PRACTICAL APPLICATIONS
OF
DYNAMIC SYMMETRY

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PREFACE

IN this book are published for the first time a series of lectures given by Mr. Hambidge in New York during the winter of 1921 on his return from Europe, where he had spent two years measuring and studying examples of Greek art. His work there was the final corroboration of twenty-five years' careful experimentation in plant life, of tireless study of the natural symmetry laws used by the various races of the world, and of the test and application of his discoveries to his own work as an artist.

So strong was his belief that significant expression could be born only from a development through fine craftsmanship, and that the so-called higher arts would continue to be superficial and imitative, unless built on a firm foundation of structural technique, that he devoted much time to actual experiment in various phases of the crafts or basic arts. He purposely made the designs and layouts illustrating these lectures, simple technical examples of the use of the principles and not aesthetic criteria which might tempt the student to imitation. His whole effort was to encourage creative originality, not to impose personal opinion.

No changes have been made in the arrangement or text of the lectures; they are given here as Mr. Hambidge first delivered them. The drawings of natural forms have been selected mostly from his unpublished material and added to illustrate more clearly the difference between static and dynamic symmetry. The two pottery examples have been taken from *The Diagonal*, a small monthly magazine published for Mr. Hambidge by the Yale University Press, for comparison of the Greek use of dynamic symmetry with the later use of static symmetry. Careful study of these two aspects of the law of symmetry will show that the static is an instinctive symmetry, producing obvious pattern arrangement; the dynamic an inner law of growth developing subtle rhythmic balance. The designs for important architectural plans by the best of the later artists show an obvious symmetry arrangement in comparison with the subtle precision and highly developed simplicity of the design for a frying pan by a comparatively obscure Greek potter; yet both have a quality of order which all composition without schematic plan entirely lacks. The difference between these two forms is perhaps as inherent as that separating the symmetry of a snow crystal from the living symmetry of a plant.

Much of the elementary material in the first chapters has been published previously in Mr. Hambidge's other works but is here enriched by subsequent study in European museums. The succeeding chapters give for the first time the author's practical application of these elementary principles to modern problems of design.

A book of this special character can only touch upon the world of natural forms, giving a few illustrative examples, with the hope that the student will be stimulated to delve farther into this fascinating subject. With dynamic symmetry as a formulating principle to lift this natural pattern into higher rhythmic form, a new world of design opens up. Natural pattern copied literally lacks the quality of art; but vitalized and formalized by an intelligent principle, containing the same inherent law as itself, it reveals undreamed-of possibilities.

In his approach to dynamic symmetry the student should first free himself from the fear of the mathematics involved. Mathematics, while keeping him within the bounds of reason, will liberate his creative imagination. The mathematics of dynamic symmetry are exceedingly simple and herein lies their value to design. Out of this principle of structure, simplicity will emerge, not the simplicity of barrenness but the simplicity which has sloughed off the superfluous and retained only what is necessary to enriched development.

It is easy to swing into rhythmic composition through the establishing of diagonal lines, without understanding the areas created by them, but by this method alone composition is liable to become thin and flowing. After a plan is carefully laid out by diagonal lines, the student should thoughtfully consider each area and exhaust it thoroughly through the Greek method of area analysis. He will find that this process will enrich and discipline his imagination. The rectangles of dynamic symmetry should be drawn and redrawn until they are absorbed and can be used as an unconscious rhythmic technique. But danger also lies in overanalysis, in forming design by a too intellectual process of area dissection. Balance must always be kept between technique and imagination.

It is impossible to reach a complete understanding of dynamic symmetry without knowledge of Greek art, Greek thought, Greek civilization. The past must ever be a living source of inspiration, not imitation. The Greek way is the New Way; not to accept the appearance of things but always to search for the inner truth.

M. C. H.

New York City,
August 11, 1932.

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INTRODUCTION

SYMMETRY is the rhythm base of design.

It is impossible to introduce rhythm into design composition without first introducing symmetry.

A certain amount of symmetry and rhythm exist in all design but only the very best has it in proper quantity.

All design weakness is due to poverty of symmetry and rhythm.

The history of design shows us beyond question that symmetry and rhythm are consciously used by artists who are real masters of composition.

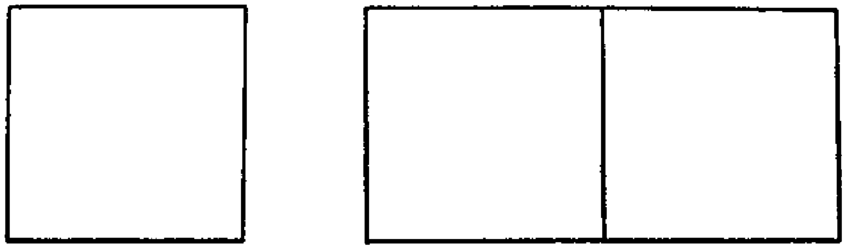
If an artist does not understand symmetry and rhythm he can only design blindly and trust to his feeling. This is all very well up to a certain point. That point however is soon reached, and if the artist has nothing but feeling and disposition to rely upon he is left groping and embarrassed for lack of technical knowledge sufficient to overcome simple mechanical difficulties. His vision is narrowed and his accomplishment curtailed if he does not understand how to order his plans to obtain compositional power.

Artists of the past have put symmetry and rhythm into their compositions in different ways but the best of all methods was that used by the masters of design who flourished during the classic period of ancient Greece.

The principles used by these masters have been recovered, after having been lost for over two thousand years, and are theoretically and practically explained in these lessons on Dynamic Symmetry.

CHAPTER I

SYMMETRY: ITS STATIC AND DYNAMIC ASPECTS



a *b*

Fig. 1

THE above diagram, Fig. 1 *a* and *b*, represents the base of symmetry, either static or dynamic.

a is one square and *b* two squares; one unit and two units. The ratio between the bounding lines of *a* is 1. That of *b* is 2. A ratio is obtained by dividing an end of an area into its side.

If we should consider these two areas as 1 or 2, or even multiple fractions of 1 or 2, as one-half, one-third, one-fourth, one-fifth, or eight-tenths or nine-sixteenths, etc., these two areas, *a* or *b*, with their even multiple subdivisions or without them, would be examples of static symmetry.

If we should lay out an area by linear measurement, say nine and one-quarter inches by sixteen and five-eighths inches, that area would be a static area composed of nine squares and a quarter of a square on the end and sixteen and five-eighths of a square on the side. No matter how we divided this area, if we used a line divided into units and even fractional parts of a unit, the result would be static symmetry, and, in comparison with another and higher type of symmetry, would be commonplace and uninteresting from a design standpoint.

There is one other method of producing static symmetry. This is by the employment of the regular figures of geometry such as the square and the equilateral triangle and their logical or natural subdivisions.

In static symmetry of this type the resultant subdivisional parts of the areas employed produce natural patterns upon which design is woven. This is the symmetry of the design of the Gothic, Byzantine, Coptic, Celtic, Roman, Assyrian, Persian, Hindu, Chinese, and Japanese.

Of course individual workers at any time may use, and undoubtedly have used the linear method of fixing the areas of design, but the regular figure base is characteristic of the design periods mentioned. Of these two methods, the linear and the regular figure, there can be no question whatever about the superiority of the latter.

So far we have been speaking of areas for design which were intentionally, or consciously, selected by the designer. There must have been design produced at different times during history when the designers paid no attention whatever to the areas which their designs occupied. In this case they would produce a unit of form or pattern or intentionally sketch out a design arrangement and let it occupy any area chance fixed. A combination of units of form or pattern would automatically result in static symmetry by the very nature of the phenomenon of repeat. And where a design is sketched out intentionally without consideration for the extent or limit of its area the result again would be static symmetry. If this were not so there would not be recognizable design.

This unconscious or unintentional type of symmetry is always produced during barbaric, formative, or decadent periods of design production. The world in recent times has been going through a formative period. It is not barbaric because civilization is too sophisticated. It is not decadent because there has been nothing to decay. Decadent periods always follow those of full fruition. There has been no design period of full or ripe fruit since that of the Gothic. The Hellenistic was a decadent period and it followed immediately after the rich classic development of Greek design. The world today is rapidly approaching another great flowering period of design.

The student should remember that the symmetry aspect of design is to some extent purely mechanical and it must not be confused with creative intuition. The personal element in design is dependent upon creative intuition, one of the greatest if not the greatest element in all art. This aspect can hardly be taught but it can be encouraged and assisted. And one method of rendering this assistance is to reduce the mechanical part of creative effort to as simple principles as possible. And the student should also remember that principles do not mean rules.

These latter are the offspring of personal recipes and formulae, the negatives of all art. The creative intuition is a very delicate affair and can grow and expand only when it is freed from the difficulties of mere technique. The finest intuitive expression can be rendered abortive by even a slight lack in knowledge of technique. A clear conception of the position of symmetry makes it apparent that its aesthetic value is indirect. Symmetry is part of the grammar of artistic expression and without knowledge of its principles we shall be unable to give adequate expression to our creative dreams.

To sum up and stress the points in the foregoing paragraphs:

Unless symmetry is present design does not exist.

There are two types of symmetry; the static and the dynamic.

Static symmetry is produced in two ways: by using a linear unit of measurement divided into even fractional parts such as a foot, a meter, etc., or by the regular figures of geometry such as the square or the equilateral triangle or multiples or natural subdivisions of these.

The regular figures of geometry produce the best static symmetry because they automatically supply necessary design rhythm. Speaking figuratively, we cannot introduce music into our design without some means of controlling rhythm. Pattern is a necessary consequence of rhythm or *vice versa*. The two are inseparable. It is easier to obtain and to control rhythm through pattern than it is the other way around. All the great design of history excepting that of Egypt and Greece, of the classic period, was built upon the regular figures of geometry.

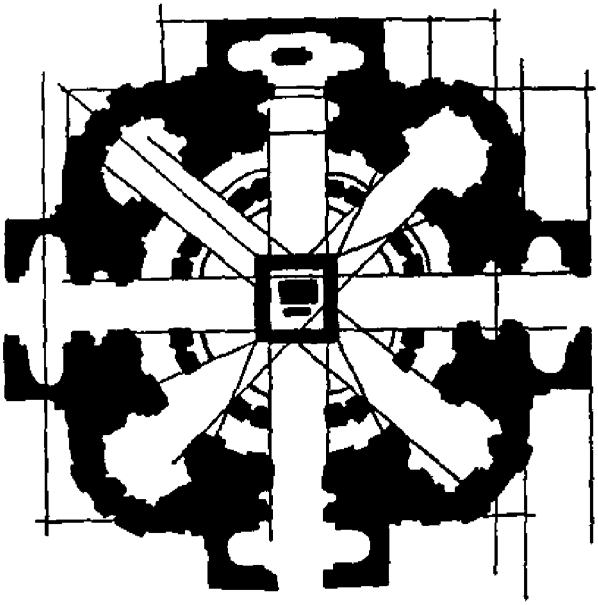
Unconscious or unintentional symmetry is produced by savages, decadent designers, or designers who are passing through a formative period.

It may not be inappropriate to add here that:

Effective composition is impossible without design.

When design is weak realism is liable to be dominant.

Plate I is a plan of a building by Michaelangelo. The symmetry construction is left on the drawing, the parts of the rhythm to be used being indicated by heavy washes. The symmetry construction lines of course would not appear in the finished work. The base of the arrangement is a square divided naturally, and it is apparent that the symmetry is static. This is but one of many such themes left by the Renaissance master.



Plan of a building by Michaelangelo

PLATE I

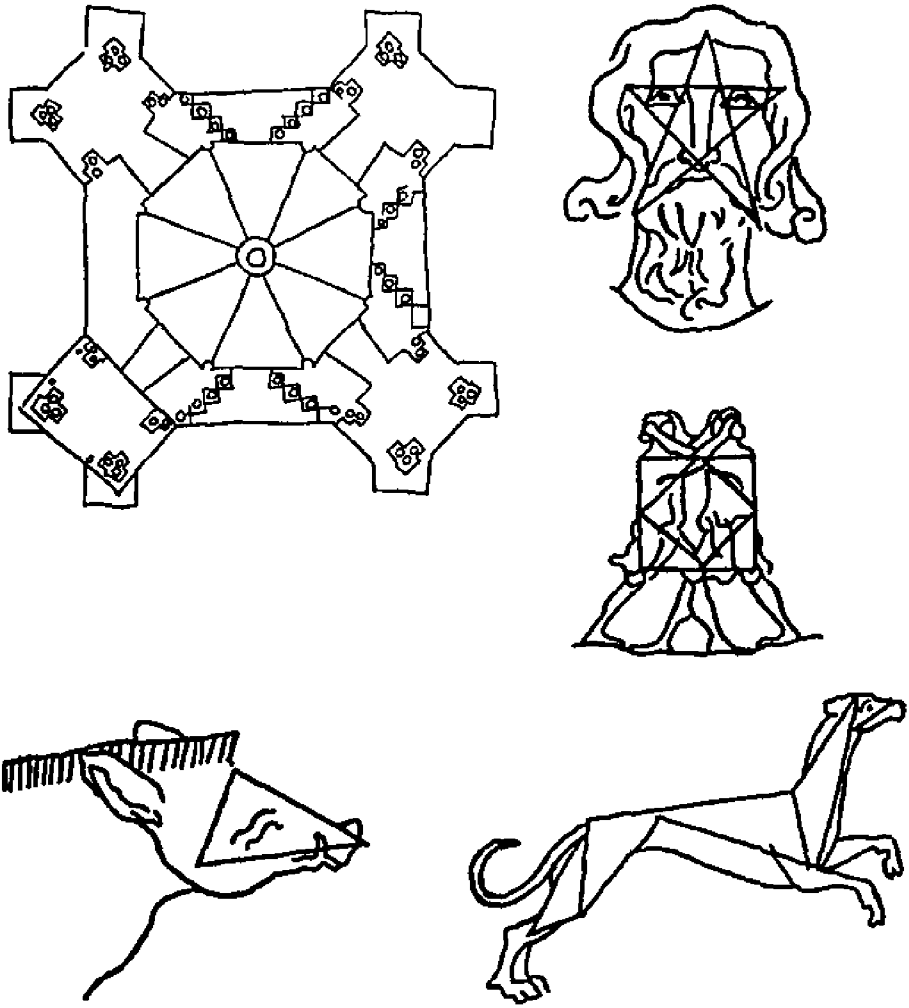
Plate II is a group of symmetry arrangements from the notebook of Villard de Honnecourt, a thirteenth-century French Gothic architect and supposedly the creator of the Cathedral at Cambray, appropriated as public property and destroyed by the French Revolutionists. De Honnecourt antedates Michaelangelo considerably but we find in the latter's work the same general conception of rhythm that we do in the work of the French master.

Plate III is from a notebook of Leonardo da Vinci. The symmetry themes, allowing for individual selection on the part of the two men, are identical with those of De Honnecourt. That is to say they belong to the same general base.

It will be noticed that, with the exception of the example by Michaelangelo, the symmetry plans are rendered freehand.

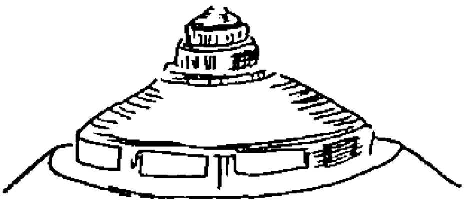
Later the De Honnecourt sketches will be considered more fully, especially those which show the regular pentagram.

Static symmetry rhythm themes based upon the regular figure are generally recognizable by inspection. It is suggested that the student glance over a collection of examples of historic ornament and make rough analyses of the rhythm themes.

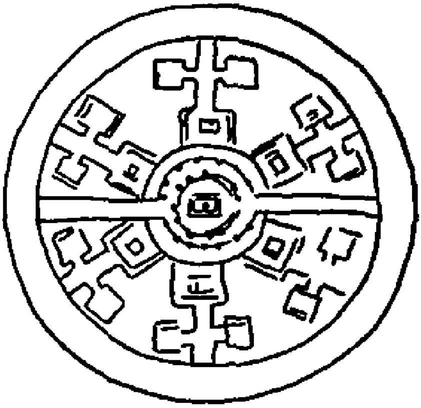


Symmetry sketches from the notebook of Villard de Honnecourt, showing how this French Gothic master of the thirteenth century experimented with rhythm

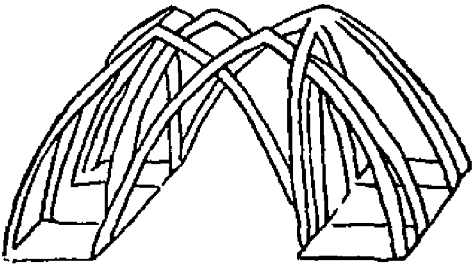
PLATE II



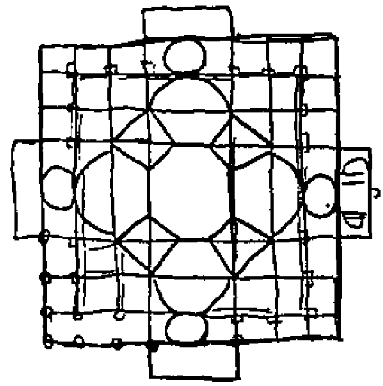
a



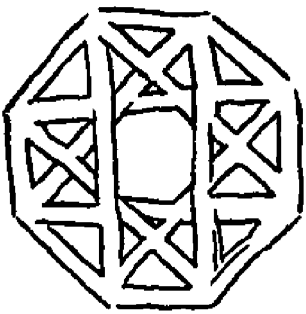
b



c



e



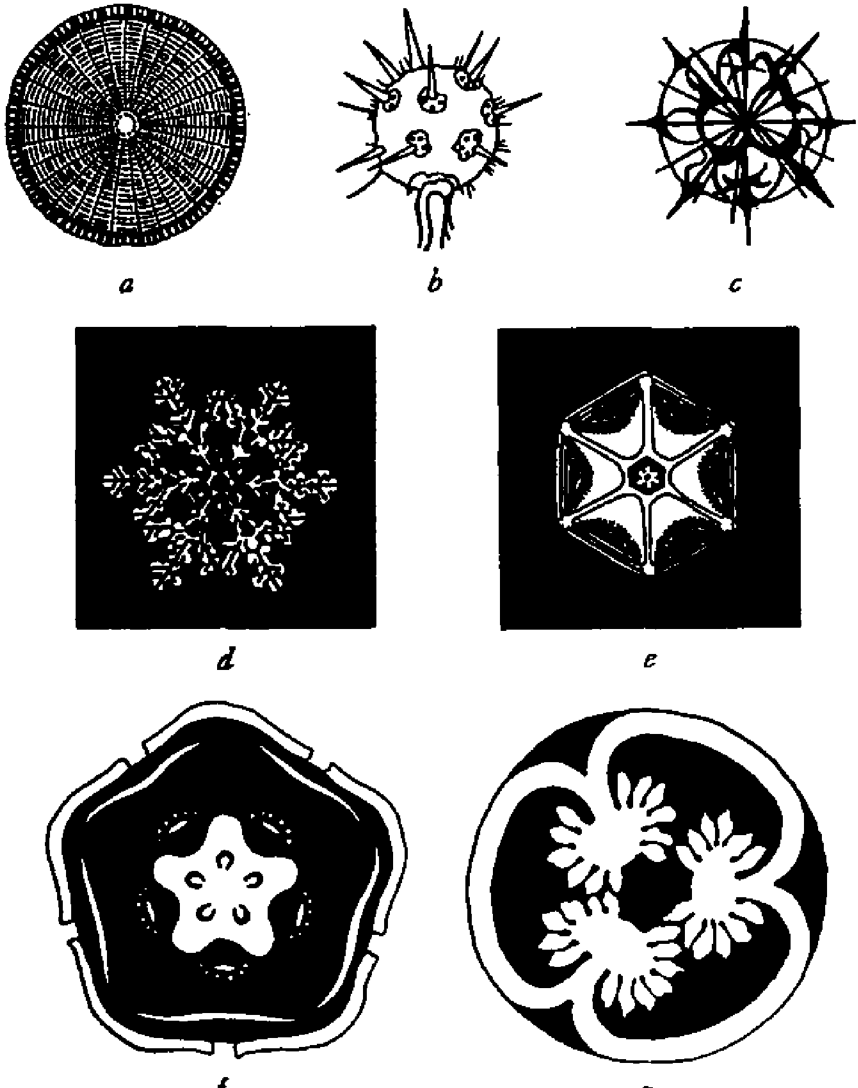
d

From the notebooks of Leonardo da Vinci

a *and* b, *elevation and ground plan of a mausoleum;* c *and* d, *elevation study and plan;* e, *rhythmic ground plan*

PLATE III

In nature static symmetry is found in crystals and in regular pattern arrangements such as we see in certain flowers, diatoms, etc. The systems of crystallographic indices furnish sufficient proof of the static nature of crystal forms. For the purpose of making these indices the crystal is imagined to be centered upon intersecting ordinates arranged

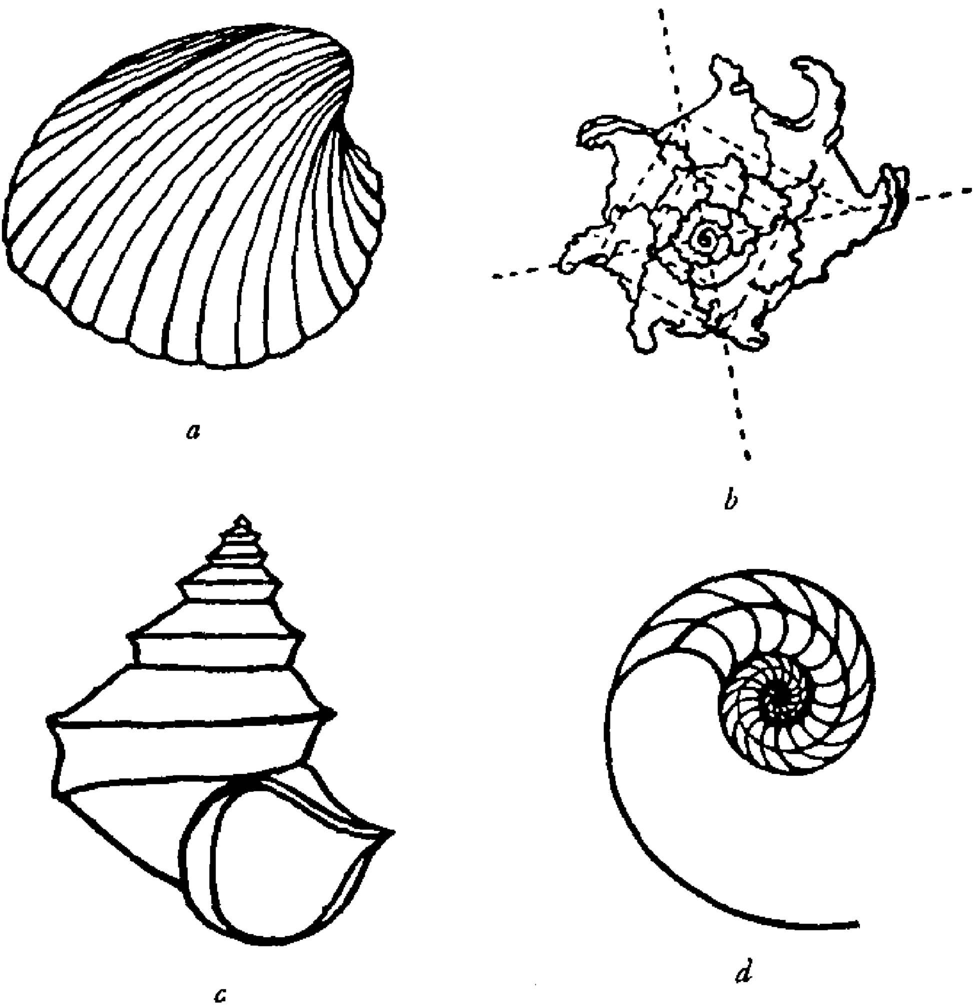


a, *a characteristic Diatom*; b *and* c, *skeletons of Radiolaria;* d *and* e, *snow crystals;* f, *plan and praefloration of the flower of the Linden;* g, *section of the ripe pod of St. John's Wort* (Hypericum graveolus)

PLATE IV

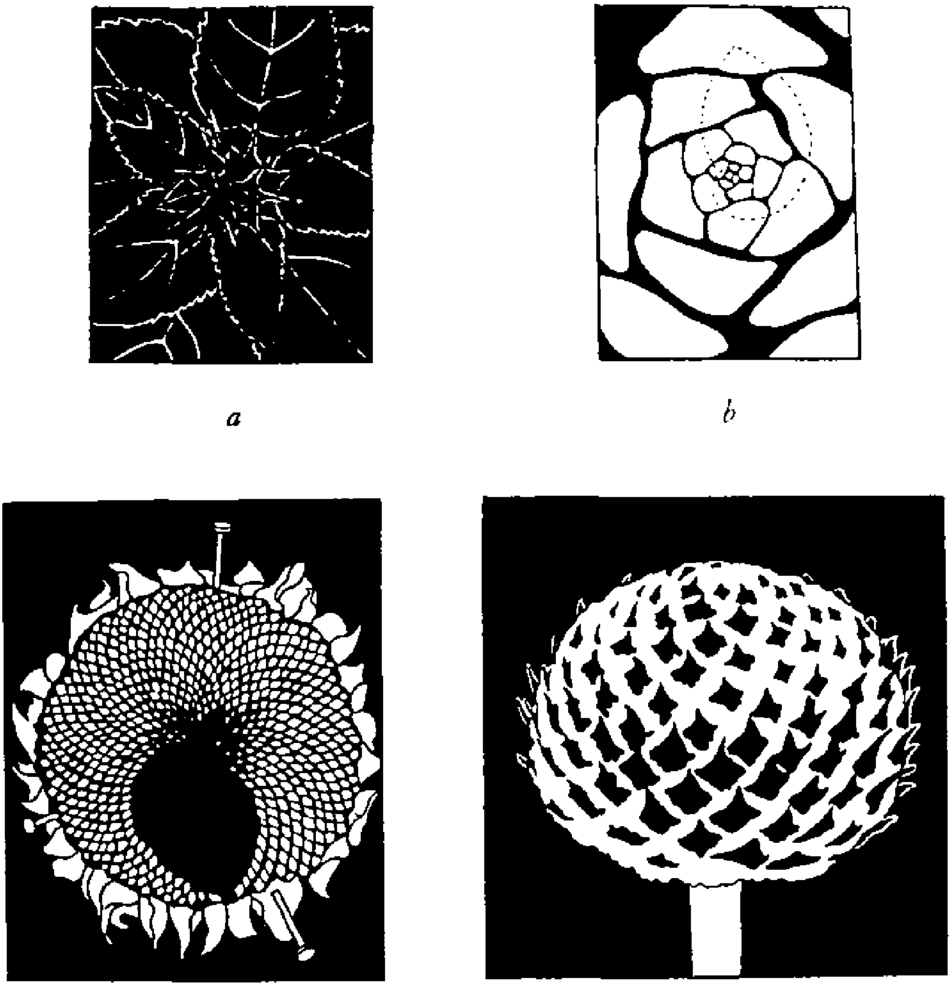
for the three dimensions. These ordinates have a ninety-degree or right-angle relationship to each other. It was discovered that, along these ordinates, planes and intercepts of the crystal could always be represented by whole units and even fractional parts of a unit.

Curiously the five regular solids of geometry, of which more later, could not be expressed by such indices.



Drawings of various shell spirals, showing dynamic symmetry in nature

PLATE V



a *b* *c* *d*

Drawings showing dynamic symmetry in the law of phyllotaxis.
a, b, *sunflower and perennating bud, from* Relation of Phyllotaxis to Mechanical Laws, *by A. H. Church;*
c, *sunflower head, from photograph by the author;*
d, *Cephalaria, from* Urformen der Kunst, *by Karl Blossfeldt*

PLATE VI

COMMON HOUSEHOLD ARTICLES SHOWING THE USE OF DYNAMIC SYMMETRY BY THE CLASSIC GREEK ARTISTS

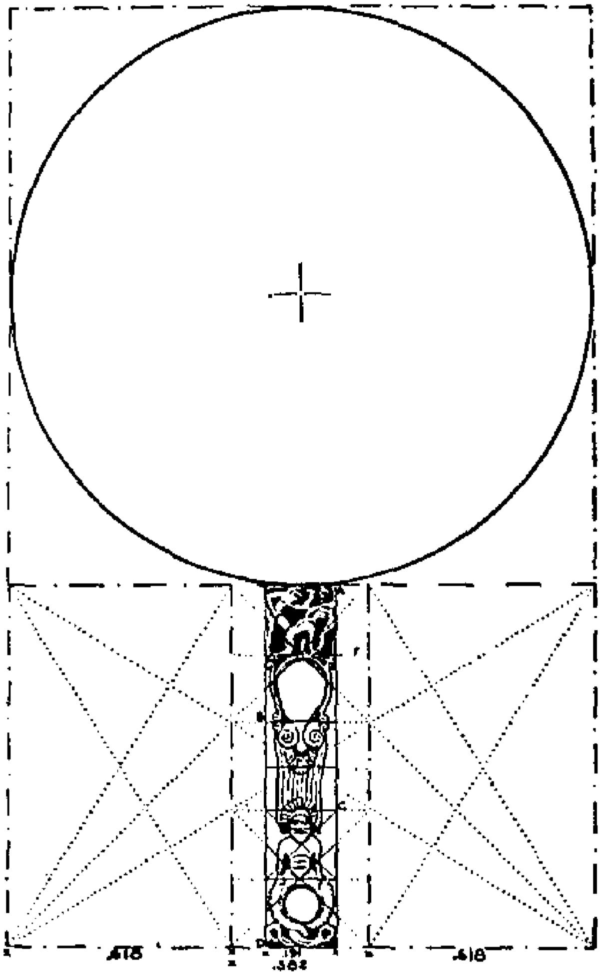


Diagram 1. Drawing of Bronze Patera

A SIMPLE COOKING UTENSIL AS A GREEK MASTERPIECE

A sixth-century B.C. bronze frying pan in the Metropolitan Museum of Art, New York City, furnishes a design theme in a perfect whirling square rectangle.

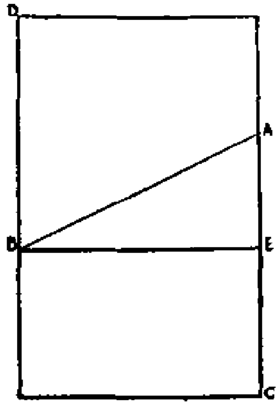


Diagram 2

Draw a square, DE, and bisect one side as at A, Diagram 2. Make the line AC equal to AB. The area DC is a rectangle of the whirling squares and the area BC is its reciprocal. Consider the area BC as a rectangle of the whirling squares, that is, a similar shape to the whole, and draw its diagonals and the diagonals of its reciprocals as in Diagram 3.

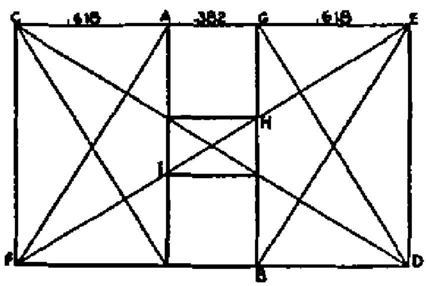
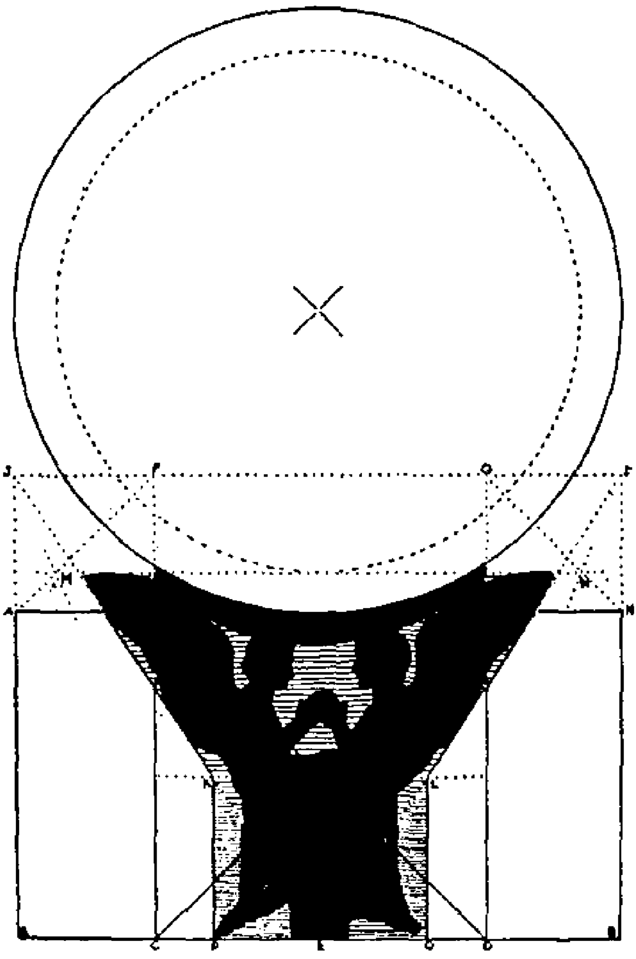


Diagram 3

The areas AF and BE, Diagram 3, are the two reciprocals of the area CD. These reciprocals exhaust the area CD except the area AB. This last area is important for the present purpose. Considering the area CD as represented by the ratio 1.618 then the line CA represents .618, the line GE .618 and the line AG .382; these added equal 1.618. The area AB which we term a .382 area is composed of the square AH, the whirling square rectangle HI and the square IB. This fraction .382 is the reciprocal of 2.618. Therefore, the area is composed of the whirling square rectangle GI plus the square IB.

The width of the handle of the frying pan divided into its height furnishes the *ratio* 5.236 and its reciprocal is .191. But 5.236 equals 2.618 multiplied by 2 and .191 equals .382 divided by 2. Consequently, the area of the *handle of the frying pan occupies one-half* the area AB, Diagram 3. The handle design is placed in the center of the .382 area. Reference to the analysis of the design, *Diagram 1*, shows that AB equals two squares, CD two squares and BC two whirling square rectangles. The disk of the frying pan of course is a circle described by the major square of the major whirling square rectangle.

A GREEK BRONZE MIRROR FROM THE MUSEUM OF FINE ARTS, BOSTON, A THEME IN SQUARE AND ROOT TWO



Draw a square and its two diagonals as Diagram 1.

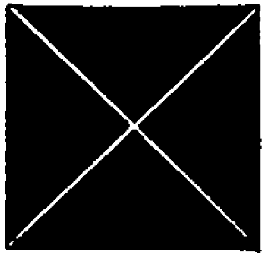


Diagram 1. Greek Bronze Mirror

Use these two diagonals of the square to construct the rectangle Diagram 2.
DC is equal to DF and AB is equal to AE.

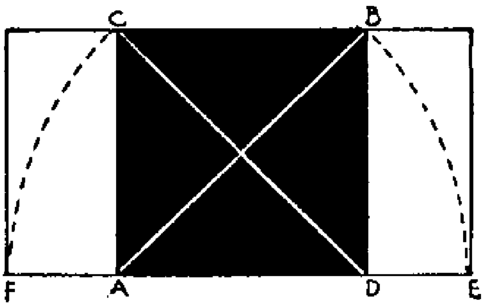


Diagram 2. Greek Bronze Mirror

Upon the side of the rectangle of Diagram 2 construct a square as in Diagram 3. This rectangle AC of Diagram 3 is the rectangle which exactly contains the bronze mirror with its two decorative figures of Cupid and Psyche playing a game of chance.

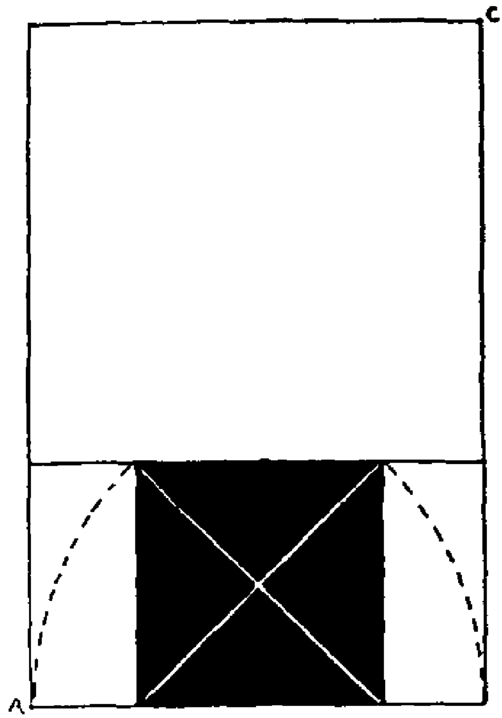


Diagram 3. Greek Bronze Mirror

ANALYSIS OF THE DETAIL

The area AB, Diagram 4, is composed of two root-two rectangles which overlap to the extent of a square. These figures follow from the constructive use of the diagonals of the primary square as shown in Diagram 2. Use one of the diagonals of this primary square to obtain the line DG or CF and draw the line JI. Complete the rectangle JB. This rectangle equals one-half the overall rectangle. AD, CH, and DF are root-two rectangles and JD, CI are squares overlapping to the extent of the root-two rectangle DF. From E, the middle of the line, BQ, draw the lines EJ and EI. These lines will cut a line marking the

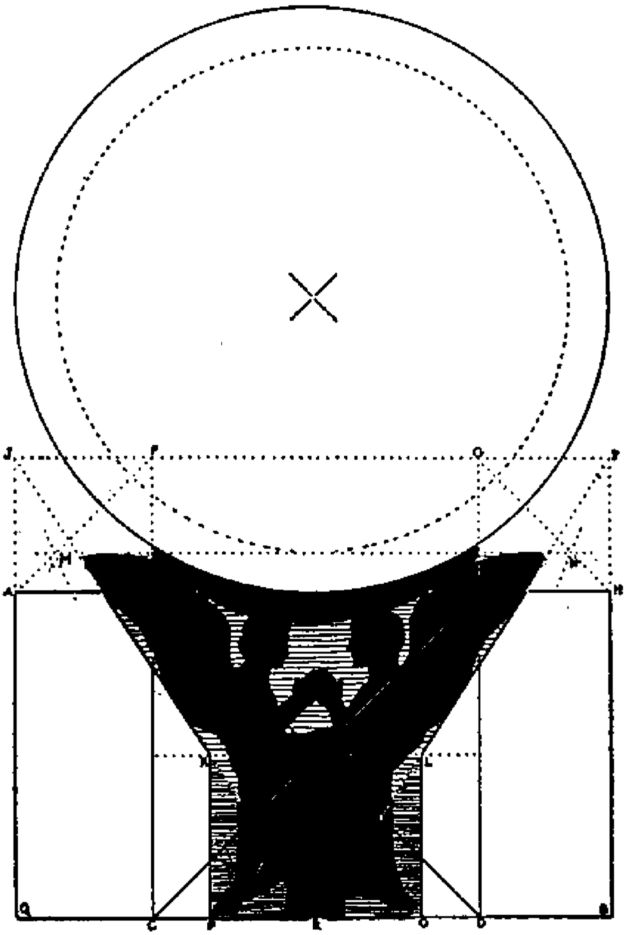


Diagram 4. Greek Bronze Mirror

middle division of the primary square at K and L. Draw the lines KP and LO. Lines drawn from P to J and O to I cut the diagonals of the two squares AF and GH at M and N. Draw the line MN. The symmetry theme of this design is now developed. If necessary, the analysis might be carried further and the fact shown that every detail was expressible in terms of root two and square. This, relatively, minor design is characteristic of all Greek design. The symmetry theme is definite and consistently one thing throughout. The satisfying harmony found in all good Greek design is due more to this consistency of symmetry theme than to any other single factor.