' of division by 9 or 12 is not mandatory.
- □ The typesetting area remains harmonious with respect to the page if it is related to the diagonals of the spread and the diagonals of the page.
- □ The calculated inner margin of a spread must be enlarged by the binding correction for compensation of optical loss of white space due to binding.
- □ For easy reading, the line length should not exceed 70 characters – including spaces.
- □ The line-length can be influenced by the font size and the choice of font (narrow-running vs. broad-running).

The interested reader might want to look at some examples of books. The Royal Library in the Hague has a website dedicated to 100 highlights out of their collection [4].

Literature

[1] Hagen H., Egger W.. TeX Font Sampler. NTG, Dante, Gutenberg. 2004.

[2] GLaD-construction: http://world.std.com/˜wij/glad/tschichold.html

[3] Kohm M.. Satzspiegelkonstruktion im Vergleich. Die TeXnische Kommödie. 4, 2002. 28 – 48.

[4] Koninklijke Bibliotheek Den Haag: Honderd hoogtepunten uit de Koninklijke Bibliotheek. http://www.kb.nl/kb/100hoogte/index.html.

[5] Taylor Ph.. Book Design for TeX Users. MAPS 19, 19 – 22, 28 – 36. 1997.

[6] Tschichold J.. Ausgewählte Aufsätze über Fragen der Gestalt des Buches und der Typographie. Birkhäuser Verlag Basel. 2. Auflage. ISBN-3-7643-1946-1. 1987.

For further reading as cited by [6]:

[7] Graaf van de J.A.. Nieuwe berekening voor de vormgeving. In: *Tété*. Amsterdam. November, 1946.

[8] Kayser H.. Ein harmonikaler Teilungskanon. Occident Verlag Zürich. 1946.

Jan Tschicholds werk verschenen in het Nederlands:

— Jan Tschichold. Opstellen over typografie. Gerards & Schreurs. 1988.
— Jan Tschichold. De proporties van het boek. De Buitenkant. Amsterdam.
  ISBN 90 70386 36 4. 1991.

I would like to thank Michael Guravage for proofreading and helping to turn this text into correct English.

Notes
1. A manual is available from http://people.freenet.de/kohm/markus/komasatzspiegel.pdf in German or from Gutenberg on http://www.gutenberg.eu.org/pub/GUTenberg/publicationsPDF/42-kohm.pdf in French.

Willi Egger