Introduction

From earliest history man's close kinship with nature has
guided him toward a sense of proportion in the shaping of his
world. Just as mathematics began with the measurement of
objects and space, design began with the arrangement of
objects in harmonious relationship to each other and to the
space they occupied. The linkage of mathematical systems
and design can be traced to the earliest cultures, and science
and art have frequently found a common denominator in the
search for perfect form throughout history.

Wherever plans have been called for in the building of
objects, the division of areas, or the decoration of flat surfaces
grids have been involved. Dictionaries define the grid as "a
network of uniformly placed horizontal and vertical lines for
locating points by means of coordinates." Grids were used by
Renaissance artists as a method of scaling their sketches and
cartoons to fit the proportions of monolithic murals. Grids
are basic to cartography and for centuries military plans have
been plotted on the coordinates of grids. Classic architects
used grids to plot perspective and scale their plans. From the
time of Gutenberg typographers have used grids to design
letters and complete the makeup of the printed page.

The factors that distinguish a designer's grid from
ordinary makeup sheets are the grid's regard for proportion
and its compatibility with the solution to the design problem.
There are two ways that the designer can bring mechanical
form into harmony with those aesthetic considerations that
help to determine the quality of a design. One way is through
the use of his own natural and intuitive sense of proportion,
and the other is through the application of certain systematic
principles of proportion developed by mathematicians,
artist-designers, and architects throughout the course of
design history.

Most designers prefer to rely on their intuitive sense
of proportion in approaching the design problem, but a
knowledge of the principles of proportion can be useful in
determining the correct division of the space within a layout
and assessing the quality of the resulting design. For that
reason a brief review of some of the most commonly used
rules of proportion will precede and form a background for
this exploration of the grid and modular design systems.

By the time civilization had spread across the Aegean Sea and reached its culmination in the acropolis at Athens, clear rules of aesthetic proportion had been laid down. It was Phidias, the master planner of the acropolis, and Ictinus, the architect of the Parthenon, who demonstrated the design potential of the division of a line into an extreme and mean ratio. This was the division of space that was later to be known as the "golden section."

One of the earliest definitive statements of the formal order of aesthetic form was contained in a book written by Fra Luca Pacioli in 1509 called De Divina Proportione. The proportion that he called divine is the continual proportion derived from the division of a line into two parts in such a way that the proportion of the full distance to the larger part should correspond geometrically to the proportion of the larger segment to the smaller. When extended, these proportions become a Fibonacci series (named for a thirteenth century mathematician from Pisa). This is a series in which each succeeding number is equal to the sum of the two preceding numbers.

The golden section:

This set of proportions is based on the pentagon—a regular five-sided polygon—that together with its related pentagram, or five-pointed star, consists of scores of golden sections. The golden rectangle is constructed with the short side equal to the extreme section of the long side. It is also possible to construct a golden rectangle beginning with the square of the extreme section, as shown in the illustration on page 12.

For those designers who are mathematically inclined, the golden section is an irrational number, 1.61803398, known as \( \Phi \)—a symbol chosen to represent it in the early twentieth century because it is the first letter in the name of the Greek sculptor and planner, Phidias. The golden section is usually expressed algebraically as \( a:b = b(a+b) \).

The square:

The golden section is not the only guide to aesthetic proportion. Several combinations based on the simple square play an important role in the division of space. The square represents a natural division of the golden rectangle, and it provides the base for the root-2 rectangle (\( \sqrt{2} \)), which is formed by swinging an arc of the diagonal of a square. The resulting rectangle has sometimes been confused with the golden rectangle—a confusion that probably grew out of the activities of a cubist group who used the root-2 rectangle and called their 1912 exhibition in Paris "La Section d'Or." This rectangle provides the basis of the A series of rectangles that is accepted as standard in Europe and the United Kingdom. The common A4 size is \( 8\frac{1}{4} \times 11\frac{1}{4} \) inches (210 x 297 mm).

The square also plays a key role in the modular
system that grew out of the tatami mat in Japanese domestic architecture. Measuring approximately 3 × 6 feet (.91 × 1.83 m), the tatami mat’s double-square proportion divided the floor area into a variety of patterns and provided the basis for the splendid asymmetrical form of the traditional Japanese houses.

The square, the simplest of all rectangles, has probably been an even more important factor in the development of the modern designer’s grid than the golden section or any other system of proportion. Any designer who has had the opportunity to prepare a layout within the square format has found this to be an unusually rewarding experience, even though the shape is uneconomical and impractical for most purposes.

Dynamic symmetry:

In the twentieth century two people played a primary role in the revival of the golden section as a design element. One was Jay Hambidge, an author and art instructor, whose book...
The diagram at the right includes eight golden rectangles in a Fibonacci series positioned to create a logarithmic spiral. The sketches below by Le Corbusier link the spiral to its form in nature and provide the inspiration for his expanding museum plan.

*Elements of Dynamic Symmetry* was first published in 1920. The other was Le Corbusier, an authentic genius of twentieth century design, who developed the first clearly identifiable design system called the *Modulor*.

*Elements of Dynamic Symmetry* is now all but forgotten, but in its time it produced a cultlike mass of followers in the art schools. It was probably Hambidge who first visually linked the golden rectangle to the logarithmic spiral (see above). His writings put a strong emphasis on the diagonal and he developed a series of dynamic rectangles based on a projection of the root-2 rectangle. Hambidge pointed out that the diagonal of a rectangle, when joined with a perpendicular
leading to one of the corners created a "harmonic subdivision." He took the expression "dynamic symmetry" from the writings of Plato, and one of his sources of information on classical proportion was the first century B.C. architect and scholar, Vitruvius.

The Modulor:

Two thousand years after Vitruvius completed his monumental ten-volume work called *De Architectura*, another architect, Le Corbusier, began to work out a system of architectural proportion called the *Modulor*. Though Le Corbusier does not identify Hambidge as a source of his information on proportion and the logarithmic spiral, he does acknowledge his indebtedness to Matila Ghyka, who in turn was influenced by Hambidge. In any event the *Modulor* made a major contribution to the form of modern architecture and

Le Corbusier developed an elaborate design system based on the golden section and the human proportions. He called his system the *Modulor* and built it around three main points of the anatomy—the top of the head, the solar plexus, and the tip of the raised hand.
The design for the first book on the Modulor was prepared by Le Corbusier using the Modulor as a grid. The original was in black, red, and tones and textures of gray.

became the foundation stone for most design systems and modern grids.

Le Corbusier’s Modulor was primarily concerned with architectural form, but he was quick to point out its application to other areas, including the design of the printed page. This design system took the golden section one step further by linking it to the scale and proportion of the human anatomy. Le Corbusier selected the solar plexus, the top of the head, and the tips of the fingers of an extended arm as the principal anatomical locations. The distance from the ground to the solar plexus represents the extreme division of the golden section, and the distance between the solar plexus and the top of the head is the mean. From this base Le Corbusier produced an infinite series of mathematical proportions that could be applied to a wide range of architectural dimensions.

Most applications of the Modulor to graphic design, including Le Corbusier’s own designs of Le Modulor, L’Architecture d’Aujourd’hui, and Suite de la Modulor, have not
These forty-four divisions of space in a common rectangle were prepared by Le Corbusier to suggest the wide range of options available when designing with the Modulor.

**The grid:**

Because the development of the modern grid was an evolutionary process, it is impossible to isolate a single designer as its inventor or accurately list all the pioneers who contributed to the development of modular systems of graphic design. The design schools of the European continent were its principal laboratories, and its influence spread swiftly around the world in the 1950s and 1960s. Over the last three decades the grid has been used by a growing number of graphic designers, frequently with such skill and freedom that a casual observer would never suspect that the design was related to a mechanical form or modular system.

Today the grid has many champions, but it has its
Paul Rand’s grid for an IBM Annual Report sets a disarmingly simple pattern for the complex range of material that such a publication normally includes in its content. A share of detractors, and it has become a matter of considerable controversy among contemporary designers. When it is used with skill and sensitivity it can lead to the production of handsome and effective pages and it can give the overall design a sense of cohesion and continuity that has a distinctive unifying effect. However, in the hands of a less able designer or when the priority is given to the structure, rather than the creative concept, the grid can become a straitjacket that produces dull layouts and a rigid format.

Learning to prepare and work with the grid is not as complicated as many educators would have us believe, nor is it as simple as some designers pretend. As Paul Rand, America’s foremost graphic designer, points out, the explanation of a grid “may seem very simple on the surface, but working with a grid is not so simple. So much depends on the material the designer is called on to incorporate into his designs and the virtually endless surprises he encounters.
Solving a design problem is much like running a maze. The designer selects a line to follow only to learn that the constraints he encounters send him back to probe another direction until he finds a clear path to the solution. The application of the grid to his design procedure presents similar problems. If the designer formulates a grid before he has arrived at a design concept, he may well find that he has blocked the way to the correct solution. In the following paragraphs I will list some of the priorities in designing with grids, but in the final analysis each designer will have to work out his own procedure to suit his thought process, working methods, and personal style.

1. At the foundation of any modular approach to design is a firm understanding of the communication problem, from its objectives to the potential response of its readers. He will need to know what constraints are inherent to the project,
such as space, time, and the inevitable budget.

2. Before serious designing can begin, the designer should have an accurate measurement of the physical requirements: the nature of the visual material and the space it will occupy, the order and continuity best suited to the presentation of the content, and the degree of emphasis that each element may require. This calls for value judgements. It is not just the number of words and images, but the degree of emphasis given to them, that will eventually determine the value of visual communication.

3. The next step in the design process is the distillation of all the forces into a single design concept. It is at this point that the grid will most frequently enter the designer’s thinking, though it may enter at earlier or even later stages. In any event, it should be clear that the grid and modular systems should serve the idea and not lead it. When grid structures dominate the creative process there is a real danger that a rigid solution may result.
The grid above was designed by Josef Müller-Brockmann for a series of advertisements like the one at the right. The grid on the facing left page was one of several designed by Massimo Vignelli for Alcoa Aluminum advertisements.

4. As the designer turns to the form of the grid he will seek the same simplicity in its structure that he sought in the design concept. The grid may take many forms. It may merely define the margins and type columns or it may provide a complex framework for a wide range of typographic options and visual opportunities. In any event, it will be judged by the quality of the resulting design and not by the intricate tracery of its own form.

*Form and function:*

The pattern of a grid will be guided by the function of the content and the design concept. Because each grid is custom-made to fit the parameters of a specific project and because its design is governed by the particular working style of an individual designer, grids will take on an almost unlimited variation in form. However, there are a few general principles that apply to most grids and these will be useful to the designer in preparing modular systems.

The *orthodox design grid*, which forms the basis of the
modular design systems that were developed in Ulm, Basle, and Zurich during the years after the war, is based on a uniformly spaced combination of horizontal and vertical lines that produce a pattern of squares similar to those on a graph sheet. This grid calls for the not-always-easy-to-attain standardization of the horizontal and vertical measurements based on the line-space (type height plus the space between the lines) of the dominant text face. For example, if the type is 10 point with 2 points between lines, the basic measurement is 12 points, or 1 pica. If the type column is 14 picas
Sometimes a single grid can serve several different purposes. The grid on the facing page was designed by Massimo Vignelli for Knoll International to control a total identification program that consisted of forms, letterheads, catalogues, price lists, and brochures, a few examples of which are shown above and right.
wide with 1 pica between columns, the grid will divide into 14 pica squares with 1 pica of separation. If a 48-point type is used for the headlines, each line will take four increments of space, and if a 6-point type is used for captions, each line of caption type will take half a line.

In practice it is not always possible to divide the grid into squares, but designers working with grids should understand the advantages of this approach. A pattern of squares on a page is not only an ideal base for a modular structure, but it also groups naturally into horizontal and vertical rectangles in the proportions of $1 \times 2$, $2 \times 3$, and $3 \times 4$.

The vertical lines of a grid will control the inner and outer margins, define the type columns, and determine the space separating them. The positioning of these lines will be nearly always measured in picas and half picas to correspond with existing typographic standards.

The horizontal lines of the grid will determine the head and foot margins, the depth of the type columns, and

The remarkable signage system on the facing page was designed by Otl Aicher, an early exponent of grids in Germany, for the Munich Olympic games. It was based on a grid (left) and interchangeable elements forming a body alphabet.
the location of the headlines and visual material. Unlike the vertical lines that are normally positioned according to pica measurements, the horizontal lines are often spaced on the basis of line-spaces (a 9-point type with 1-point leading will yield a 10-point increment). This is one of the reasons a perfectly square grid is not always possible.

In some publications the grid may be expected to provide for several different column widths. It is possible to add as many vertical lines as are necessary even though they produce a random pattern, but many designers prefer to work within a more tightly structured modular system where the different column widths are all provided for. Several grids in this book show how this multiunit system works.

Note: In this book the term “unit” used to define grids will apply to column widths. A six-unit grid will identify a grid that provides for a maximum of six columns, etc. Other writers have used several other methods of identifying grids.

The grid assumes its most important design function when the vertical and horizontal lines combine to produce
the squares or rectangles that form a blueprint for the printed page. In the design process the working grids can take several different forms. The grid may be an actual size overlay rendered on tracing paper or transparent acetate, or it can be an underlay that shows through the layout sheets.

Many designers like to make their preliminary sketches on sizes smaller than the finished page. On magazines it is common practice to work on one-quarter or one-third scale grids. Similar or even smaller sizes are often used for the thumbnail layouts of book pages. In the planning of newspaper pages the working grids are usually half scale.

Most final layouts and mechanical paste-ups are prepared on actual-size grid sheets. These are usually printed in blue ink. In the future some working grids may be adapted to computerized systems, where they will guide the final layout on visual display terminals, or they may even be fed into terminals to prepare pages in a fully automated preset program.

In recent years the grid has been used to solve a wide range of design problems. It has been an important aid in the preparation of annual reports, brochures, directories, catalogues, sign systems, advertising campaigns, and corporate identification programs. The grids accompanying this introduction illustrate a few applications of the grid to areas other than publication design.

It may be appropriate to close this introduction to the grid with a few words of caution. Josef Müller-Brockmann, a Swiss designer noted for the clarity and graphic form of his designs, maintains that the “grid system is an aid, not a guarantee. It permits a number of possible uses and each designer can look for a solution appropriate to his personal style. But one must learn how to use the grid; it is an art that requires practice.” As a final note of caution, Le Corbusier in his comments about the design system he called the Modular points out, “I still reserve the right, at any time, to doubt the solutions furnished by the Modular, keeping intact my freedom, which must depend on my feelings rather than my reason.”
This diagram illustrates one of many ways that the classic proportions of the printed page can be determined. The resulting margins may be overly generous for most readers and for most contemporary book production.

papers are used the mirror layout has a major functional advantage.

The advent of coated paper and halftone surfaces with high opacity solved the problems of show-through, and this in turn led to greater freedom in layout and a more asymmetrical form. These new forms became particularly valuable when the layout of pictorial material was coupled with the placement of text. When running text is positioned on the right-hand side of both pages the layout normally presents better opportunities for picture placement (the layout of this book is a case in point).

In working out even the simplest grid most book designers begin with a flat plan consisting of about a dozen
One of the precise typographic grids created by Jan Tschichold to control the design and production of Penguin Books is shown with his detailed instructions above. The design is characteristic of the formal and traditional approach found in Tschichold's later work.
critical spreads. The flat plan will usually be prepared in about one-quarter scale. The spreads will be executed either as thumbnail sketches or as rough paste-ups of halftones clipped from available sources and combined with rendered indications of type matter. The flat plan will usually include a title page, most of the front matter, and several typical spreads. In preparing a flat plan the designer should also concern himself with ideas for the binding and endpapers. Unfortunately, many publishers treat the book jacket as a separate entity, often using different designers for the book and its more advertising-oriented exterior. But, where possible, a better book will result when the total design is coordinated at an early stage of the design process.

In the advance planning stage the designer will also concern himself with the specific problems of the book's typography—the special demands of poetry and drama; the amount of text and its relation to type size and columns; the need for subheadings, tabular matter, diagrams, and listings. Behind the simplest grid there is often a complex process of analysis. Without the sketch layouts of a preliminary flat plan that tests the grid against the variations of content, it may become distorted by the many conditions it will be exposed to in the completion of the typographic design.

The classic page proportion is generally accepted as 2:3 with an equivalent, but somewhat smaller, rectangle for the text. The inside margin is one-half of the outside margin, and the top margin is half the size of the base margin. There are several methods of positioning the type within the page. One of the most commonly used is the diagram reproduced on page 69. Its origin is obscure, but it was rediscovered by van de Graaf and has been widely used by contemporary designers like Jan Tschichold. The proportion of 2:3 is close to, but not precisely equal to, the golden section, which is 0.618:1.

The modern book designer will find classic proportion interesting, but will be more inclined to use his own judgement in working out the format of his pages. He will usually rely on his own innate sense of proportion, his design experience, and the conditions and the constraints of the
Bradbury Thompson's typographic grid (right) and the spreads on the facing page from an American Institute of Graphic Arts publication demonstrate how a simple grid can give form and structure to a book.

project in hand. Pleasant as traditional book margins are, they are often ill suited to either the economics of modern publishing or the habits and expectations of contemporary readers. It is even possible that classic margins were based on the needed space for the scribe's hands as much as they were selected for their divine proportion.

In magazines and newspapers designers nearly always work within the set sizes of established format. The book designer, on the other hand, will often, but not always, have the right to select the size and shape of his pages. He will also have a unique concern with the thickness and weight of the resulting volume and to this extent his design will become three-dimensional. The choice of size is not always the designer's prerogative. If the book is part of a series, a predetermined size may be indicated, and sometimes merchandising problems and economic considerations will determine the size and even the weight of a book.

Pocket books are an example of the ultimate constraints placed on a book designer. This important category of books has a standard size of $4\frac{3}{8} \times 7$ inches ($110 \times 180$ mm), with only minor variations, in the proportion of
Another book grid designed by Bradbury Thompson for a collection of stories by Edgar Allan Poe. provided lines for the unique central axis of the typography.

3:5. This is a reasonably pleasant proportion, but a somewhat better proportion exists in French pocket books that are narrower in relation to their height and more nearly approximate the golden rectangle. With all the limitations that pocket books impose on the designer there have been some notable exceptions to the poor typography of most of these books. Jan Tschichold set a style for Penguin Books in England that resulted in clear and lucid typography, and the French book designers, with a long tradition of designing novels in small formats, still treat this page size with considerable respect.

The contemporary book serves many and varied purposes that influence the structure of grids and the shape of their design. Textbooks and educational books serve an expanding knowledge explosion that demands new visual treatment and new forms in bookmaking. Books published in a series must often work with a common grid or a grid adapted to serve an overall style, while also providing for the
The design of the spreads for Poe's *The Black Cat* effectively combines symmetrical elements within an asymmetrical framework.
Ed Day, design director of Mitchell Beasly in London, designed this grid (above) to provide a master plan for a group of encyclopedias. The grid guided the creation of nearly 2000 pages with 11,000 color illustrations of widely varied content. The pages on the right are from the Random House Encyclopedia.

special needs of a given volume. Encyclopedias need grids that are rigid enough to keep the content organized and clear, but flexible enough to allow for widely varied visual material. Reference books in general need to be planned to take advantage of the storage and retrieval function of computerized composition, while providing for updating and modification with a minimum of resetting.

It is impossible in a study of this dimension to cover all of the aspects of book design, but no examination of the grid as a design instrument can be complete without an examination of some of the technical developments that may determine its future.
The simple grid (above) was designed by Lou Silverstein of the New York Times for a book about built-in furniture, consisting of diagrams, photographs, and short copy.

Hermann Zapf, one of the world’s foremost designers of typefaces and books, had this to say about contemporary bookmaking in Homage to the Book: “The time is not far off when the manuscript will be put into a reading machine which, via a computer, produces the information necessary for book production on paper or magnetic tape. The computer will also be programmed to correct automatically . . . check the logic of thoughts . . . and even translate a complete work into a foreign language. The automated machine works to the programmed instructions fed into it, putting in running heads, chapter headings, folios, captions, and subtitles . . . performing other typographic chores. In this electronic future, the responsibility of the book designer will be even heavier. No longer will he be an unnecessary cost factor; he will direct the whole orchestra in which any false note means additional cost and loss of time.”

These are not mere idle thoughts, but a recognition of the growing need for book publishing to examine current economic pressure in terms of future technological possibilities. Much of the hardware for this revolution is already beyond the prototype stage and the software is in research and development. Hermann Zapf and Aaron Burns, who is president of the International Typeface Corporation, have
The grid at the right was designed for my recent book *Layout: the design of the printed page*. The basic grid structure not only guides the placement of varied word and visual content, but becomes a major force in the design of the book jacket.