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"In the Beginning, There was the Ratio, and the Ratio was with God, and the Ratio was God"

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"In the beginning, there was the ratio, and the ratio was with God, and the ratio was God"*

BY DONNA STANTON

A little over 10 years ago I came across a page in an introductory graphic design textbook upon which there was a drawing of the logarithmic spiral derived from the proportions of something called the Golden Ratio. The Golden Ratio was unfamiliar to me, so I read the very brief explanation that accompanied the diagram ..."An ancient proportion ...found in nature... historically represented in the architecture and artwork of many cultures... it represents the Fibonacci series of numbers...it is useful in design...the famous 20th-Century architect Le Corbusier used this proportion to develop the 'modulor,' a system of measurement." That was it. No practical application to graphic design. In fact, no example of a practical application to *anything*.

Yet, something about the diagram in that textbook made sense to me—on an intuitive level—and I started to include the exercise of drawing the Golden Ratio in graphic design courses I taught. Students panicked. Why? The Golden Ratio is *geometry! Math!* My students were studying graphic design, *not* the dreaded "M" subject! And why shouldn't they have panicked? I was hiding behind a pretty thin veil myself —I still count on my fingers and I nearly failed the only geometry course I had ever taken some 30 years ago— yet I was asking graphic design students to take a leap of faith and learn some geometric ratio when I couldn't even explain its relevance to graphic design. I realized that I had to arm myself with more information—information relevant to graphic design—to reinforce the credibility of teaching this ratio. What I found—am still finding—is a rich and rewarding body of information that spans centuries, cultures, continents and curricula. It has strengthened my teaching, stimulated me to make art, enhanced my professional design practice, and even led me to apply the Golden Ratio to design my house.

The Golden Ratio is also called the Golden Mean, the Golden Section, the Golden Proportion, the Divine Proportion, the Phi ratio, or, simply, Phi. It is described as the ratio wherein a certain length is divided such that the ratio of the longer part to the whole is identical to the ratio of the shorter part to the longer part, where each dimension is *exactly* 1.61803 times the next smaller dimension. Phi is most often

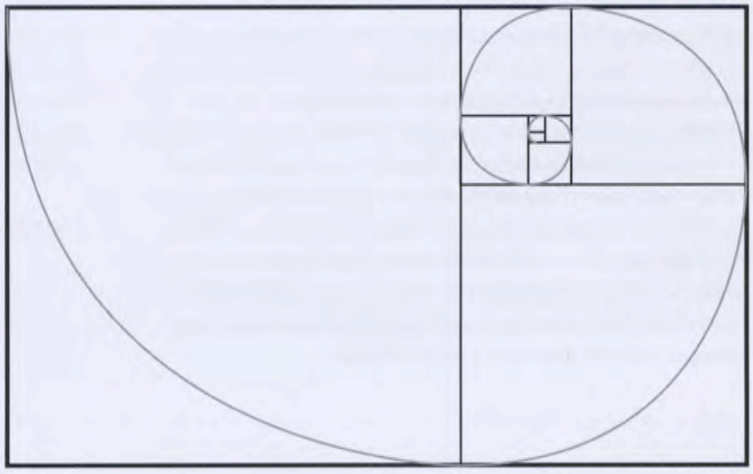

Figure I

*Charles Seif, *Zero: The Biography of a Dangerous Idea*

Figure II

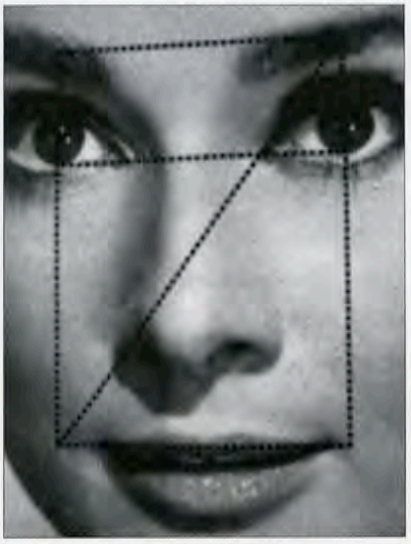

Figure III

diagrammed by the Golden Rectangle. Construction of the Golden Rectangle reveals the logarithmic spiral and other proportions within it such as the square and the Fibonacci Series of numbers (Figure I). The Golden Ratio is proven geometrically to relate to the pentagram. The five-pointed star—represented by the pentagram—is an historical symbol of the human body and of life. Phi proliferates in nature, and is most frequently diagrammed by the shell of the chambered nautilus. The growth of the chambered nautilus exactly represents the logarithmic spiral, as do seed distributions in many plants such as sunflowers and cacti. Pine cones, daisy petals, phyllotaxis (the arrangement of leaves on the stem of a plant), the bones in your hand, the double helix configuration of the DNA molecule and other natural forms exhibit Phi.

And, there is more. Matila Ghyka (*The Geometry of Art and Life.* Dover, 1977) used Helen Wills, an early Olympic tennis champion, to reveal Phi in what he called the "...average or ideal face..." Jonathan Hale (*The Old Way of Seeing.* Houghton Mifflin, 1994) found Phi in his analysis of Audrey Hepburn from a film still from *Funny Face* (Figures II and III). (I tested this by drawing a Golden Ratio over a snapshot of my face and I am happy to report that my face—and presumably yours too—is identical in proportion to Wills' and Hepburn's.) Hale, an architect, used a quote from *Funny Face* to segue his analysis of Phi from Hepburn to a tree. He quotes Fred Astaire as saying to Hepburn, "When I get through with you, you'll look like...well, what do you call beautiful? A tree. You'll look like a tree!" Hale shows us a maple tree in his book, perfectly encapsulated within Phi. (Still a disbeliever, I promptly tested this with a photograph that I took of a maple tree. It works [Figure IV].) Hale followed his analogy from the human face to nature and to architecture, referring to the need for a building to embody harmonic pattern in order to be recognized as a place.

After reading Hale, I read more about the use of Phi. My reading took me back through successive centuries. In the 12th century, the architect Villard de Honnecourt made sketches of the human body, revealing that the waist is positioned approximately 1/3 of the way between the shoulders and the feet. From an historic notebook of de Honnecourt's sketches, he appeared interested in harmonious divisions of space, most notably having to do with medieval church design. However, de Honnecourt is also credited with developing a diagram which reveals how a line may be divided into any number of equal parts *without using a ruler.* During the 15th and 16th Centuries, Aldus Manutius, Geoffrey Tory, Albrecht Dürer, Leonardo da Vinci and others explored the proportions of the human body in their work. More important, during the same time period, Manutuis had used these proportions in the design of books and Tory and Dürer had used them in the design of typefaces. I had found what I was looking for: the deliberate use of Phi in the design of human-made artifacts including—and directly relevant to my teaching graphic design—the design of typefaces and of books. Books designed in the 17th and 18th Centuries, such as those by John Baskerville and Giambattista Bodoni, also reveal the application of Phi. During the Arts and Crafts Movement of the late 19th Century William Morris, Charles Ashbee, Frederic Goudy and others established 'private presses,' printing establishments where books and design ephemera were produced to reflect the beauty and craftsmanship of book publishing during the Renaissance. Morris produced a typeface which he named "Golden," perhaps as a tribute to the ratio he used in his designs.

Figure IV

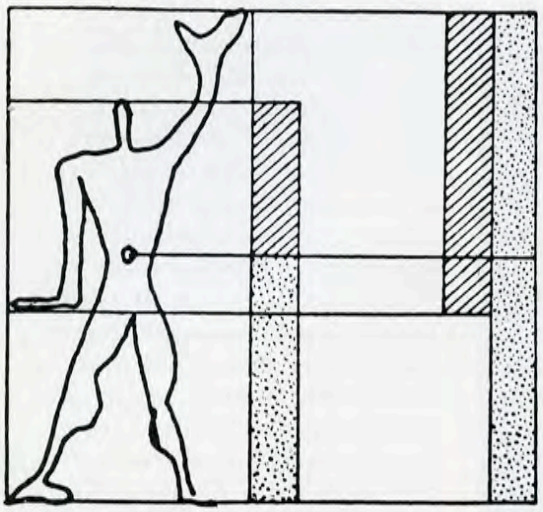

Figure V

In the 1940s and 1950s, the graphic designer Jan Tschichold researched book design of the medieval and incunabula periods, and he devised diagrams to visually explain the proportional relationships he found between page width, height and text block area (*The Form of the Book*, 1975. English translation, Hartley and Marks, 1991). Tschichold used de Honnecourt's 12th Century diagram as the prime example of the development of harmonious divisions (proportional relationships of the text and other graphical elements on the page), and he demonstrated how, using Villard's diagram, a page may be divided into any number of equal parts without a ruler. Tschichold also referred to the work of Hans Kayser. In 1946 Kayser wrote *A Canon for Harmonious Page Division* in which he also supported de Honnecourt's findings. Tschichold found that others including J.A. Van de Graaf (1946) and Raul M. Rosarivo (1956) had devised similar diagrams. In the late 1940s Tschichold put his observations to practical use while, as Design Director for Penguin Books, he redesgined the Penguin Series according to the Golden Ratio. Here was a practical application to which my students could relate!

I found fascinating connections between the design of architecture and what we now call graphic design. In 1954, the architect Charles Edouard Jenneret (known as Le Corbusier) proposed in his book, *The Modulor*, that the height of a man's upraised hand is twice the distance from the base of his feet to his abdomen. He advocated a method of learning in which observation of natural forms plays the primary role. He devised a scale using Phi and he used it in all aspects of design including typographic design and building design (Figure V). In 1996, two high school mathematics students, David Goldenheim and Daniel Litchfield, with their teacher Charles Dietrich devised a method of subdividing a line segment into any number of equal segments. This mathematical construction (called the GLaD construction after Goldenheim, Litchfield and Dietrich), was subsequently observed by the contemporary textbook designer William Johnston to be a variation of Villard's 12th Century Canon, which the 20th-Century graphic designer Tschichold deemed so relevant! Web site design presented in 1999 by William Drenttel demonstrates geometry in graphic design. Drenttel bases the design of web sites on modular components derived from Phi.

I began to use Phi in my personal artwork and in my professional design practice. The first time I used Phi in a large project I did for a new client, he remarked at how the booklet I designed was so beautiful and so "connected" from the first to the last page. No one had ever before expressed that kind of response to my work. I found that using Phi in my professional work provided a foundation for the development of visual relationships that strongly tied my work together. The more I used these relationships in my private practice and in my personal artwork, the more I realized that providing the same kind of foundation for my students might enable them to better understand the concepts of graphic design. To further assist me toward providing a rationale for teaching graphic design students about Phi, I found a text, *The Elements of Typographic Style* (by Robert Bringhurst, Hartley and Marks, 1992) in which an entire chapter is devoted to proportions, specifically Phi. Included is Le Corbusier's Modulor as it may be applied to graphic design. I had found credible evidence for teaching this geometry to my students, and more important, I found that they need not fear the dreaded *math*. It is relatively simple to produce strong, effective graphic

Figure VI

design while using Phi as a guide. In fact, a ruler isn't needed and page proportions may be designed with pencil, compass and straightedge. No numerical calculations are necessary!

I devised a project in which students may firsthand recognize the relationships between the use of ratio in architecture and in graphic design. I tell them that they are going to design a poster. To prepare themselves, they read a chapter from Hale, "The Principles of Pattern" and one from Bringhurst, "Shaping the Page" (Bringhurst and Hale promote Phi and provide examples of balance, symmetry, and harmony in the pentagon, musical scales, the Fibonacci Series and Le Corbusier's Modulor). I show students examples from my own observations (Figure VI), and I send them out, sketchpad and pencil in hand, to draw the facades of pre-20th-Century homes (vernacular architecture prior to the 20th Century is likely to exhibit Phi). I ask them to pay particular attention to relative placement of windows to each other, windows to doors, roofline to sill, height of roof peak to sill, placement and height of chimney(s), width of chimney(s) in relationship to width of front door(s), roof height, windows, doors, etc....When the students return to the classroom, they scan the sketches into the computer as I instruct them to try to find proportional relationships in the elements of the house. Then I ask them to find a proportion in Bringhurst that most closely matches the proportions in their sketches. Students are often initially highly skeptical that the design of houses has anything to do with typographic design, and they wonder how on earth to correlate the drawing of a *house* to the design of a *poster*. Then they see that they actually *can* find the proportions of the house they drew in the book about typographic design! I have been assigning a variation of this project for about six years, and *it works every single time!* Students are amazed, and, what makes me so excited about this project is that each time I assign it several students usually approach me saying that they had begun to pay close attention to the facades of the houses in their neighborhoods or as seen from the bus on the way home from class. One semester, a young woman who was concurrently taking a music appreciation class told me that her music professor discussed Phi in class and related it to what they were studying. She, in turn, found similarities between music and graphic design. She made a connection between two classes having what she had previously perceived as completely different subject matter, and *she was excited about her discovery.* I find that this project frees students to think in new and innovative ways and provides cross-disciplinary connections. The conscious application of specific ratios in their work gives them, literally, a foundation from which to build a strong, solid poster design. Figure VII is a poster designed, using Phi, by Melissa Koleshis in the Graphic Design III class during the Fall 2000 semester.

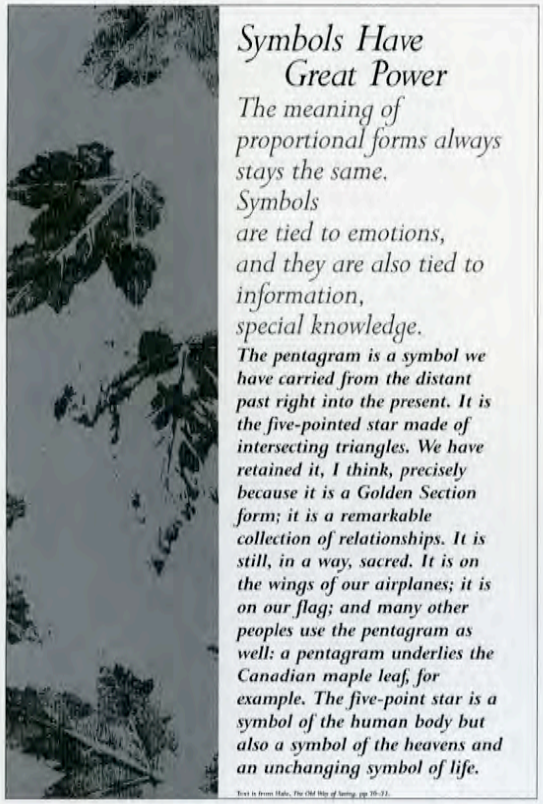

Figure VII

I am happy to say that I now live in Phi. When I moved to Massachusetts two years ago, I looked up Hale, after reading in his book that he was an architect practicing in the Boston area. He accepted my request to draw up plans for an 18th-Century-style cape. Just after my husband and I moved into our very modest and then quite unfinished house last year, a neighbor came over to introduce herself. After being in the house for only a few minutes, she looked around and stated that there was "something about it" that reminded her of an old cape she had once lived in. "This house just seems so right," she remarked, "So comfortable. It's brand new, but it has the personality and warmth of the old."
"Yes," I responded, "it's Phi."

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