

Jan Tschichold

"Consistent Correlation Between Book Page and Type Area"

The Form of the Book: Essays on the Morality of Good Design

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Consistent Correlation Between Book Page and Type Area

TWO CONSTANTS reign over the proportions of a well-made book: the hand and the eye. A healthy eye is always about two spans away from the book page, and all people hold a book in the same manner.

The format of a book is determined by its purpose. It relates to the average size and the hands of an adult. Children's books should not be produced in folio size because for a child this format is not handy. A high degree or at least a sufficient degree of handiness has to be expected: a book the size of a table is an absurdity, books the size of postage stamps are trivialities. Likewise, books that are very heavy are not welcome; older people may not be able to move them around without help. Giants should have books and newspapers that are larger; many of our books would be too large for dwarfs.

There are two major categories of books: those we place on a table for serious study, and those we read while leaning back in a chair, in an easy chair, or while travelling by train. The books we study should rest at a slant in front of us. Few, however, will go to such length. To bend over a book is just as unhealthy as the usual writing position enforced by a flat table. The scribe of the middle ages used a desk; we hardly dare call it that any more because the slope was so steep (up to 65°). The parchment was held in place by a string across it and could be pushed upward little by little. The active line, always horizontal, was at height-of-eye, and the scribe sat per-

fectly upright. Even at the turn of the century, clergymen and government officials used to do their writing standing up behind a small desk: a healthy and reasonable position for writing and reading that has, alas, become rare.

The reading position has nothing to do with the size and dimension of textbooks. Their formats range from large octavo to large quarto. Still larger formats are the exception. Textbooks and coffee-table books rest on a desk. They cannot be read freehand.

Those books we like to hold in our hands while reading come in a variety of formats, all based on octavo. Even smaller books can be perfect provided they are slim; without effort they can be held for hours in one hand.

Only during church service do we see someone read from a book that has been set up: the reader's eyes may be at arm's length from the letters of the text. An ordinary book page is only a forearm's length from the eye of the reader. We are talking here about profane books only; not all of the following considerations and rules apply to sacred books as well.

Book pages come in many proportions, *i.e.* relationships between width and height. Everybody knows, at least from hearsay, the proportion of the Golden Section, exactly $1:1.618$. A ratio of $5:8$ is no more than an approximation of the Golden Section. It would be difficult to maintain the same opinion about a ratio of $2:3$. In addition to the ratios of $1:1.618$, $5:8$ and $2:3$, for books the ratios of $1:1.732$ ($1:\sqrt{3}$) and $1:1.414$ ($1:\sqrt{2}$) are used (see figure 18).

Figure 1 shows a little-known, very beautiful rectangle, derived from the pentagon (proportion $1:1.538$).

The geometrically definable irrational page proportions like $1:1.618$ (Golden Section), $1:\sqrt{2}$, $1:\sqrt{3}$, $1:\sqrt{5}$, $1:1.538$ (figure 1), and the simple rational proportions of $1:2$, $2:3$,

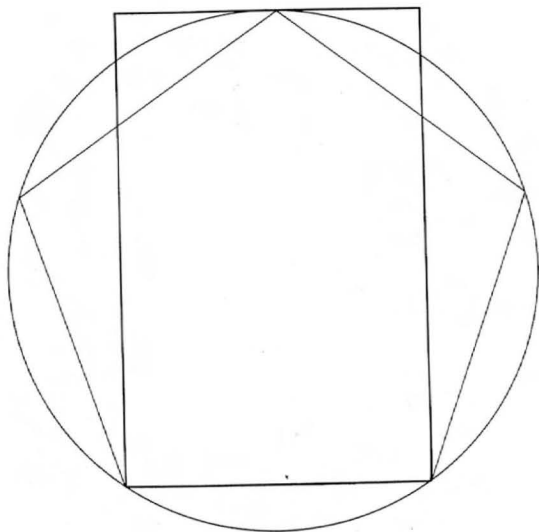


Figure 1. Rectangle, derived from a pentagon.
Proportion 1:1.538 (irrational).

5:8 and 5:9 I call clear, intentional and definite. All others are unclear and accidental ratios. The difference between a clear and an unclear ratio, though frequently slight, is noticeable.

Many books show none of the clear proportions, but accidental ones. We do not know why, but we can demonstrate that a human being finds planes of definite and intentional proportions more pleasant or more beautiful than those of accidental proportions. An ugly format causes an ugly book.

Since utility and beauty of all printed matter, whether book or flyer, ultimately depends on the page ratio of the paper size used, someone wanting to make a beautiful and pleasant book first has to determine a format of definite proportions.

However, a single definite ratio like 2:3, 1:1.414 or 3:4 is not adequate for all kinds of books. Once again it is the purpose which determines not only the size of the book but also the page proportions. The wide ratio of 3:4 is very well suited to books in quarto format because they rest on a table. The same proportion of 3:4 would make a small pocket book both unhandy and unseemly; even if it were not particularly heavy, we could hold it with one hand for only a short time, and in any case, the two halves of the book would always fall backward: such a book is much too wide. The same applies to books in A5 format (14.8 × 21 cm; 5⅞ × 8¼ in, 1:√2), unfortunately not so rare. A small or free-hand book has to be slim if we want to handle it easily. A ratio of 3:4 would not be suitable; one of the following proportions is better: 1:1.732 (very slim), 3:5, 1:1.618, or 2:3.

Small books have to be slim; large books may be wide. The small ones we hold in one hand; the large books rest on the table. The old sheet formats, all about 3:4 in proportion, when folded yield ratios of 2:4 and 3:4 in succession; the quarter-sheet is quarto or 3:4, the eighth is octavo or 2:3. The two major proportions of 2:3 (octavo) and 3:4 (quarto) form a sensible couple, like man and wife. The attempt to push them aside with the help of so-called normal formats, which use the hybrid ratio of 1:√2, goes against nature, like the wish to cancel the polarity of the sexes.

The new DIN raw sheet formats avoid the alternation of ratios 3:4 / 2:3 / 3:4 / 2:3 and retain their original proportion when halved. This ratio is 1:1.414. Sheets which, because of

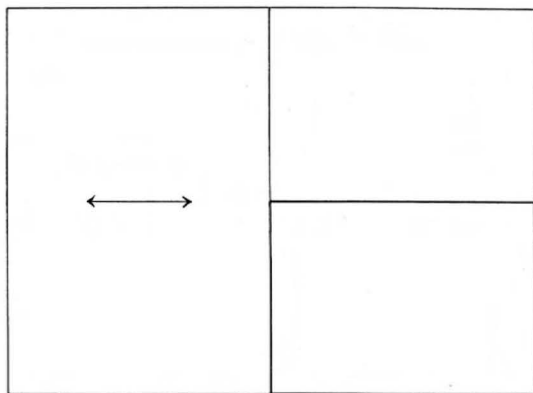


Figure 2. Quarto format, direction of grain shown.

their grain, are suitable for quarto, I cannot use for octavo books, because the grain would run the wrong way. Nor can I use them for *sextodecimo* books (1 sheet = 16 leaves or 32 pages) because the signature would be too thick. It follows that we would do just fine without the sheet proportion of 1:1.414 (see also figures 2 and 3).

The A4 format (21 × 29.7 cm; 8¼ × 11¾ in.) is well suited for two-column typesetting of magazines, for which even A5 (14.8 × 21 cm; 5⅞ × 8¼ in.) may be adequate; single-column typesetting on the other hand is seldom satisfactory in either format. Moreover, A5 is unpleasant when hand held, because it is too wide, too unwieldy and inelegant. The book proportion of 1:1.414 has existed once before, during the High Middle Ages, when many books were writ-

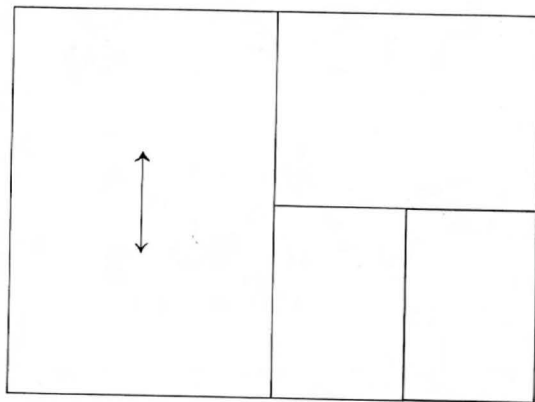


Figure 3. Octavo format requires the other grain direction.

ten with two columns. Gutenberg, however, preferred the page proportion of 2:3. During the Renaissance we seldom discover the ratio of 1:1.414. On the other hand, we spot numerous definitely slim volumes of great elegance, which should be our exemplars.

Except for the four-column *Codex Sinaiticus* in the British Museum, one of the oldest books in the world, there have been few square books. There is no need for them. As textbooks they are needlessly low and of irksome width; as hand-held books they are unwieldy and more clumsy than any other format. During the Biedermeier era, a sedate and comfortable period, when typography and the art of making books began to fall apart, nearly square quarto and very wide octavo formats were not uncommon.

Around the turn of the century it became apparent how hideous books had become during the Biedermeier period. The type area was centered in the middle of the page, and the four margins were of equal width. All connection was lost between the pairs of pages, and they fell apart. The problem of a relationship between the four margins finally had become obvious, and rightly so. A solution was sought through use of numerical values.

However, these efforts took the wrong direction. Only under certain circumstances may the margins form a rational sequence (one expressible in simple numbers) such as 2:3:4:6 (inner margin to upper to fore-edge to foot). A margin progression of 2:3:4:6 is only possible with a sheet proportion of 2:3, and the typesetting format has to follow suit. If another sheet format proportion is being used, say 1: $\sqrt{2}$, then a margin progression of 2:3:4:6 leads to a type area proportion different from that of the page proportion and therefore disharmonious. The secret of a harmonious book page is not necessarily hidden in a relationship between the four margins expressible in simple numbers.

Harmony between page size and type area is achieved when both have the same proportions. If efforts are successful to combine page format and type area into an indissoluble unit, then the margin proportions become functions of page format and overall construction and thus are inseparable from either. Margin proportions do not dominate the page of a book. Rather, they arise from the page format and the law of form, the canon. And what does this canon look like?

Before the printing process was invented, books were written by hand. Gutenberg and other early printers perused the written book as an example. Printers took over the laws of book form which the scribes had been following. It is cer-

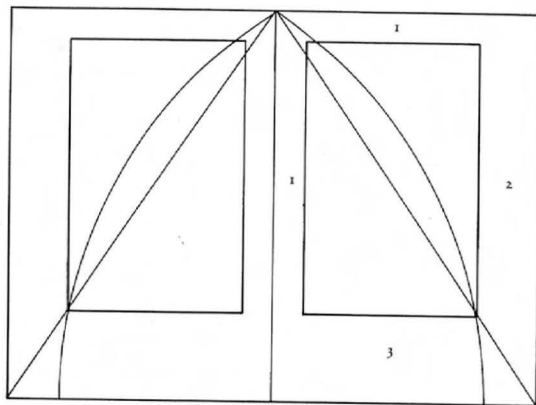


Figure 4. Framework of ideal proportions in a medieval manuscript without multiple columns. Determined by Jan Tschichold, 1953. Page proportion 2:3. Margin proportions 1:1:2:3. Text area proportioned in the Golden Section! The lower outer corner of the text area is fixed by a diagonal as well.

tain that there existed fundamental codes. Numerous medieval books show a surprising conformity in proportions of format and position of type area. Unfortunately, such codes have not come down to us. They were workshop secrets. Only by carefully measuring medieval manuscripts can we attempt to track them down.

Nor did Gutenberg himself invent a new law of form. He used the shop secrets of the initiated and followed in their footsteps. Presumably, Peter Schöffer had his hand in it as well. Superb calligrapher that he was, it may be presumed

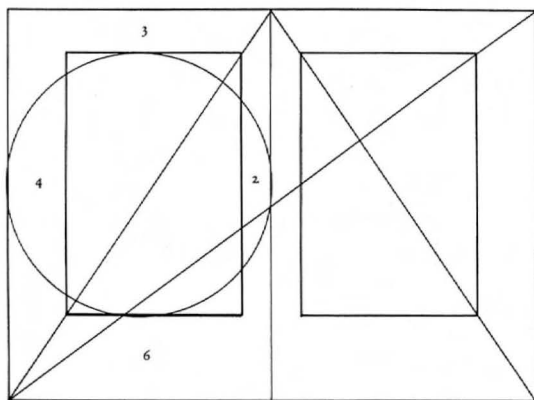


Figure 5. *The secret canon, upon which many late medieval manuscripts and incunabula are based. Determined by Jan Tschichold, 1953. Page proportion 2:3. Text area and page show the same proportions. Height of text area equals page width. Margin proportions 2:3:4:6.*

that he was conversant with these Gothic workshop secrets.

I have measured a great number of medieval manuscripts. Not every single one follows a code exactly; artlessly made books are no prerogative of our time. Discarding those, we only count manuscripts that were obviously produced thoughtfully and artfully.

After much toilsome work I finally succeeded, in 1953, in reconstructing the Golden Canon of book page construction as it was used during late Gothic times by the finest of scribes. It may be seen in figure 5. The canon in figure 4 I abstracted

from manuscripts that are older yet. While beautiful, it would hardly be useful today. In figure 5 the height of the type area equals the width of the page: using a page proportion of 2:3, a condition for this canon, we get one-ninth of the paper width for the inner margin, two-ninths for the outer or fore-edge margin, one-ninth of the paper height for the top, and two-ninths for the bottom margin. Type area and paper size are of equal proportions. There have been other schemes, empirically developed, where equal proportions of type area and page format have been postulated. What had been missing, however, was the *use of the diagonal of the double page spread*, which here for the first time becomes an integral part of the construction.

What I uncovered as the canon of the manuscript writers, Raúl Rosarivo proved to have been Gutenberg's canon as well. He finds the size and position of the type area by dividing the page diagonal into ninths (figure 6).

The key to this positioning of the type area is the division into nine parts of both the width and the height of the page. The simplest way to do this was found by J. A. van de Graaf and is shown in figure 7. His method results in my own figure 5, and figure 6 of Rosarivo. For purposes of better comparison I have based his figure on a page proportion of 2:3, which van de Graaf does not use.

The final and most rewarding confirmation of my results as shown in figure 5 came from Villard's Diagram, inscribed in figure 8. This so far little known and truly exciting Gothic canon results in harmonious divisions and may be drawn into any rectangle whatever. Without use of a scale, a line may be divided into any number of equal parts. Figure 9 shows Villard's Diagram once again.

Raúl Rosarivo's investigations have proved the validity

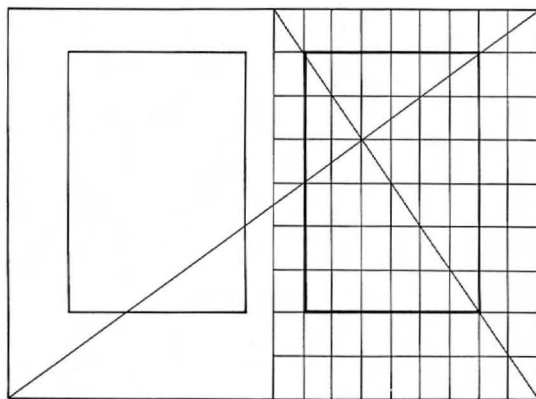


Figure 6. Division of height and width of a page into nine parts, following Rosarivo's construction. Like figure 5, this involves a 2:3 page proportion. The end result is congruent with figure 5; only the methods differ. This proved to be the canon used by Gutenberg and Peter Schöffer.

of the late-medieval scribe's canon as determined by myself for the first printers and thus corroborated its accuracy and its importance. However, we must not believe that the format ratio of 2:3, which belongs to this canon, was sufficient to meet all requirements. The late medieval period demanded neither particular convenience nor elegance from a book. Only much later, during the Renaissance, books were produced that were delicate as well as lightweight and handy. Little by little books appeared in smaller formats and in pro-

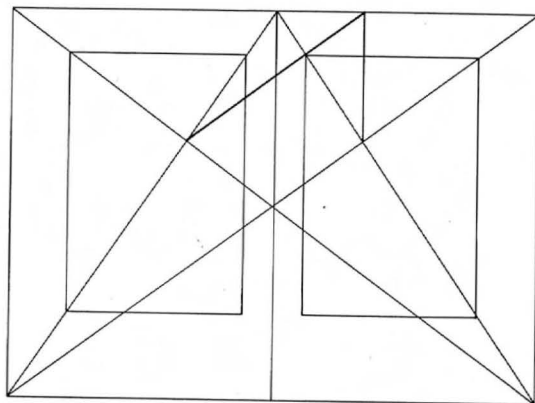


Figure 7. Division into nine parts, after van de Graaf, using a page proportion of 2:3. The simplest way to achieve the canon in figure 5. Compass and ruler instead of computations.

portions which are still conventional today: 5:8, 21:34, $1:\sqrt{3}$, and the quarto format, 3:4. As beautiful as the ratio of 2:3 may be, it cannot serve for any and all books. Purpose and character of the work frequently demand another good proportion.

But the canon in figure 5 works for other format proportions as well. Used for any book format, it will invariably result in a non-random and harmonious position of the type area. Even the relative size of the type area may be altered without destroying the harmony of the book page.

Let us have a look first at the book formats of the Golden

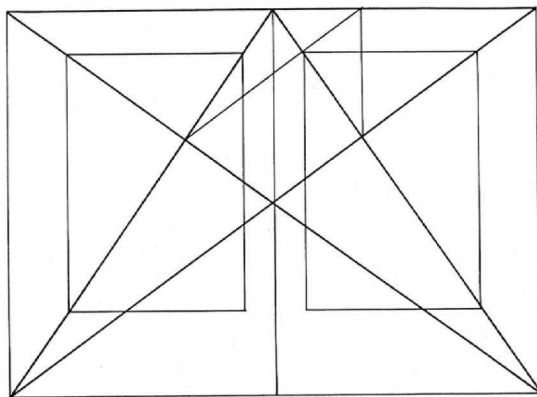


Figure 8. Villard's Diagram. Included in our page construction plan there is also a variation on Villard's Diagram. This is a canon of harmonious division named after its inventor, Villard de Honne-court, an architect who lived and worked during the first half of the thirteenth century in the Picardy region of Northern France. His manuscript *Bauhüttenbuch* (workshop record book) is held at the National Library in Paris. Using Villard's canon, shown in bold, it is possible to divide a straight line into any number of equal parts without need of a measuring stick.

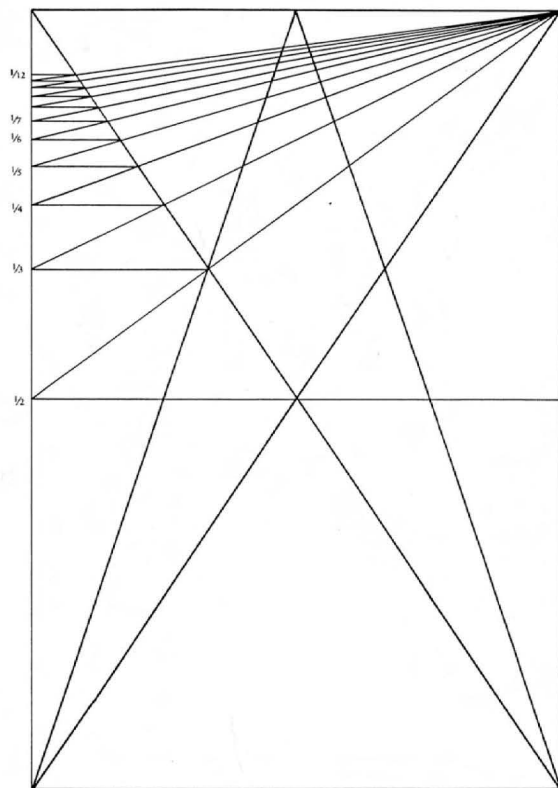


Figure 9. Villard's Figure, inscribed in a rectangle of 2:3 proportion. The longer side divided down to a twelfth part.

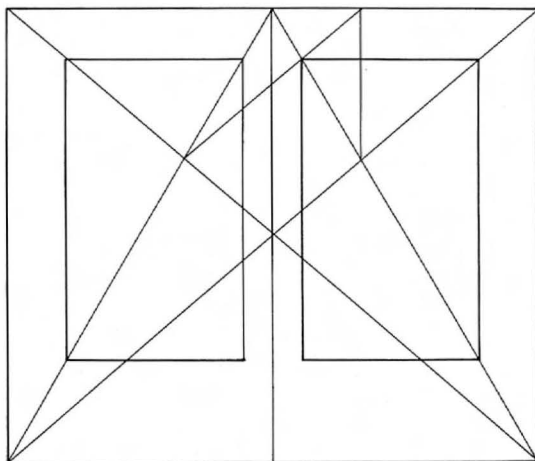


Figure 10. Page proportion $1:\sqrt{3}$ (1:1.732). Division into ninths of both height and width of the paper.

Section and the proportions $1:\sqrt{3}$, $1:\sqrt{2}$, and quarto (3:4). We shall use the division into ninths, as developed in figure 5. Figures 10–13 show the application of Villard's Diagram as well, which may be drawn into any rectangle. Figures 14 and 15, square format and landscape, demonstrate how we arrive at harmonious and nonarbitrary type areas even when using unusual formats. A landscape arrangement is suitable for music books, for example, and for books containing pictures in oblong horizontal format. In most cases a page proportion of 4:3 works better than 3:2, which is too low.

Even the division into ninths, while no doubt the most

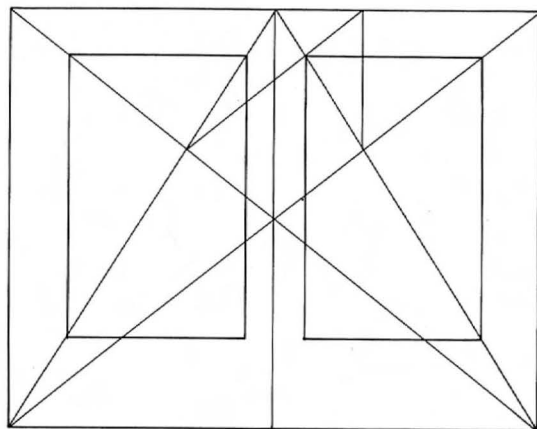


Figure 11. The page proportion of the Golden Section (21:34). Paper height and width are divided into ninths. (For page proportion of 2:3, see figures 5 through 7.)

beautiful, is not the only correct one. Dividing into twelfths we get, as shown in figure 16, a larger type area when compared with figure 5. Figure 17 shows a sample of division into sixths based on a page proportion of 2:3, after a small Italian prayer book written by Marcus Vincentius late in the fifteenth century, a picture of which may be seen in Edward Johnston's *Writing & Illuminating & Lettering*, plate xx. It was with deepest satisfaction that I found the key to the magnificent page construction of this masterpiece of calligraphy within my canon, and over more than forty years I have not ceased to admire the book. The type area is half the height of

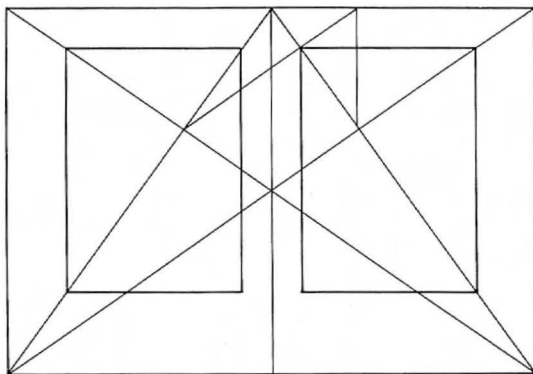


Figure 12. Page proportion 1: $\sqrt{2}$ (the DIN normal format).
Paper height and width divided into ninths.

the parchment, and the page (9.3×13.9 cm; $3\frac{5}{16} \times 5\frac{1}{2}$ in.) holds twelve lines of twenty-four letters each.

If necessary, the height of the paper may be divided any way you choose. Even narrower margins than those shown in figure 16 are possible, as long as the link between type area, single page diagonal and double page diagonal remains intact; only this guarantees a harmonious position of the type area.

The typographical system based on the number twelve, whose unit is the cicero or pica, divided into twelve points, has neither originally nor necessarily anything to do with the canon here related, not even with the book page of 2:3 proportion, which was the one used by both Gutenberg and Peter

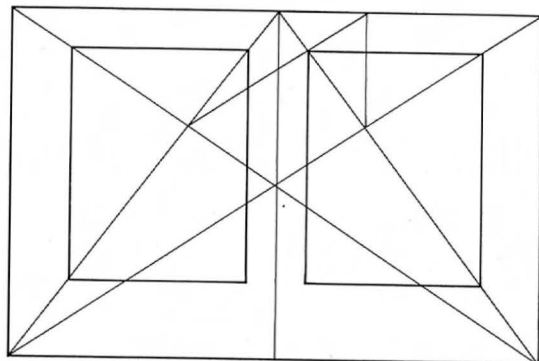


Figure 13. Page proportion 3:4 (quarto). Paper height and width divided into ninths. Here, too, the type area must mirror the proportions of the page.

Schöffer. When book printing began, the pica divided into twelve parts was unknown and general rules did not exist. Even the natural measurements taken from the human body, like yard, foot and the width of a thumb, the inch, were not defined exactly. It is likely that given lengths were divided using Villard's Diagram, and that every printer did his own calculations based on units that were not at all universally valid.

The convenience of determining all measurements, including the paper size, in picas and points for a page proportion of 2:3 is purely accidental. Other proportions are not so obliging. If you have to work with proportions at all, a slide rule or wheel is a necessity. From 1947 until 1949 I worked in London, England, in order to completely rebuild the look of

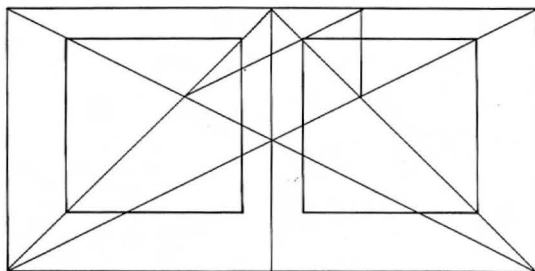


Figure 14. Page proportion 1:1. Paper height and width divided into ninths.

all editions published by Penguin Books. I constantly had to work in picas and to alternate between inch and centimetre. Example: determine a proportional ratio in inches and eighths-of-an-inch, find the equivalent value in centimetres and millimetres, then check the numbers on a circular slide rule. England neither reckons nor measures in the decimal system, hence a tool like the slide rule is practically unknown in the British book trade. Consequently an irrational relationship like the Golden Section has to be found by strictly geometrical means (using compass and ruler). It doesn't hurt to learn how to do this. But using a slide rule, I would set it at 1:1.618 or 21:34 and simply read that a book in the format of the Golden Section, 18 centimetres high, has to be 11.1 centimetres wide.

Wherever possible the width of the type area should come out even in full picas, or in half picas if absolutely necessary, and the inner margin or gutter at least in half picas again. The width of the trimmed top margin, and in fact the entire trim

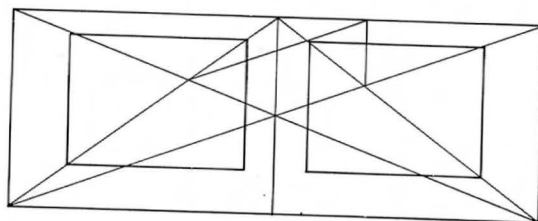


Figure 15. Page proportion 4:3. Paper height and width divided into ninths.

size, has to be given in millimetres, even if all calculations have been done in picas. A bookbinder knows millimetres only. All of these specifications are contained in the pair of specimen or sample pages, which must precede production.

Circumstances seldom permit the mathematically correct size and positioning of a type area. Frequently we have to be content with a close approximation of the ideal. Neither can we always place the typographical text block as high as would be desirable, nor, as a rule, is the calculated inner margin of sufficient width. Such a gutter will be correct only if the book either consists of a single sheet only or lies perfectly flat when opened. It is the *appearance* of the open book that has to relate to the canon. The gutter must *appear* to be as wide as the outer margins. Unfortunately it is not only shadow but also the small portion of the paper that disappears in the sewing or stitching that diminish the visible width of the gutter.

And there is no infallible formula that tells us how much to add for binding. Much depends upon how this is done. As a rule, fat books need a little more room than slender volumes. The weight of the paper counts for a little as well. If we

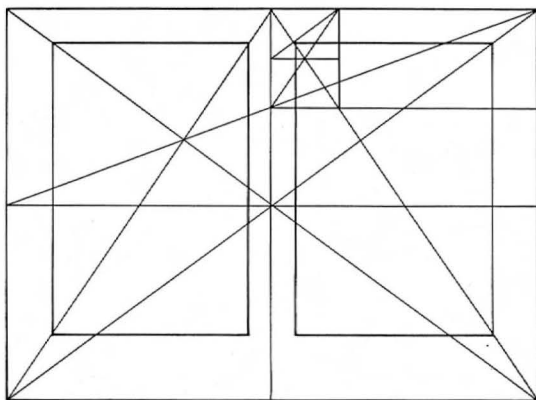


Figure 16. Page proportion 2:3. Paper height and width divided into twelfths, using Villard's Diagram, as shown in figure 9. A geometrical division is simpler and better than an arithmetical computation.

want to be certain, we have to trim a pair of pages down to the print area and then glue them into a dummy volume of the finished book. This dummy must already include the probable or likely addition for binding. Otherwise the outside margins will not be correct. Perhaps the dummy may have to be altered accordingly later, *i.e.* it may have to be widened or trimmed down. An additional millimetre or two of trim width in the sewn book hardly affects the proportions of the cover or case, since book cases protrude approximately 2.5 mm at the face and 2 mm each at both head and foot; in all they are 4 mm higher than the sewn book. Furthermore, it is

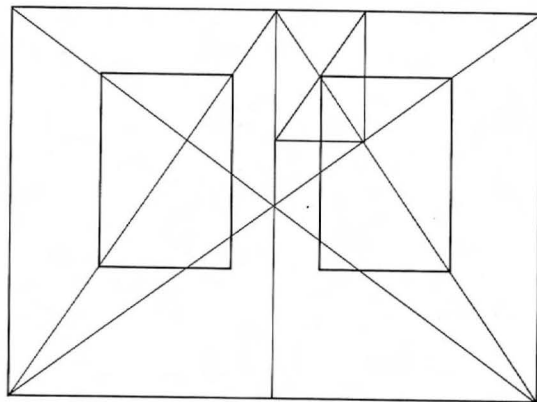


Figure 17. Page proportion 2:3. Page height and width divided into sixths. Both applied in a little prayer book written by Marcus Vincentinus (Marcus de Cribellariis) in the late fifteenth century.

the open book that counts, the exposed pages; the size of the case or cover is determined by the sewn and trimmed book and does not matter here.

Choice of type size and of leading contribute greatly to the beauty of a book. The lines should contain from eight to twelve words; more is a nuisance. The broader margins resulting from division by nine permit a slightly larger type size than does the division by twelve. Lines with more than twelve words require more leading. Typesetting without leading is a torture for the reader.

Nor is it fruitless to point out the correspondence be-

tween type width and page proportion. A square book format, not exactly one of the best, needs a broad type, so that the shapes of the letters o and n more closely coincide with the format of the book. Narrow type would be entirely unsuited to a square book. On the other hand, typefaces of the familiar format are correct for the usual shape of books since the contours of the letters o and n closely resemble the proportion of the page.

The page number does not belong to the text block. It stands alone. As a rule I use centered numerals at the foot of the type area. This is usually the best and also the simplest solution by far. In exceptional cases I will place my page numbers under the text block near the outside. As a rule I then draw them in by a quad so as not to cause discord with a partially blank last line of text.

Medieval manuscripts show small page or leaf numbers in the upper outer corner of the parchment.

It is better not to count a centered running head without a separating rule as part of the text block, especially when the page number is at the bottom. However, if there is a rule between text and running head, then both are part of the text block.

When typography hit bottom near the end of the nineteenth century, all manner of styles were copied naïvely in their obvious outward appearance, like initials and vignettes. Yet no one thought about page proportions. Painters attempted to free the shoddy typography from atrophied rules, and in doing so, they objected to everything that might infringe upon the newly declared artistic freedom. Subsequently they had small or no regard for exact proportions. They abhorred mention of the Golden Section, possibly because for a time people had abused the ancient proportion as

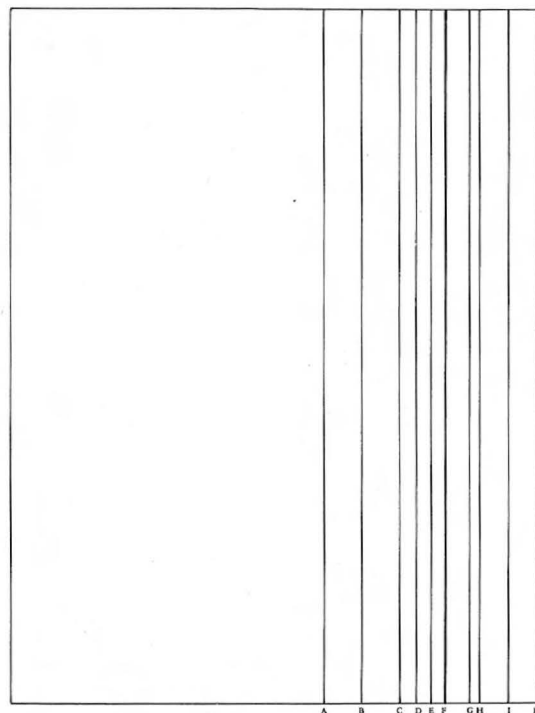


Figure 18.

A 1:2.236 (1: $\sqrt{5}$)	E 3:5	H 2:3
B 1:2 (1: $\sqrt{4}$)	F 1:1.618 (21:34)	I 1:1.414 (1: $\sqrt{2}$)
C 5:9	(Golden Section)	K 3:4
D 1:1.732 (1: $\sqrt{3}$)	G 1:1.538 (Figure 1)	

a general recipe for producing *art*, dividing and shaping just about everything according to it. For this reason no one intentionally used book formats of rational or irrational proportions any more; nor did anyone care about a planned type area. If a beautiful book appeared now and again, it was because an exceptional person had cared enough to look at masterful works of the past, had abstracted a few rules, had developed a *feel* for good proportions between page size and text block position. Unfortunately, such an indefinable *feel* is neither a reliable rule, nor can it be taught. Real progress can be achieved only through tireless scientific study of the flawless works of the past. It is this unflagging effort in the meticulous investigation of old masterpieces that we have to thank for the most important printed works of the present; only research into the secrets of old book formats and type areas will in the end bring us much closer to the true art of making a book.

In the first half of our century one wanted to limit the great number of available raw sheet formats. The average side proportion of the old formats, 3:4, which gave us a quarto format of 3:4 and an octavo format of 2:3, was quite sensible. However, some people saw a disadvantage in the variety of proportions offered by quarto and octavo. Thus today's *normal* format was created based on the proportion of 1: $\sqrt{2}$, which is retained when the sheet is folded. But the fact that no one paid much attention to page proportions is coming back to haunt us. This lack of attention led to the baby being tossed out with the bath water, as the large number of old formats was reduced to little more than one. Many people believe this narrow norm of paper formats to be the answer to all their format problems. This is an error. The selection among the new formats is much too small; the hybrid

proportion of 1: $\sqrt{2}$ is only one of many, and is certainly not always the best.

Figure 18 provides an overview of all rectangular proportions mentioned here and also gives the rare ratio of 1: $\sqrt{5}$. A, D, F, G, and I are irrational relationships, while B, C, E, H and K are rational ones.

Anyone who produces books and other printed material must first look for suitable paper sheet sizes of the correct proportions. Even the most beautiful script does not help if the format, say A5, is unpleasant to start with. In the same way, a disharmonious text block in an unfortunate position destroys all potential beauty.

Countless type areas, even in the slender formats, are too high. Dissonant or unharmonious book pages cannot be avoided when our innate desire to see a text block proportioned according to the Golden Section, or at least approximating it, is confronted by a page format in 1: $\sqrt{2}$ proportion or 3:4. If we want to create a harmonious page from one of the new sheet formats, we either have to alter the page format, or we have to set the text block in proportion with the page format. Nobody will gripe about good paper proportions as long as there are choices left to be made. The correct type area, the other condition for a beautiful book, has seldom been researched, still less in any methodical manner. Like typography itself, in the nineteenth century, the type area was neglected to such a degree that any alteration seemed permissible. The recent history of the text block is full of attempts to push aside old and unsatisfactory results and replace them with the unconventional.

What all these attempts have in common is arbitrariness. The old law had been lost, and it was not to be found again with 'feeling' alone. This is where I succeeded by measuring

countless medieval manuscripts. The rediscovered canon, shared here, is free from all arbitrariness and ends all laborious groping. In all its many variations it will inevitably lead to books where page format and text block agree with one another and become a harmonious unit.

LITERARY REFERENCES IN CHRONOLOGICAL ORDER

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