ATUM to ATOM

Book 2: Geometry, Number and Cosmokrator

Asia Shepsut

`… and behold, there was a man whose appearance was like the appearance of brass, with a line of flax in his hand, and a measuring reed; and he stood in the gate' [***Ezekiel 40***]

2012

CLEARVIEW HEARD IT FROM HEARKEN
HEARKEN HEARD IT FROM TONE
TONE HEARD IT FROM SOUND
SOUND DID HEAR IT FROM THE SECRET
SECRET HEARD IT FROM THE VOID -
AND VOID TAPPED IT FROM THE TAO

A Lauterwasser in ***Water Sound Images*** *2006, quoting Juang Dsi's*
The True Book from the Southerly Blossom's Rim *1974*

Frontispiece: The Babylonian winged Goddess with horned helmet, accompanied by her lionesses and owls, holds up in each hand the circle and rod of the Geometry Measures (British Museum)

PRINTING INSTRUCTIONS

This book is formatted to print onto A4 pages as loaded on any ordinary colour printer. The pages can then be slid into a plastic spine of appropriate width, purchasable from stationery shops, or put into ring-binder file, so that your own pages of personal material can be interleaved.

Suggestions for inclusions, amendments or corrections are welcome, and should be sent to the contact names on the www.cosmokrator.com Feedback site.

Title and Contents pages: The Ouroboros Symbol

The *Ouroboros*, or snake eating its tail, represents the seamless continuity of the Universe, the reality beyond the illusion of a beginning and end. In the present book it stands for the meeting of Ancient with Modern knowledge, and encapsulates the idea of recurring octaves, or cycles – *the one on the title page is taken from an Alexandrian Gnostic manuscript with the Greek inscription 'All is One', whilst the ouroboros on the Contents Page is twisted into the symbol for infinity*

CONTENTS

THE NATURE OF GEOMETRY

Geometry can simply be used to make patterns (***Ill. 2- 2***) but also more deeply as an aid to understand the nature of Spirit and Mind within Matter – Sacred Geometry. It reveals the underlying blueprints through which (as we saw in ***Book 1*** on Music) we can view how energy waves bring the World into being – which is where the experiments conducted by Hans Jenny are so stunning and revealing (more below on this). All the Cosmokrator books point the way towards the architecture of the Universe in terms of simple numbers and shapes before they multiply and obscure the underlying plan. Because geometry is neutral we can apply it to any one level of existence, or to all of them at once – in this short book for much of the time we follow some drawing exercises, often leaving you to come to your own conclusions. There are three main types of growth:

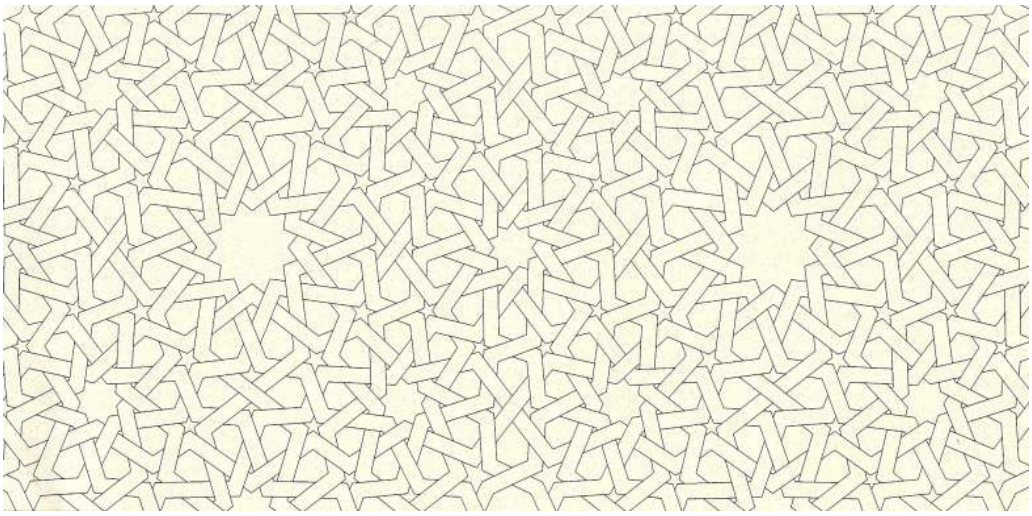
Arithmetic:	1	2	3	4	5	6	7…
Geometric:	1	2	4	8	16	32	64…
Harmonic:	1	1:2	2:3	3:5	5:8	8:13	13:21…

THE PRIMARY SHAPES FROM LINE AND CIRCLE:- TRIANGLE, SQUARE, PENTAGON (1,2,3,4, 5)

In something as simple growing or buying flowers for the home, as well as variety of scent and colour, we may also unconsciously seek enjoy variations in the geometry and number of leaves and petals and their layout. Any one flower can becomes a single focus for delight in beauty and order, and in fact only 1,2,3, 4 and 5 and their multiplication are needed to generate an entire cosmos of arrangement in two-dimensional geometric and harmonic development.

Ill. 2- 1: Flowers from a typical plant nursery catalogue

Repeating geometric shapes create patterns: one summer workshop study group I worked with concluded that *Pattern is a force-field which submits all elements to law and order.* This is obvious when we look at the Islamic pattern below, yet even the most complex of them starts from simple beginnings, and we will map different types of net with the primary shapes as their seed. Frithjof Capra is famed for pointing out the match between



Ill. 2- 2: Islamic strip weave pattern with twelve-point stars as 'black hole' centres

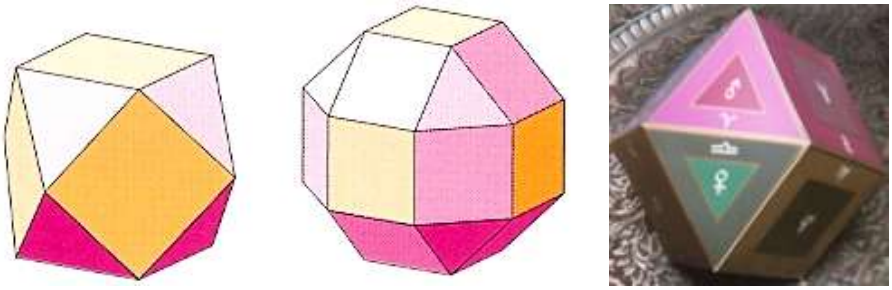
the viewpoints of modern physics and ancient mysticism, stating that LI, the fundamental law of nature in the Chinese system of thought is translated by the great expert on Chinese science, Joseph Needham, as 'dynamic pattern'. 'Cosmic organization… is, in fact, a Great Pattern in which all lesser patterns are included, and the 'laws' which are involved in it are intrinsic to these patterns', he quotes. When we watch such patterns at work in moving water or oriental carpets; in processes of life or systems of proportion in art, we are experiencing 'coagulated music', feeling life around us in terms of waves and vibration. Here I must mention a new book I have only just read, called ***The Wavewatcher's Companion*** (2010) by Gavin Pretor-Pinney which gives a whole new meaning to spending summer in a deck-chair at the seaside, just watching the waves, as the starting point to becoming aware of all the other waves of life!

Spotting patterns in everything ordinary around us raises our levels of consciousness and by a kind of alchemy brings order to the whole of one's personal chakra tree (more of chakras in a minute). Now we already know from the Cosmokrator book on ***Music (Book 1***) that different string lengths correspond to different musical notes, and doing geometry in this book is another way of studying music all over again, this time with ruler and pencil on the visual plane. This is why Hans Jenney wrote, 'What we want to do is as it were, to learn to 'hear' the process that blossoms in flowers, or 'hear' embryology in its manifestations'. His book, ***Kymatik,*** was originally a two-volume work in German about the behavior of matter when activated by sound. When published in English in 1967 it caused a sensation, immediately placed at the top of the group of cult books I have listed later, along with Theodore Schwenk's ***Sensitive Chaos*** (reprinted 2002). Jenny's predecessor, Chladni, had shown that pollen scattered on a stretched membrane such as drum hide or brass plate would fall into a particular configuration if a vibrating violin bow was held to its taut edge. Jenny tried the effects of connecting music electronically (an effect lasting longer and therefore more precise and measurable) to such surfaces – on which he placed sand, mercury, water, or kaolin paste, as well as pollen. After its rediscovery by a new generation and republished as one book in 2001 it was followed by other books taking the exploration further,

most notably Alexander Lauterwasser's ***Water Sound Images*** (2006). Altogether they highlight our awareness that the universe is formed and then held together by cosmic music, and that this cosmic music in essence manifests through simple numerical and geometric shapes. By looking at those numbers and shapes it really is possible to know everything, at least in essence! This is why the Cosmokrator model is so potent.

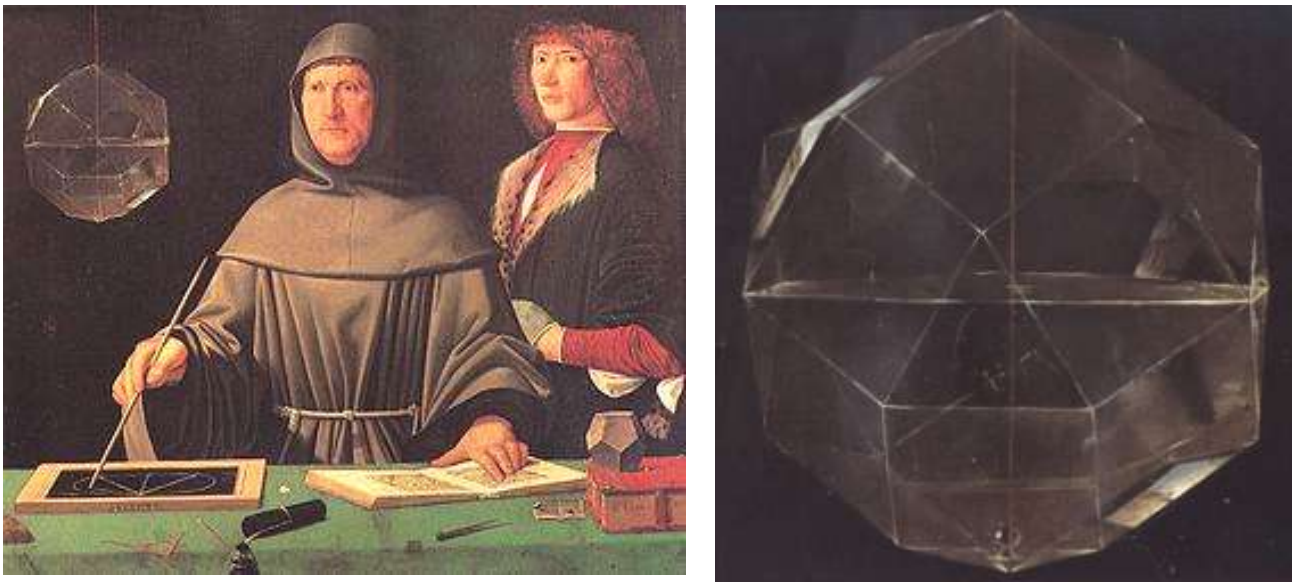
GEOMETRY, NUMBER AND COSMOKRATOR

If you hold up your model of Cosmokrator, as far as its geometry and number are concerned, technically it is a form of cuboctahedron made up of squares and triangles - seven of each – all with sides of equal length enabling them to fit against each other without gaps. As we note later, Seven is a key number in several ways.



Ill. 2- 3: The regular cuboctahedron (left) and 'small' rhombicuboctahedron – from Skinner's Sacred Geometry – contrasted with the Coskokrator model (see also Book 0, Ill.0-2)

Though also related to the 'small' rhombicuboctahedron above middle (also made up of squares and triangles just like the crystalline one suspended in the painting below in the portrait of master geometer, Luca Pacioli) you must already notice that Cosmokrator is not a straightforward Archimedian cuboctahedron with regularly alternating squares and triangles as above left, but an *irregular* version of it (we analyse all the main three-dimensional forms fully in ***Book 5***).



Ill. 2- 4: Portrait of the 15C Italian mathematician Luca Pacioli, friend of the painter Piero della Francesca, with closeup of the suspended so-called 'small' rhombicuboctahedron which he stares at

By twisting its two halves at the 'equator' by one facet, the squares and triangles on your model now meet up in alternating pairs of either triangles or squares – more suitable for demonstrating zodiacal pairs of opposing Signs, whilst the Black –v- White Polar Axis forms the seventh opposition consisting of a square and a rectangle. With its 14 facets it is the ideal geometric volume to embody the zodiac and Polar Axis (our ***Veil of Isis 4)*** and doubled up with its ruling planets marked in the interior of each square or triangle it also represents our ***Veil of Isis 5*** in a nutshell (see later books). In other words, through its properties of Number, Music and Shape, Cosmokrator embodies the Octave, its Semitone range, and even the Shrutis (quartertones), along with their colour equivalents, though in this book we concern ourselves solely with the unfolding of numbers in the regular shapes of flat geometry, with colour put to one side for the time being. Where we noticed the equivalences between Number and Music in the previous book, in this one we can start in reverse to see how geometric shape, too, is formed by – and expresses - musical ratios. Bearing in mind that the level of geometry expressing Cosmic Law is known as Sacred Geometry, it is through music and geometry that the Laws of the Universe are accessible to all (and have not been improved upon by the very difficult theories of modern Physics!).

OVERALL AIM OF THIS BOOK

This is a book about Number, rather than numbers – for people like me for whom mathematics is not their field but want to understand life in its basic principles. So many good books have been written in past decades on Sacred Geometry that it would be pointless to repeat them (much mutual borrowing and repetition goes on between them). What I felt *would* be helpful is to draw up a 'key' to those books by giving a succinct summary of the main steps in the journey of geometry that school children (and grownups too) should all take at some point in their lives. Then if further detail is required the pioneering longer, classic books listed below in chronological order can be turned to – I will often point you to them in our text, and use their images.

The early stages of the book proceed slowly as I lay out foundations that will only 'tell' much later on. I ask for your patience in this, hoping you will not skip the beginning but spend time lingering on the first three of four key steps in geometry. Later the text speeds up because later developments can usually be absorbed in the wink of an eye – in fact these stages are best picked up fast without trying too hard, since the mind operates best in flashes – think of Plato's idea that you are mostly polishing what your higher intellect knows already.

What I see as the canonical books, published mostly from the 1960s onwards, are constantly reprinted even today, and mostly all available in shops and libraries. Later glossy, more derivative books capitalizing on them (usually using exactly the same material) always come over as thin in comparison - but they too have their uses. Given geometry is by nature universal, inevitably there has to be some duplication and borrowing, and while some are more flimsy carbon copies of their originals than others, any worthwhile writer usually adds a new perspective from their own field of expertise or direct personal observation – many simply improve on the illustrations. I make no apologies, then, for using what I have learned from others as my initial foundation, but hope in relation to Cosmokrator that I, too, can contribute new dimensions that others have not looked into.

THE CLASSICS

- Hans Jenny ***Kymatic/Cymatics*** 1967 (quotations are made from the 2001 revised edn combining Vols I & II)
- Archibald H Christie ***Pattern Making*** 1969 (Dover reprint of the original 1910 publication)
- Alexander Thom ***Megalithic Sites in Britain***; ***Megalithic Lunar Observatories*** 1971
- Newsletters and publications of the London ***Research Into Lost Knowledge Organisation (RILKO)*** issued in the last three decades of the 20C - and related essays by the Chairman of the Edinburgh branch, Maryel Gardyne, on her website www.atomandoctave.co.uk.
- Warren Kenton ***Tree of Life: Introduction to the Kabalah*** 1972
- Nader Ardalan and Laleh Bakhtiar ***The Sense of Unity: the Sufi tradition in Persian architecture*** *Foreword by Seyyed Hossein Nasr* 1973
- John Michell ***The View Over Atlantis*** 1969; ***City of Revelation*** 1973
- Frithjof Capra ***The Tao of Physics*** 1975
- Ernest G McClain ***The Pythagorean Plato: Prelude to the Song Itself*** 1978
- Keith Critchlow ***Order in Space*** 1969; ***Islamic Patterns*** 1976 and ***Time Stands Still*** 1979
- Matila Ghyka ***The Geometry of Art and Life*** 1977 (Dover reprint of the original 1946 publication)
- Ernest G McClain ***The Pythagorean Plato: Prelude to the Song Itself*** 1978
- György Doczi ***The Power of Limits*** 1981
- Robert Lawlor ***Sacred Geometry*** 1982
- James Adams ***The Nuptial Number of Plato*** *introduction by Keith Critchlow* 1985
- H-O Peitgen and P H Richter ***The Beauty of Fractals*** 1986
- Anne Macaulay ***The Quest for Apollo (****sequel to* ***Apollo's Lyre): The continued search for the origins of the Cithara and Apollo in Megalithic Britain*** *(unpublished manuscript, some chapters now published in learned journals)* 1989
- John McLeish ***Number: from ancient civilisations to the computer*** 1992
- Keith Critchlow, Robert Lawlor, Anne Macaulay, Kathleen Raine and Arthur G Zajonc ***Rediscovering Sacred Science*** 1994
- Michael S Schneider ***A Beginner's Guide to Constructing the Universe*** 1994
- Miranda Lundy ***Sacred Geometry*** 2000
- Rupert Sheldrake ***The Sense of Being Stared At*** 2003

NOTE ON THE ABBREVIATIONS USED IN PICTURE REFERENCES FOR ANCIENT SEALS OR OTHER ARTEFACTS

Many of my illustrations come from two useful academic seal catalogues which in the captions are referred to by their acronyms:

- Pierre Amiet ***La Glyptique Mesopotamienne Archaïque*** 1984 = ***GMA*** *(one book)*
- Several editors ***Corpus der Minoischen und Mykenischen Siegel*** 1964-2011 = ***CMS*** *(several volumes)*
- Winfried Orthmann ***Der Alte Orient (Propyläen Kunst-Geschichte Vol.XVIII)*** 1975 = ***PKG***

ADDED DIMENSIONS

There are three new approaches I want to weave in to this short guide:

1. It can be used as a manual to build up your own self-awareness. I lay great store by asking you to try out the geometry for yourselves, as it is important to apply it to day-to-day life by looking around you: there is a difference between knowing *about* something and making it your own from direct experience. Because we ourselves are *in* the universe and part of it, 'the split between I and the world is no longer valid', said Frithjof Capra in a talk given at RILKO (more of this body later) in the 1970s. This is especially so for the earliest stages of geometry, not only because it is so easy to do, but also because it does have a profound effect on finessing your awareness of this angle on life – indeed it almost gives you X-ray vision! This means you need to notice geometric relationships for yourselves rather than having them spelt out for you all the time. Once you experience the magic of doing the geometry yourself, verbose explanation is not really needed anyway, so equip yourself with ruler and compass! The books on the previous page can be referred to if you do need more detailed explanations.

   Plato believed geometry's shapes are already known in our souls at birth, and I try to use simple language to make this material as easy for children as for adults to take in. Thus it could be used as a teaching manual for a term's work - whose contents I try not to over-explain or encumber with tedious maths, on the whole leaving the uncluttered lines and shapes to speak for themselves. As with the Music Book, because you are being asked to awaken your own senses and intelligence, your experience of Cosmic Number in the way geometric shapes divide up will become first-hand knowledge, and the more you notice it at work around you, the more fulfilled will your life be, since you relink (*re-ligare*) to the life-enhancing invisible processes constantly going on beneath the surface, rather than holding on to mere theory and remaining untouched – not very useful. Share your experiences (e-mail on last page).

   As part of the process I hope you will collect your own discoveries (articles torn out of newspapers/diary items/your photographs) and store them in a file or scrapbook (electronic or hard copy) or - as it mushrooms with the books you buy - bookcase and filing cabinet! One way of starting this off is to print a copy of this booklet and put it in a ring-binder file with dividers numbered 1-13, or by geometric shape, inserting your own material where appropriate. Referring both to modern quantum theory and the mystical traditions of the Far East, Capra concluded, 'Mystical knowledge can never be obtained just by observation, but only by full participation with one's whole being'.

2. Use the progression from simple to more complex shapes as analogous to the story of the unfolding Creation of the Universe. On this level the booklet can simply be read as a short course in metaphysical geometry which with ***Book 1*** on ***Music*** provides an indispensible foundation for understanding the more complex Cosmokrator books that follow later. In one form or another we all need to know how the world became the way it is and how we fit into it: geometry is one of the clearest languages for

describing the process. Quite apart from providing the infrastructure for great art and architecture, scholars and artists of the Italian Renaissance, like the ancient Greeks, believed the study of geometry has a cleansing effect on intellectual and moral judgment. (I will not cover Gematria, or the numbers and geometries associated with the letters of the Greek and Hebrew alphabet.)

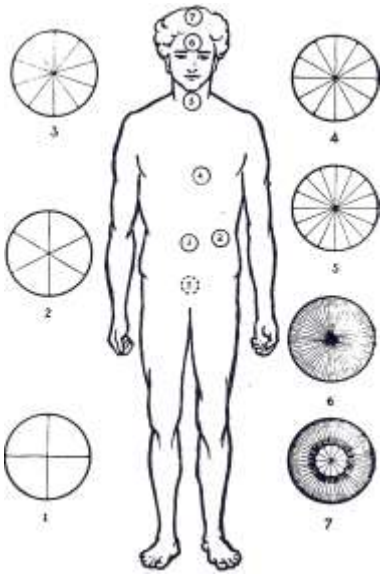
3. As an art historian and archaeologist I will also follow a personal line of enquiry into how old Man's knowledge of geometry might be, and aim to weave new evidence formerly buried in specialist journals or books into the mainstream, adding more ancient examples to the well-worn items from the past used in earlier books. I will be able to show just how much geometry was already known and applied in the arts of the really ancient world, many millennia before Greece or Ancient Egypt (the usual civilisations referred to). As far as I have discovered, schools of geometry date to as far as back as the time Man could draw a line in the sand with a stick, or thought to indicate heaven and earth by circle and square, with those of the Italian Renaissance onwards standing right at the *end* of the line of transmission.

   In an early interlude, I recount from first-hand experience the story of pioneering groups in London that in my lifetime have succeeded in reviving knowledge of Sacred Geometry throughout the English-speaking and Islamic world, to the extent of getting it onto school syllabuses (from kindergarten level to the Sixth Form).

I should expand on these three headings just a little more, so you know what to expect.

1. THE HUMAN INSTRUMENT

Because both music and geometry reveal invisible force fields at work, and our own body is the instrument that picks these up through the senses, psyche, mind and spirit (remember Warren Kenton's map showing how these



1. *Root (4-fold)*
2. *Sex and Movement (6-fold)*
3. *Navel (10-fold)*
4. *Heart (12-fold)*
5. *Throat (16-fold)*
6. *Forehead (normally 2-fold - Ill. 2- 21 gives the more common bilateral division)*
7. *Crown (1000-fold)*

Ill. 2- 5: Positions in the body of the Seven main Chakras

levels interconnect in ***Book 0, Ill 0-23***), I will treat our journey through Geometry as taking these body centres into account. We swim through force-fields at higher dimensions all the time – mostly as unaware of them as a fish might be of the water surrounding it – and we are connected to them via a set of seven connecting 'valves' funnelling into the body, known in the Hindu tradition as 'wheels', or *chakras.* According to those with the sensitivity to see them they have different geometric divisions, like flowers (see also ***Book 0 Ill. 0-16***)! The diagram aove gives a basic idea of their subdivisions and body position, each being attached to a particular point in the body by its own umbilical cord (for more detail see ***Ill. 2- 129***), so they will be introduced where geometrically relevant. In the process you might come to realize that one or two of your own chakras are out of balance within the whole tree, needing attention to either reactivate or - on the contrary - power them down. At this point, I cannot resist quoting here (from a ***RILKO Newsletter*** for Summer 1978, p.9) the conclusions of Andrew Davidson following an overwhelming experience at the Stone Circle of Drumin:

> *Months of painstaking research in collaboration with John Williams and Bill Lewis had already shown that on each stone there were no less than seven points at which a spiral form of energy was mainly concentrated…. As a general rule, three of the seven centres on each stone were below ground with four above and, counting from the bottom upwards, the fifth band or centre produced the strongest reaction. Neither the nature of the energy, nor its source, was immediately apparent, however, and it was only after this rather unnerving experience at Drumin that I realized the celestial origin of the energy and recognized the astrological influence of the sun, moon and planets upon the seven centres, in similar fashion to that traditionally held for the seven chakras in the psychic body of man.*

2. GENESIS: CREATION OF WORLDS AS STAGES IN GEOMETRY

We can gain some understanding of the unfolding of the Universe we inhabit in terms of Geometry. Through both logical thinking and imagination we can see its Genesis as a progression from basic to detailed using only compass and straight edge. There is no need for a ruler as such, since proportional geometry requires no measurements when generated from criss-crossing circles and lines - a hallmark of Sacred Geometry.

Shapes are born out of each other as webs of pattern - or force-fields - establish themselves. George Smoot in his ground-breaking book ***Wrinkles in Time*** (1994) describing his team's discovery of the Big Bang theory conveys the process of law and order spreading through a chaotic Universe at the material level in its earliest, unregulated stages, beautifully describing the conflict between chaos and order (what Plato would call The Same and the Different) that continues to play out at every moment of our lives today:

> *The big bang universe expanded to enormous size, cooling as it grew. At a certain point it was cold enough for symmetry breaking to occur and for the forces to differentiate – to freeze out in countless locations across space. Starting at each of these locations, the symmetry-breaking fanned out across the universe at the speed of light. Inevitably, these ever-expanding regions of broken symmetry collided with each other. And when that happened, each expanding region's broken symmetry did not perfectly match up with the other regions it hit. This had dramatic consequences.*
>
> *The most evocative analogy is that of a pond on a cold day. Different parts of the pond begin crystallizing, and as the ice spreads across the pond different freezing regions encounter other freezing regions. However, one region's crystals rarely link perfectly with those of other regions. And that is why ice in a pond – or in an ice cube for that matter – is crisscrossed with thin white lines which are really fractures marking where the crystals align improperly.*

From this we realise that everywhere *regular patterns underlie passing phases* in an ever-fluctuating process of self-regulation and self-harmonisation which all things in the world attain, lose – and then strive to regain. But all the time it is the pure cosmic blueprints of the invisible world that govern such intermediate unresolved stages, as Smoot characterises so vividly. By making such networks visible through his experiments, Hans

Ill. 2- 6: Sand grains on a steel plate vibrating (from left to right respectively) at 1690; 2500; 4820; and 7800 cycles per second –Jenny 27-30

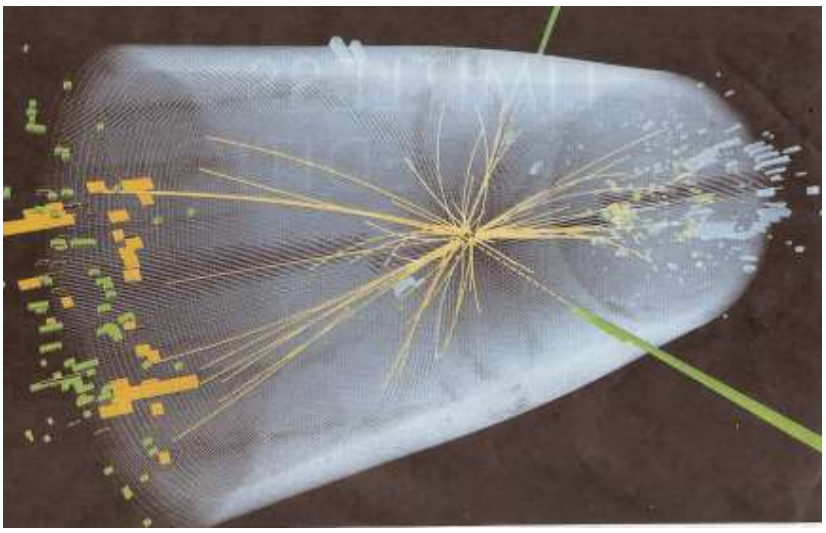
Jenny's work was a landmark in proving that this process must be going on all the time around us at all levels of existence. In the example above, grains of sand make their way to pure geometry as the *kilohertz* wavelength of excitation is increased, each grain of sand travelling along the lines aroused by the sound source.

Discerning those underlying combinations of number and shape as they unfold on the material level gives

Ill. 2- 7: God Creating the World with a pair of Compasses – miniature from Le Bible Moralisée, BN Paris

insights about the initial formation of the physical Universe and of Genesis itself. The latter starts at a higher level of existence, being the process of Spirit erupting into Matter. Our Geometry journey, in exploring the nature of the very first steps of Creation is a superior language for describing the subtle levels of Reality at the Desire and Plan stages that *inevitably precede* manifestation into Matter. God the Divine Principle, like an

architect, must first *want* to build, and needs to have a *plan* in mind before there is a chance of its appearance in material form! As I write this, CERN in Switzerland announces they have pinned down the Higgs-Boson 'God particle', purportedly publishing a picture of it –as much a contradiction in terms as depicting God as a bearded man (at least we know this is simply anthropomorphic symbolism), highlighting the folly of materialist science.



Ill. 2- 8: 'Collision between protons causing a Higgs-Boson particle explosion'– London Metro 5 July 2012

Over the millennia, to explain the physical world around us human kind has used analogies and stories to understand how physical existence did come into being. The thumbnail sketch of its seven main stages given in the ***Book of Genesis*** contrasts with the scientific view that looks at the process in terms of the interaction of ever more complex Elements, their atomic structure and combinations in molecules (considered in ***Books 3*** and ***5***) – each view valid on its own level. Though the astonishing array of shapes and secretions we find in the organic world of plants and animals (considered in ***Books 4*** and ***6***) are examples of non-geometric stages of formation, Plato in his work, ***Timaeus***, explained the underlying fabric of the world around us as founded on Geometry and Number alone, being the stages preceding their final outward 'look'. His approach is neither religious nor scientific in the way we think of religion and science today: it is metaphysical, and its stages so simple that it dovetails easily into the Seven Days of Creation of the ***Book of Genesis***, as well as having points of contact with the inner structures of Atoms as revealed to us by modern Physics ('Atom' is a Greek term, originally used to refer to 'the building blocks of the Universe'). We all know the Hindu parable of a group of people put in a dark room with an elephant in it, all reaching out to touch the part nearest to them. Depending on which part of the elephant they feel, so they report back on what the elephant must be like, with wildly contradictory descriptions but *together* adding up to an accurate overview.

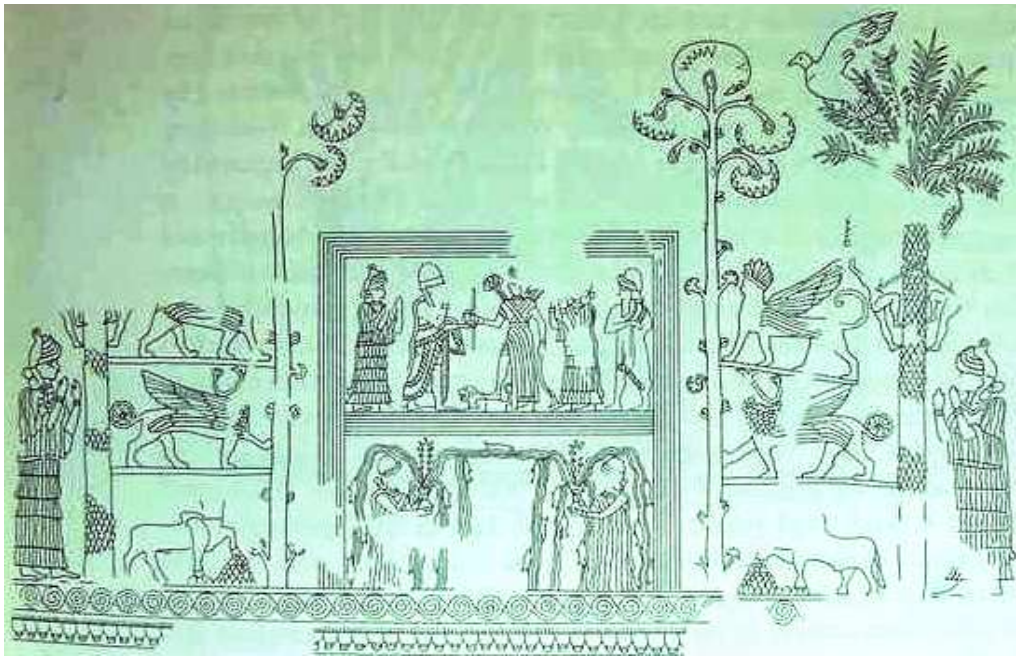
We, too, can use several perspectives to get a handle on where we are - in this book concentrating on the metaphysics of Geometry to explain the Universe. One angle on the Creation of the World does not negate another, and it is a shame when people think modern Physics negates Plato – or the ***Book of Genesis*** for that matter! The Platonic definition of the Ultimate Cause/God as an invisible point with no dimension (see under

One and Oneness) to me is more successful in conveying something of Divine unpindownability. The first few verses of the Book of Genesis at the very start of the Bible describe the Creation of the World in six main stages branching from simple to complex (the seventh stage being a long rest). Here we pause too for a moment to say what we mean by *World* and *Universe*. By *World* we mean Life on Earth and all manifestation on it, including the biosphere, known in the Classical world as Gaia - the sky beyond it as if studding its upper skin. By *Universe,* however, we refer to everything created beyond and including Gaia – the Solar System and all other galaxies, as well as the background against which they move. It boils down to saying that *World* is a human being's view of Creation from their point of view on Earth, whereas *Universe* is a change of perspective to God's view from the Centre, looking out on everything up to its farthest Circumference from down in its deepest Centre. The term *Creation* is limited to the realm of plants and animals - and Gaia's geology and biosphere on which their lives depend - with human beings at its crown.

As a process way beyond human ken, for the average human being the first chapter of ***Genesis*** is sufficient explanation to grasp the general picture of how we got here, and we will place some of its verses against the appropriate geometry where obvious. A child understands the Genesis account in the ***Bible*** as a story, understanding its real implications later in life, and in the same way even a child can straight away count and play with geometry, gaining both conscious and unconscious insights into the nature of the Universe which later in life also pays off in depth of vision.

3. GEOMETRY IN THE PREHISTORIC AND ANCIENT WORLD

We cannot underestimate just how crucial it was for civilisation to gain mastery over geometry. In Mesopotamian art from the Third Millennium onwards the image of Inanna (Venus, the Goddess of Life and



Ill. 2- 9: Ishtar on her lion hands rod and circle to the King in the Investiture Scene from the Palace of Mari

Harmony) handing the king a rod and circle is commonly repeated, as in the top panel (middle block) of the drawing of a 2M fresco above (see also our frontispiece picture). The drawing is a composite of sections of a very damaged wall painting dating back to the early Second Millennium uncovered in the palace of Mari in Syria showing Ishtar (her name now in different language, but she is still Venus) standing on her lioness to present the rod and circle of authority to King Zimrilim, whilst in the panel beneath lesser deities hold vases with streams of life-giving water for the trees. Since she is famed as the Goddess of the *ME* (life measures) to me these two instruments to me must be none other than the compass and straight edge by which these measures are laid out, as in surveying and planning buildings (implying also the authority of the king to lay down the law). They would express the geometry of the cycles of the planets (that of Venus being a pentagon – see ***Book 11***).

The rod and ring are depicted more clearly in the next two images - a 3M cylinder seal design and a stone relief - confirming this as a common ritual. The first again shows Ishtar in her role as Goddess of Geometry handing the rod and circle to the King as he waters a baby palm – both rites conveying his royal authority and power. On the much larger relief, from his horned headdress we know this is the Sun - God of Law, Order and Justice: he is facing the Goddess and himself holds up the rod and circle, precursor of the Scales of Justice. In the same hand he also holds what looks like a looped up surveyor's rope, and again the baby palm features between them, seeming to point to a connection between good measure and a successful agricultural economy.

Ill. 2- 10: 3M Akkadian cylinder seal design and Sumerian relief showing the circle and rod accorded by Venus

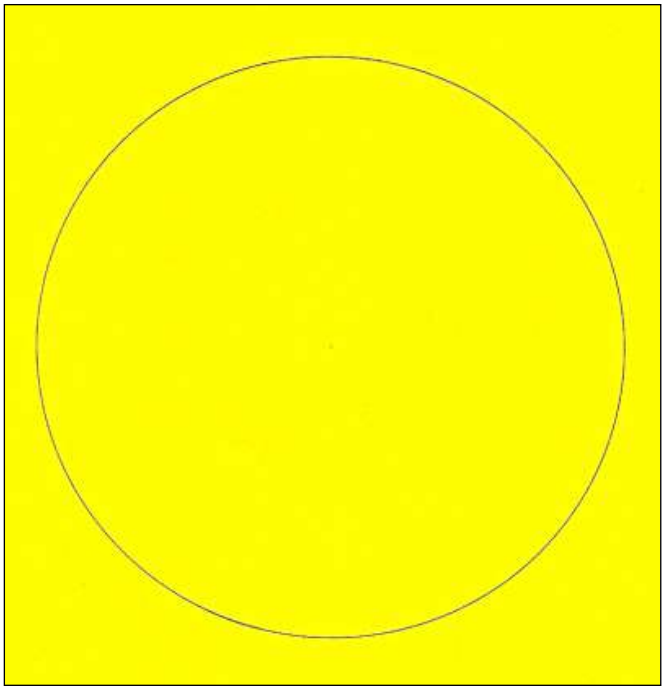
Bearing these three new approaches in mind, we now start our geometry journey in earnest, looking at its basic elements. It starts with an invisible point – nothing to do with the Higgs-Boson particle.

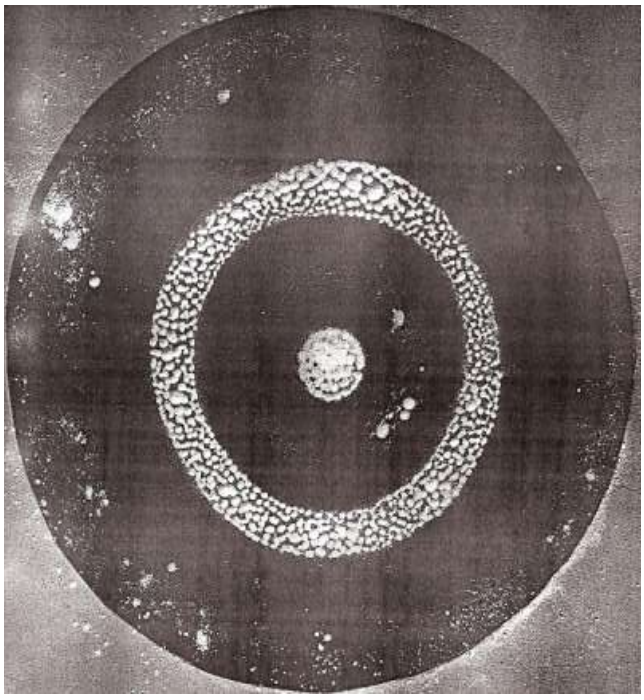
ONE AND ONENESS: IN THE BEGINNING – CIRCLE AND POINT

Neo-Platonic philosophers both past and present say that geometry is innate in the mind, in whose perfection every awakened human soul delights. Whereas Euclid's famous treatise on geometry starts with a *Vesica Piscis* (we come to this after the Circle) Keith Critchlow's book, ***Order in Space*** starts with a dot, a point that has no dimension, yet is the beginning of all things in the midst of nothingness – the Void (drawing below left).

AND THE EARTH WAS WITHOUT FORM, AND VOID - AND DARKNESS WAS ON THE FACE OF THE DEEP: AND THE SPIRIT OF GOD MOVED UPON THE FACE OF THE WATERS [*Genesis 1:2]*

There is also an Islamic wise saying (*Hadith*) where God says of himself, 'I was a hidden secret that wanted to be known'. The circle perfectly expresses the secret of its centre, and when we take a compass and draw a circle from that invisible point, whether its circumference is as tiny as a coin or vast as the sky itself, it has made itself manifest, just as a note sung or the impact of one material on another creates a ripple effect from the point of origin. Try these two things for yourself.





Ill. 2- 11: The centre point of a circle (left) is technically invisible, having no dimension; lycopodium powder on a drum top when connected to the human voice singing 'Oh' (right) falls into a perfect circle – Jenny 67

DRAWING THE CIRCLE

The talent of the Florentine painter Giotto, Vasari tells us, was recognised when as a shepherd boy he was seen drawing freehand a perfect circle on a rock - we lesser mortals need a compass. Without a starting point nothing in the universe can be drawn or - by analogy –be created. That powerful dot is the point where you place the stable arm of your compass, while the arm with pen or pencil screwed in is adjusted in or out. Singing the vowel 'Oh' is the musical equivalent.

Job (38,2:4-7) in imagination took the liberty of speaking as if he was God addressing mankind, reminding them they were not around yet when He first laid out the Cosmos (***Ill. 2- 7***):

> *Where wast thou when I laid the foundations of the earth? Declare, if thou hast understanding. Who hath laid the measures thereof, if thou knowest? Or who hath stretched the line upon it? Whereupon are the foundations thereof fastened? Or who laid the cornerstone thereof, when the morning stars sang together, and all the sons of God shouted for joy?'*

As if answering Job's rhetorical question, Smoot and his Big Bang team of physicists describe the process (at the material level) of an expanding cosmos from an initial starting point in more prosaic terms,: *'10^{-42} seconds (one millionth of a trillionth of a trillionth of a trillionth of a second) after what we believe to be the origin of the universe… it grew from being the tiniest fraction of the size of a proton… to an essentially endless expanse'.* This process occurred *'at an unimaginably high temperature… creating space as it expanded'*.

Lines are extensions of dots; planes are extensions of lines and solids extensions of planes. These progressions are a simplified way of understanding how the universe was very quickly able to pile up into the forms of the material world from radiating spheres. At whatever level, the process of expansion is sufficiently represented by the two-dimensional geometric nets we see drawn in endless combinations, representing constructive principles running throughout the universe according to the governing number or numbers – creating vast force-fields (as in ***Ill. 2- 2***). As ***Isaiah*** (*14,13*) put it, '*The carpenter stretcheth out his rule; he marketh it out with a line; he fitteth it with planes and he marketh it out with the compass',* hence his trade is used as an analogy of God marking out the world and constructing it and his Son Jesus – the incarnation of God on Earth - was a carpenter. Christ likened the Kingdom of Heaven to a mustard seed that sprouts and grows into a vast tree where birds nest. Taking into account all levels of manifestation, we should understand such a movement from centre to periphery as arising in the invisible world of Spirit and branching vertically through Mind and Soul before reaching its horizontal manifestation in the world of the senses where we can see, touch, hear, taste or smell its forms. An intention, emotion or idea radiates in the same way as a water drop generates ripples.

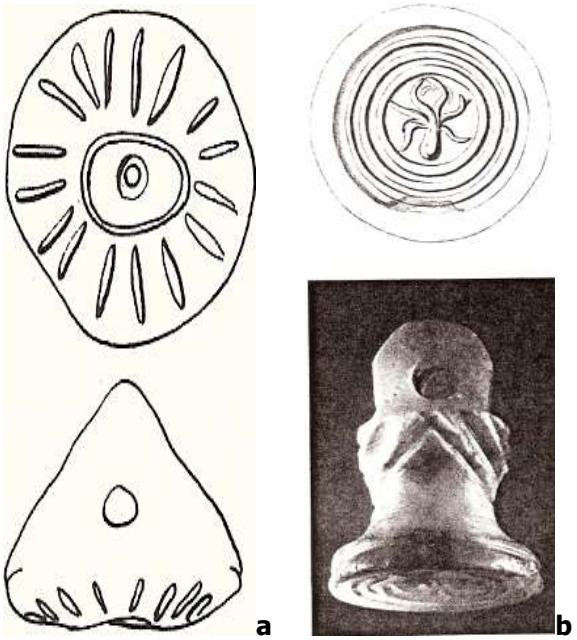
Ill. 2- 12: Circles radiating from a centre point in everyday phenomena: a water drop generates ripples (left) and vibrating wet porcelain clay erupts from its centre yet continuously returns to it from its edges (right)

We experience from drawing a circle how the emergence of a regular circumference around a centre point gives us an image of perfection. No wonder it was used in the Renaissance to express the nature of God, 'Whose

centre is everywhere, and Whose circumference is at the centre' (*Ill. 2- 11*). In the natural world, ripples from a centre point show up everywhere, the radiative nature of the circle already illustrated at the beginning of this book (*Ill. 2- 7*,*Ill. 2- 12* and *Ill. 2- 13*) in plant life as petals radiating from at a centre point at the stalk top, on the same principle as the skull on the top of the spinal column - a human adaptation of the same structure.

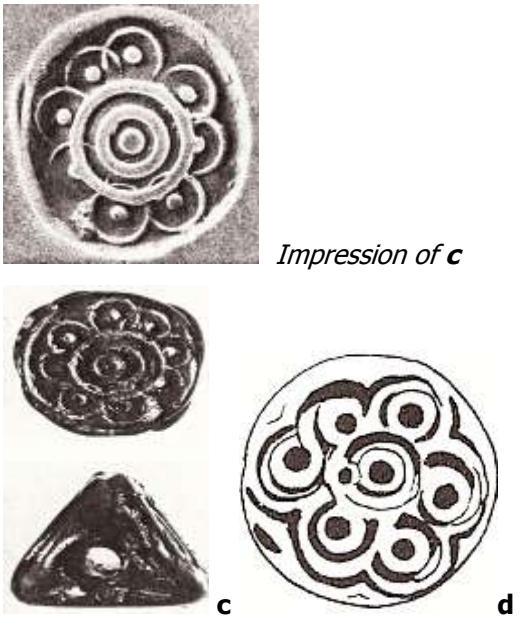
Once manifestation reaches its fullest extent the created form then tries to return to its origins, alive or dead, and interestingly one current theory of physics gives us a model of the universe as a doughnut whose outward circumference turns back on itself towards its hollow centre whilst another version twists it into a 3-D Mobius strip, akin to the two kinds of *ouroboros* where the endings (tail) join up with beginnings (mouth). The return process is seen under way in the two pictures of water and wet clay above, and some Jenny photos even clock the movement of individual grains of sand slowing jumping back to their excitation source. Unsurprisingly, Plato saw the journey round the edge of the circle as the perfect expression of a cycle, and McClain in ***Pythagorean Plato,*** brilliantly analysing Plato's intellectual models and myths in terms of geometry and music, sees the Circle as the Platonic form of The Great Mother of the Universe, exactly as the Taoist sees it (see our frontispiece quotation in green capitals!).

The circle designs below used on Protohistoric stamp seals of the 4-5th millennium BC (before writing was invented), and on Minoan seals two or three millennia later, may sometimes be freehand (**a**) but on some they are geometrically precise (**b**) - proof that seal makers must have had compasses of some kind to be able to draw out such designs (though the designs on Seals **c** & **d** can be explained by the use of tubular drills).



a **b**

*5-4M Protoliterate Iranian stamp seal (Tepe Gawra, GMA 27) and Minoan stamp seal (**b**) from two millennia later(CMS XII,250)*



*Impression of **c***

c **d**

*2M Minoan prism seal CMS Supplement I,108 (**c**, left) and (**d**, far right) 5-4M Tepe Giyan button sealing (the seal that made it does not survive - GMA 93)*

Ill. 2- 13: Radiating circle designs as used on 5-4M Iranian and 2M Minoan seals and sealings from Crete

In the case of ancient Iran, seals were normally used for labelling goods and identifying the official to whom it belonged – as uniquely as the more complex credit card is used to identify an individual today. Whether cosmic allusions were being made as well, we cannot tell.

THE CIRCLE AND PI

This seems the right moment to introduce a key proportion: the relationship between the length of the diameter of a circle to the length all the way round its circumference, a ratio we call π (Pi). This is a useful constant to know since it is more difficult to measure the length of a circle by running round it with a rope than using the ratio to calculate it through knowing its diameter (as in the case of a stone circle, for instance). 21st century excavation at the Orkney site of the Ness of Brodgar have revealed flat stones with geometric carvings on them – including the circle below (c.f. the zig-zags in ***Ill. 2- 31***).

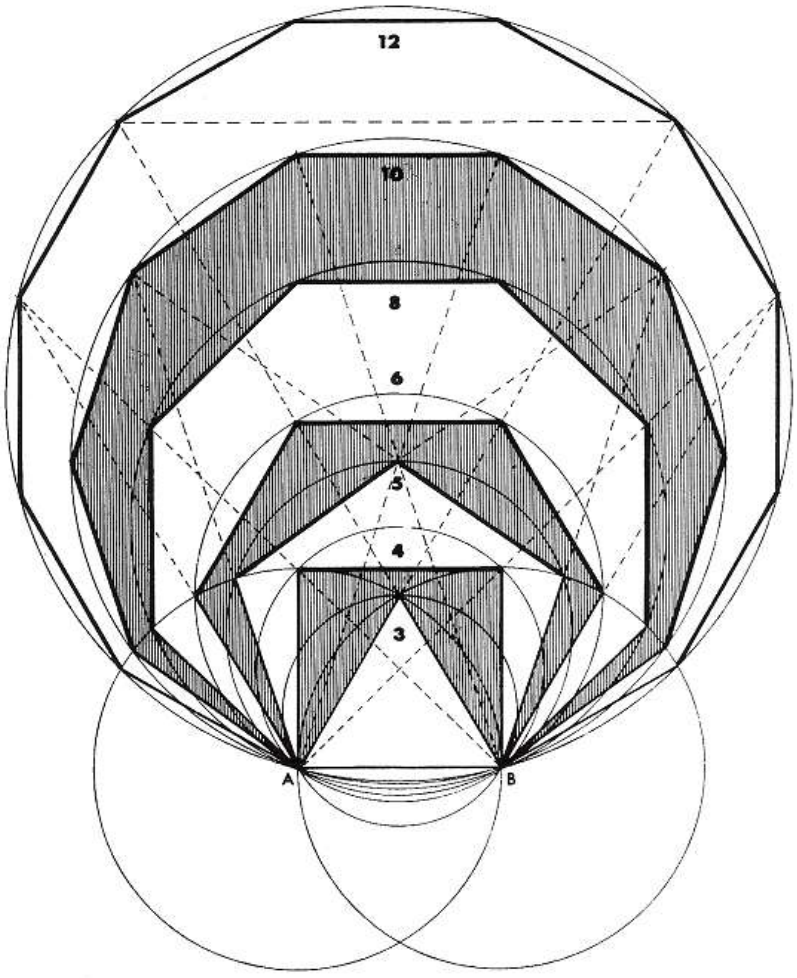
Ill. 2- 14: Carved and painted circle found at the Ness of Brodgar, dating to at least 3,000 BC

Whatever the size of the circle, the diameter:circle ratio remains constant, at 1:3.141592 (roughly 22:7). This is an *irrational* proportion, since its exact value is so irreducible that even if worked out to any number of decimal places (mathematicians have done it as far as a million decimal places) the calculation remains unresolved, and remains so, into infinity!

This irreducibility to whole numbers throws up an interesting matter – that the Universe cannot just be explained by whole number relationships, and the importance of Pi as a binding power of the universe is more mysterious and inexplicable than the mere quantitative number given as its value. In other words, something of the immeasurability of perfection is expressed in this proportion, and like the Golden Section (dealt with near the end of this book) this property of the circle indicates its power to embrace other shapes within its field since it does not 'side' with any one of them, but runs through them all as a common denominator. We will find out that irrational proportions synthesise, whereas regular shapes with sides in whole number ratios particularize from them, at the next level of creation. Ouspensky had an interesting image to show up that vital difference of

level that we tend not to realize is at work. If someone dips their fingertips and thumb-tip in ink and stamps them once on a sheet of white paper, what is left behind are five separate and seemingly unrelated blobs. Someone looking at the sheet of paper later will look at each blob as a separate entity – but once they know how the marks were made, they know that the five blobs are attached to the single arm which held those separate fingers under its single and overriding control.

Such is the Circle (and Vesica Piscis from two crossing Circles) to the polygons. As Keith Critchlow's master diagram below shows, each regular polygon has its own governing circle which can be drawn from their centre, their corners just touching the circumference and as if held in shape by its embrace.



Ill. 2- 15: The generation of all polygons from the Vesica Piscis – from Keith Critchlow, ORDER IN SPACE

What we have here is a visual analogy for striking the note Middle C in the piano experiment, with the resulting overtones this time in geometric form. It is well worth drawing out this diagram for yourself (remember to start with a big-enough sheet of paper (A3 for instance). Consider the possibility of using different colours of pen for each circle and its polygon to make them stand out from each other.

THE TWIN CIRCLE: DUALITY AND DISCONNECTION

When two circles are drawn next to each other as on the Minoan sealing below (at **c)**, rather than expressing continuity in circular movement from a centre, we have disconnection between entities which only touch each other at one point on the circumference, standing separate from each other and more like twins than a parent. The pairing was used on 4-5M Susan seals (top row ***a-b*** below) - and favoured greatly on Minoan seals (**c-f**) two millennia later – again either as pure geometry or underlay for designs of spiders, human faces, owl-heads, cat faces, butterflies, the double shield, women's breasts, octopi - or even histrionically exotic hybrids!

GMA 496

GMA 345

Stamp sealing CMS II,3-46

Stamp sealing CMS XII-174

e: One facet of triangular prismatic stamp seal CMS II,2-124; ***f:*** *Stamp seal CMS II,2-282*

Ill. 2- 16: Examples of the use of twin circles on Elamite (a-b) and 2M Minoan stamp seals and sealings

The twin circles are a pure form of symmetrical bilateralism, an underlying constant in the design and formation of the creatures of the universe which can be seen as the first split from the original circle of Unity - either by duplication or a break into two from within. This dyad expresses the repeating octave, the diapason of two notes in unison - Plato's favourite ratio of 2:1. McClain is certain Plato was aware of the musical ratios on the monochord (see ***Book 1***) and that he favoured the use of 6:8 and 9:12 ratios in stringing of the Lyre (ultimately based on the Sindo[1]-Sumerian-Babylonian harp): this enables the avoidance of fractions and the expression of harmonics in whole numbers.

These ancient seal designs show mankind was using geometry far earlier than usually thought – and we have said that throughout this book we will continually take far leaps back in time where relevant instances arise. So whilst meditating on the nature of the Circle and its circles, this is the moment - given the extremes of ancient and modern strangely meet - to linger and fill in the story of a Geometry movement that erupted only comparatively recently, with international effect. Then we will be in position to make our next geometric move.

[1] I use the word Sind to refer to pre-Hindu western India, as Meluhha known to be a hub of trade interchange with nearby Sumer in the 3M.

HYPERBOREAN GEOMETRY IN BRITAIN IN THE SWINGING SIXTIES AND SEVENTIES

We tend to look back to the Italian Renaissance as the last time Platonic Geometry was looked at and used in the design of great works of painting, sculpture and architecture (our ***Books 10***: ***Great Paintings*** and ***11***: ***Architecture*** consider examples). The geometry revival then stemmed from the commission of scholar Marsilio Ficino by the banker, Cosimo dei Medici, to translate from Greek manuscripts rescued from the Middle East (following the fall of Constantinople, the event marking the final end of the Crusades) the entire Works of Plato - which according to McClain contain at least seven cosmological/mathematical allegories referring, amongst others, to the three kinds of progression listed in our Introduction. The study of geometry by architects and painters was always used as part and parcel of the Classical Tradition rooted in ancient Greece and Rome, so remained comparatively alive in Europe for several centuries beyond the Renaissance - but by the beginning of the 20C the application of pure Pythagorean and Platonic harmonics to the arts was almost non-existent.

Then in Britain from the 1960s, there was an upsurge of interest triggered by extensive probings into the layout of the megalithic monuments of Britain conducted by Alexander Thom, leading some scholars to realise the astonishing fact that Neolithic Man had been using harmonic geometry several millennia *before* Pythagoras! The 1960s and early '70s in Britain turned out to be the decades when cosmic geometry and the geometric method of generating natural proportion were rediscovered by groups of people interested in the original School of Pythagoras, itself now known to stand at the end of a line leading back to a Neolithic tradition - some intermediate points of transmission we can spot here and there in our examples of the ancient near eastern artefacts illustrated in this book. There was a deeper reason modern people enquired into the founding of schools based on this tradition, and this was the alarming rise of secularism and materialism in the aftermath of two World Wars, as the institutions of the past seemed no longer to be able to handle people's spiritual well-being[2]. The outwardly trivial nature of the so-called Hippy Decade of the 'Swinging Sixties' papers over the genuine soul-searching going on amongst serous-minded people seeking alternative spiritual teachings and alarmed by the crescendo of narcissistic and libertine life-styles around them – the Beatles themselves sat at the feet of the Maharishi Mahesh Yogi and popularized Transcendental Meditation (TM).

The ditching of traditional principles on the part of the 'Permissive Society' gave birth to an entire generation of children who (if they opted out of any branch of the Western Tradition of spirituality as defined by Warren Kenton) were not enjoined by their parents to exercise any of the honourable virtues that hold families and society together, and had no criteria to lead their lives by other than doing just what they liked when they felt like it. To Plato such a breakdown in society would be immediately diagnosable from the kind of music it lived by, since implicitly it is an arm of government – see ***Ill. 2- 139***). As parents, these children in turn gave birth from the 1980s to a further generation of relativists with no moral or intellectual cutting edge despite all kinds of

[2] See, for instance, Hugh McLeod ***The Religious Crisis of the 1960s*** Oxford 2007

cleverness and attractiveness – though here and there giving a nod to 'spiritual' activity by sentimental participation in publicised 'do-gooding' deeds for foreign causes but actually basing their own lives on a wasteful consumerist existence, worrying inordinately about glamour and physical appearance and still proud to be seen breaking decent norms (of course there were notable exceptions, but not necessarily on the part of those still keeping to a family religion in an ossified way). It is worth bearing in mind that for all the good aspects of the Italian Renaissance we now celebrate, the historical reality from surface events is that it was just as much an age of political manipulation, crime and war as present times appear to be. The same can be said of the Tudor period in England, eulogised today as a cultural Golden Age, yet masking a cruel and destructive political scene.

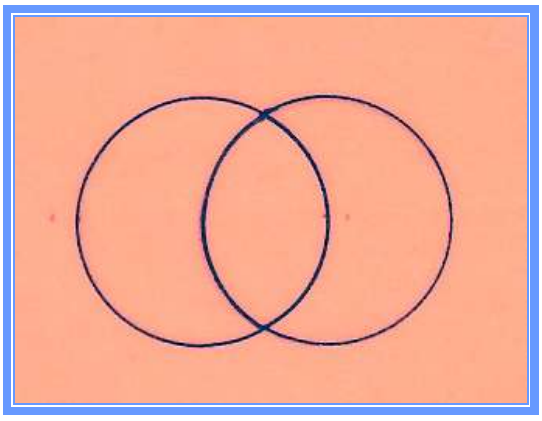
Thus it was in those decades of the Swinging Sixties and Seventies in Britain at the height of the Cold War that spokesmen began to emerge from amongst groups looking into the nature of cosmic Geometry - pre-eminently Keith Critchlow (a practising architect) and free-lance writer John Michell (who was to fight for the retention of cosmic weights and measures that the US was able to hold on to (see ***Book 12***) when on entry into the European Common Market Britain was forced to go metric). Both wrote key books and led workshops, passing on what they knew (much of it centred on Geometry) as fast as they discovered it, drawing on their current research and following up clues in the Bible, Classical writers *and* ancient civilisations. Herodotus, writing in the 5C BC for instance, intriguingly mentions how the early Greeks travelled to Hyperborea (Britain) to visit its 'spherical' temple (?Stonehenge) and learn the lore of their lyre-playing – the very instrument that sums up what Apollonian astronomy and Pythagorean harmonics are all about. Thanks to the uptake of their work by organisations such as the adult *and* even children's schools founded by the School of Economic Science (who in particular fostered Vedic philosophy, meditation and mathematics under direction from a living Shankarāchārya (equivalent of a Hindu Archbishop) in India), these two scholars took geometry into the stratosphere, spewing out showers of compass and ruler wisdom like Catharine wheels - to which the construction of harmonic proportions through the *Vesica Piscis* (***Ill. 2- 17***) was the prime key (our next geometric exercise coming up shortly). They inspired at least two generations of geometers working in many different fields, and their pioneering work in reviving indigenous Druidic and Biblical wisdoms is often referred to in Cosmokrator books.

RILKO

As already mentioned, part of the groundswell behind the general enthusiasm for rediscovering cosmic geometry in the Sixties and Seventies had been triggered by the latest research into Britain's Neolithic stone circles and Ley-Lines, already suspected by antiquarians of previous generations such as John Aubrey and Bligh Bond (of which more in ***Book 11***). In 1969 the Research Into Lost Knowledge Organization (RILKO) with a large amateur membership was formed in London to discuss and further such enquiries since the layout of these ancient temples of the sky seemed to rely on harmonic geometry, a lost knowledge needing to be rediscovered, and both Keith Critchlow and John Michell were co-opted as Council Members and flagbearers for this body, led by two wise women, Janette Jackson and Elizabeth Leader. Aware of widespread general public interest in

preceding pioneering works, RILKO reprinted old titles such as Alfred Watkins' ***The Old Straight Track*** (1925/repr. 1970) and Guy Underwood's ***The Pattern of the Past*** (1969). These were interspersed with further books by John Michell and Keith Critchlow (listed in the Classics book list above) that took on board the independent work of Alexander Thom in his magisterial surveys of the Neolithic monuments of Britain, ***Megalithic Sites in Britain*** (1967) and ***Megalithic Lunar Observatories*** (1971) in which he proved their function as astronomical observatories, laid out using Pythagorean geometries, probably with regularly knotted ropes and gnomons to provide the correct intervals. Of course it is an anachronism to call them Pythagorean: what we should say is that it was the periodicity of the planets (especially of Sun, Moon and Venus) clocked by the stone circles that gave rise to the harmonic proportions used in laying out the circle of stone obelisks at sighting angles to planetary risings and settings – to which Pythagoras was but one (very late) heir. It would be more fitting to call this system of cosmic geometry Hyperborean, or Druidic Geometry (with Herodotos' statement in mind, the main heading of this section dubs it Hyperborean, a more inclusive title given the Neolithic Scots - possibly the Picts - also played a leading part in erecting some of the oldest monuments in the Orkneys). The work of these three authors in particular served to relink Britain to its own deepest roots, whilst Anne Macaulay emerged on the scene a few years later, homing in on the Orkney Island monuments, their layout, and analyzing the full geometric and musical implications of Apollo's Lyre by picking up on the implications of the myth of the journey of Apollo from his home island of Delos to Hyperborea during the Winter months.

Keith Critchlow was teaching design courses at the Architectural Association in Bloomsbury, central London (sometimes also at the Royal College of Art in Kensington) where, initially inspired by Buckminster Fuller's geodesic domes, the harmonic geometric principles of architecture were his theme. In his first book, ***Order in Space***, (1969) he systematically explored the principles of Euclidian geometry *whose first proposition is the Vesica Piscis* (drawn below) leading toy three-dimensional developments in the Platonic and Archimedean solids that provide the most harmonically interlocking shapes for molecules and architecture. The book had been tested as course material for his classes since 1965, and was an essential preliminary exercise in Critchlow's development, but showed clearly that he had not yet made contact with the Neolithic world and its puzzles as



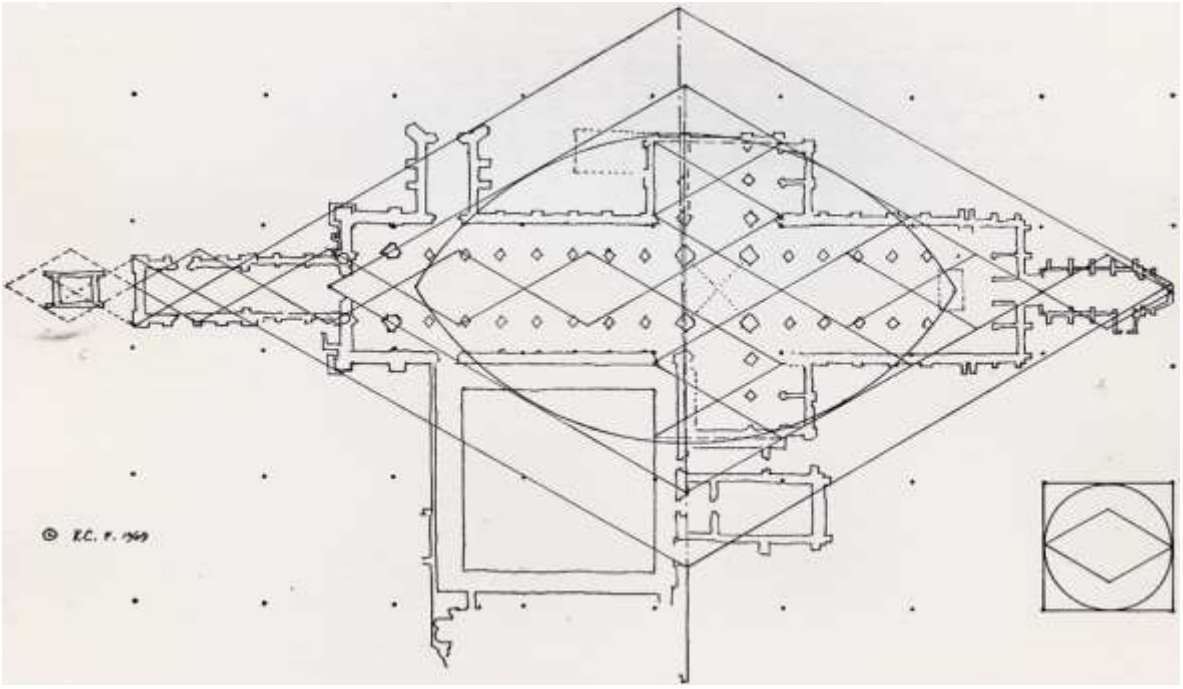
Ill. 2- 17: The Vesica Piscis, formed by two circles crossing each other's centres

revealed by Thom – but this happened soon after. At the turn of the Seventies, soon after ***Order in Space*** came out, I found myself participating in weekend workshops with Keith Critchlow and, along with my friends at the School of Economic Science who were also so inclined, reading voraciously the related books published by RILKO as they came out - most of which, together with the others I have listed, were to form, you could say, the canonical literature of the Geometry revival born out of a specific ancient-world context. Thus I can write in this book from personal experience about those individuals in Britain who in one way or another used RILKO as a clearing bank that linked them together in new research and coining new cultural attitudes that rippled outwards into British society - and in the end, much further afield. Ultimately the reason for its success is down to the benign and enthusiastic way the two women who ran it kept their finger on the pulse of all kinds of extraordinary new work whose existence was publicised in the RILKO Newsletters every year, generating a network of spiritual and intellectual connective tissue which in time stretched as far west as the United States and as far east as Iran. If I were to choose one document as evidence of the change of consciousness that took place in the Sixties and Seventies amongst decent, anonymous people, and thrusting, active students, then it must be an archive set of RILKO Newsletters which its devoted membership read and whose organized events and lectures educated young and old – here I emphasise that my view of RILKO covers its pioneering phase up to the resignation of Janette Jackson in 1980 due to old age – its continuing development under new leadership is another story in itself - for at the heart of the change of consciousness during the 'Swinging Sixties and Seventies' was the pursuit of Sacred Geometry.

When Critchlow was coopted by RILKO as one of their star scholars and regular lecturers he was immediately commissioned to look into both Stonehenge and the overall layout of the ground plan of Glastonbury Abbey, to confirm the findings of his predecessors. Here was the more serious undertow to the general hippy movement making its way to Wiltshire on the trail of the High History of the Holy Grail and its annual New Age pop concert mudbath, because of its link not only to King Arthur, but also to the story that Christianity in Britain began here, brought over by Joseph (the Tinman) of Arimathea soon after Christ's death - five hundred years in fact before St Augustine was sent from Rome to Canterbury!. Not only that: its Glastonbury Zodiac place-names seemed to be evidence of links to 3M Sumer, which Sir William Marston, an enthusiast of Biblical archaeology, had picked up on after visits to sites under excavation in Palestine and Iraq, such as Gezer, Lachish, Jericho and Kish (Janette Jackson was in possession of several key private papers involving this enlightened businessman). It was he who had put up the money for Bligh Bond to excavate Glastonbury Abbey, stating that it was as important to excavate Glastonbury as it was to dig in Jerusalem (he met Kathleen Kenyon there, and many of the British archaeologists digging under the auspices of the Palestine Exploration Fund).

Critchlow picked up on Bligh Bond's assertions about the centrality of the *Vesica Piscis* in the ground plan of Glastonbury Abbey as given in Bond's books ***Gate of Remembrance*** and ***Gematria*** (in his time the latter's findings were discredited – hence the need to go over his findings anew). Bligh's conclusion was the starting point for Critchlow's own findings published in two booklets commissioned by RILKO with other contributions by

John Michell, Elizabeth Leader, Janette Jackson and other distinguished members of RILKO: ***Glastonbury, A Study in Patterns*** (1969, reprinted several times) and ***Britain: A Study in Patterns*** (1971) whose content we home in on in detail in ***Book 11*** on ***Architecture***. Suffice it here to note that Critchlow ended by entirely endorsing Bligh Bond's assertion that there must have been a lady chapel with curved apse off the east end of Glastonbury Abbey, and that its entire ground plan would have been regulated by one grand *Vesica Piscis* dominating a network of smaller ones to define the bays (see his drawing below). In both the Abbey and separately in St Mary's Chapel he described the Vesica Piscis as 'consciously and deliberately used as a canonical scheme' that would have alluded to the hidden presence of the Virgin Mary. He found further support from Cesariano's commentary on a Renaissance translation of Vitruvius which set out three rules for the design of churches, the first of which 'fixed the overall length and breadth by means of the Vesica Piscis'.



Ill. 2- 18: The regulation of Glastonbury Abbey's ground plan by a major Vesica Piscis with auxiliary features established through others of a smaller scale – from Keith Critchlow in GLASTONBURY: A STUDY IN PATTERNS

In the second RILKO book Critchlow proceeded to show how the Vesica Piscis could also be seen to underlie the ground plan of Stonehenge too. Under RILKO sponsorship Critchlow also made new discoveries about the 3M granite stone balls of Neolithic Scotland - touched on in the introduction to the Cosmokrator website and in ***Book 0*** **.** Ignored by curators for decades, Critchlow in his next book, ***Time Stands Still*** (1979, Foreword by Seyyed Hossein Nasr), argued that these were sophisticated, spherical versions not only of the Platonic solids, but also of many other more complex solids. It was these, along with the rising tide of evidence initiated by Alexander Thom's work that enabled Critchlow to fully back up the assertion that knowledge of sacred geometry could tangibly be traced back in Scotland to at least 5000 BC and that today we were but pygmies of a dark age groping to rediscover this ancient knowledge whose principles even then was applied to many different levels,

well summed up in the lyre-playing of the Druids - where string lengths correspond to the planetary intervals of the octave, of course. Any geometry we had learned at school had been divorced from the significant movements and inner structures of the universe, but now as Keith Critchlow in his books and lectures publicly synthesized his early modernist background with all this new enquiry that was in the air, the body of the RILKO membership now saw the subject in a totally new light, from a standpoint where, paradoxically, modern movements and ancient worlds looked at, recognized, and fell in love with each other.

Initially inspired by an old 19C book reproducing Islamic geometric patterns recently reprinted by Dover (who did a great service in this direction for many such books recently out of copyright) Keith Critchlow went on to explore the world of Islamic art and in 1976 compiled his book ***Islamic Patterns*** to coincide with a Festival of Islam held at several London museums and galleries. Here he exhaustively explored the geometric grids used by the great (and usually anonymous, though we know Omar Khayyam was one of them) masters of Islamic art on mosque tiles, woodwork, metalwork and carpets, getting to the bottom of how they were constructed from the main seed shapes. Through other contributors to the Festival he became aware of authors inspired by the spiritual master of the Perennial Philosophy, Frithjof Schuon, especially those who wrote about art, geometry and science in cosmological and metaphysical terms such as Titus Burckhardt, Ananda Coomaraswamy and the Persians Seyyed Hosein Nasr, Laleh Bakhtiar and Nader Ardalan (the latter architect husband and wife team wrote a book on the traditional geometry used in Isfahan).

20C Western society thrives on rebellion from tradition, and has its own prophets who strive zealously to prove the material world is its own cause; that there are no spiritual dimensions to life; and that all people are exactly equal with no-one deserving of special respect due to superior spiritual and intellectual development. Geometry, in contrast, reveals the inevitability of a system of order and subordination of parts to the whole for the greater harmonic Good. Sometimes it appears there are no more rules to break and ugly developments in human behavior have almost forced society to accept them as inevitable aspects of our 'culture'. Plato, inspired by the personal contact we know he had with certain Persian Magi of the Zoroastrian world, believed society works best when run by an élite group of its most just and good men – surely self-evident? Yet in our times right-minded people are in the unreal position of needing to fight for norms silently adhered to still by the shocked, silent majority watching them being pulled down, and are greatly aided by looking back to ancient precedent. Geometry rejects the misshapen since it cannot fit into a pattern – and one saving grace of living in a time of the profanation of the Sacred (seeing all things as material, coupled with blindness to invisible cosmic principle) is that what used to be secret knowledge is now available to anyone seeking it out.

Both Critchlow and John Michell (having published *his* second book, ***City of Revelation*****)** eventually left RILKO: they had become suns at the centre of their own solar systems, now operating independently in their own extensive fields of influence without being bound by the financial stringencies and at times tedious bureaucracy of a voluntary organization, grateful though they were for that initial support that helped them bring the

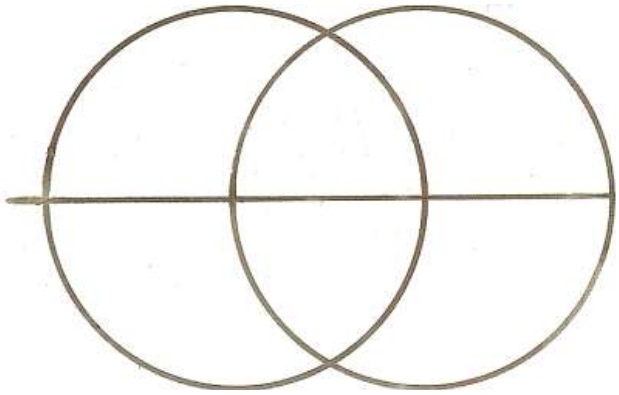
genuine Hyperborean tradition back to life. From the 1980s onwards Critchlow participated in high-profile summer schools in the US at the Lindisfarne Foundation and then formed his own organisation, Kairos, with Kathleen Raine and others, generating huge followings from the younger generation who continue to build on the foundations established in these two schools. By now Critchlow was a Magus-like figure with an astonishing grasp of the interrelationship between geometry and the other subjects of the Humanities, ultimately moving on to teach the subject at the Prince of Wales's Institute of Architecture in 1991 where many Arab and Persian students were shown ways to link back to their own heritage, just as we had in Britain through the megaliths. Through his association with the Heir to the throne himself the intellectual and spiritual influence of 'the RILKO Network has now seeped right through to the top of the pyramid.

As far as geometry is concerned, Critchlow shared the full complexity of his findings with everyone he could reach, and, intertwined with our new themes we propose to introduce, different aspects of his extraordinary achievement will crop up as appropriate in our different Cosmokrator books. In those two decades of the '60s and '70s, RILKO criss-crossed with other visionaries dealing with the mysticism of modern physics, the organic movement, folk traditions of Britain and many other New Age topics we take for granted today. It interfaced with spiritual renewal groups and their spokesmen seeking true foundations within Christianity, Islam, Kabbalah and the sky religions of the ancient world, where they overlapped in the common ground of The Perennial Philosophy (*Religio Perennis*) championed by Frithjof Schuon, T S Eliot, Réne Guénon, Seyyed Hossein Nasr, Titus Burckhardt, Martin Lings - and their many followers who took up positions in high and low places in public life to invisibly channel Spirit into the world. Without the gentle nurturing provided at the top by those two remarkable women, Janette Jackson and Elizabeth Leader, this phenomenon would not have happened. If one reads the RILKO Newsletters from the 1980s onwards, praiseworthy work continued and many new stars appeared on their stage, but it was in those two key decades that the real alchemical Work was accomplished, empowering many messengers to run off on their individual tangents to complete their particular mission in life. Relevant for this book on Geometry is that Keith Critchlow in particular stands out as RILKO's main prophet: he renewed the Islamic tradition of pattern webs; Hyperborean geometry as practiced in ancient Britain; and in revealing the Neo-Platonic inner dimensions of Glastonbury and Stonehenge gave an anchor to the Swinging Sixties and Seventies as pilgrims there idealistically embraced the myth of Arthur, the Knights of the Round Table and embarked on their own Quest for the Grail (in far less melodramatic mode than ***The Da Vinci Code***).

We simply follow the approach Critchlow takes in his books by starting our geometry journey from the simple and obvious and moving on to ever-increasing complexity through a process counting on to the higher numbers up to 13 – an approach also used by his leading students (notably Robert Lawlor and Michael Schneider) in their own books, having themselves become teachers, architects and designers. Having drawn our first circle, looked at the double circle - and considered Britain's ancient and modern schools of geometry – we have filled in enough background now to sufficiently understand the Vesica Piscis as generator of the essential geometric shapes underpinning life and can get back to the drawing board in real understanding of what we are doing.

THE VESICA PISCIS: TWO, FERTILITY OF THE CROSSOVER

Draw a circle and, with the compass radius unchanged now place the compass point on that circle's circumference, and draw another circle (it is sometimes easier to first draw in the horizontal line linking the two



Ill. 2- 19: The Vesica Piscis (VP), womb of geometry

centres). You notice that the circumference of the new circle running exactly through the centre of the first, creates a zone common to both – this is the womb shape known as the *Vesica Piscis*, since in essence it is fish-shaped. The line linking the two centres brings the first dimension into being, being a line of force. I like to think of it as standing for the perfect priest and priestesshood, of the creative and balanced cooperation between man and woman and all it can generate. True couples work together as one operating unit, independent, but with common work to do. This is quite different from the dissociated dyad of circles in ***Ill. 2- 16***, each of which keeps a separate identity and unable to produce further shapes.

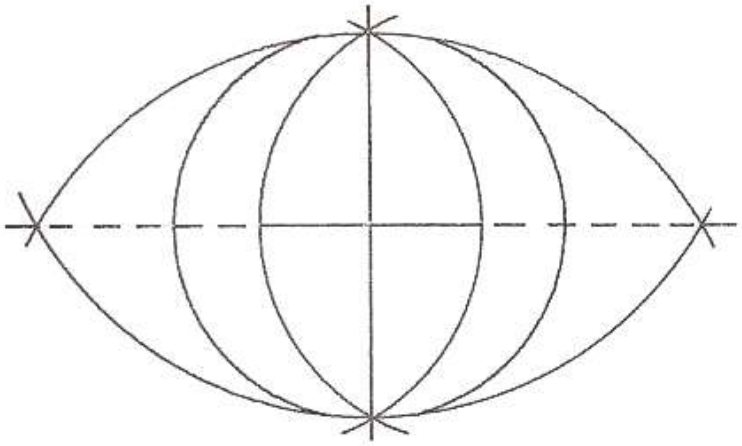
It did not take long for Critchlow to confirm from the older books reprinted by RILKO that the *Vesica Piscis* was treated with reverence. The geometric knowledge of the Masons indicate that it was known by architects and builders from time immemorial, since evidence of their knowledge remains in the very structure of buildings they have left behind based on that simple geometric construction. Earlier writers such as William Stirling spoke of the 'power of the *Vesica'* in his study, ***The Canon*** (published in 1897 and reprinted by RILKO in 1974) his attempt from Biblical and Classical sources to describe the cosmic harmony of shape from large to small. He wrote, 'It is known both to Freemasons and to architects that the mystical figure called the *Vesica Piscis*, so popular in the Middle Ages and generally placed as the First Principle of Euclid, was a symbol applied by the masons in planning their Temples'. He also pointed out how Dürer the German painter, Serlio the Italian architect 'and others of their times depicted the *Vesica* in their works', but that because of its presumed Masonic mystique did not explain it. He noted that Thomas Kerridge, the principal librarian at Cambridge University in the Regency Period, 'lectured on the *Vesica* to the Society of Antiquaries in 1820, but refused to be drawn into discussion as to its significance'. Other English gentlemen such as a Dr Oliver wrote, 'This mysterious figure, the *Vesica Piscis*, possessed an unbounded influence on the details of sacred architecture, and constituted the great and enduring secret of our ancient brethren' since clearly the proportions of height, length and breadth of

religious buildings were regulated by it. Stirling also quoted a Mr Clarkson who was of the opinion that the *Vesica* was 'known to Plato and his masters at the Egyptian colleges' and was to the ancient builders 'an archetype of ideal beauty'. But he also noted Mullinger's observation in ***Archaeologica*** that 'the *Vesica* was also held in some quarters to have the baneful influence of 'the Evil Eye' and that 'the charm most often used to avert the dreadful effects of its fascination was the Phallos'. Certainly its potency lies not only in its resemblance to an eye, but when seen from above it has the same shape as either open vagina or throat. Thus in many guises overall the *Vesica* represented the precedence of the generative power of the (all-seeing) female at all levels – by implication experienced as both benevolent *and* dangerous, a mystery not to be divulged in detail.

We based our introductory book (***Book 0***) on instances of polarity and opposites as a simple way of relating it to the pairs of opposing Signs and complementary colours on the Cosmokrator model. The separation of positive and negative poles out of an initial state of equilibrium (=), represented by a line, is the initial movement made at the beginning of the universe. According to Hindu thinking, that move creates the first line of energy from the Centre at the beginning of all things. All lines are energy: all points fixed until they, too, become lines (***Ill. 2- 8***).

IN THE BEGINNING GOD CREATED THE HEAVEN AND THE EARTH [*Genesis 1,1]:* ***AND GOD DIVIDED THE LIGHT FROM THE DARKNESS [****Genesis 1,4]:* ***: AND THE EVENING AND THE MORNING WERE THE FIRST DAY [****Genesis 1,5]***

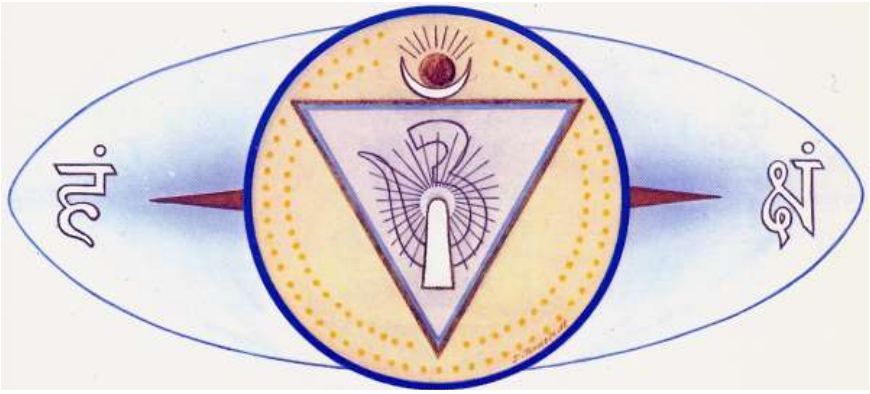
Within the *Vesica* another line can be drawn joining the circle crossing points above and below, the double arch expressing the reconciliation of opposition and complementarity of zenith and nadir – this is the nature of Two as Polarity, productive in its tension. Draw in this crossing line on your own *Vesica*, then adjust the radius of your compass to insert the circle that fits inside it, as below (it, in turn, has an internal *Vesica*, and so on into Infinity. We have just mentioned attitudes towards the *Vesica* as both Womb and Eye of the Universe, which is how this stage of the drawing looks, a construction that could signal someone's universalist philosopy.



Ill. 2- 20: The four quarters of the Vesica Piscis, perhaps usable as a badge design for the follower of the Perennial Tradition – drawing by Josephine Munthali (compare with Ill. 2- 18)

With the inclusion of the circle and inner Vesica the figure exactly resembles the all-seeing eye of consciousness of the brow chakra illustrated below, which in the realm of the soul is said by clairvoyants to have this bilateral

shape, linked by its own umbilical cord to the pineal gland suspended from the centre of the brain. Sometimes known as the Third Eye, it is the gate to the Higher Intellect that sees the whole Universe from top to bottom as One. In this illustration[3], *OM* is written in the triangle with Sun and Moon above its letter, signifying the union of objective knowledge and subjective experience of the Universe, much as a bee drowning in flower nectar still retains its individuality (a favourite idea in Classical Hindu songs). On either side are the sounds HMM and KSHM - suitably bee-like? As if a bee, try singing these three syllables – really hum, and feel their power.



Ill. 2- 21: The two-petalled brow chakra named Ājnā in the Vedic system of philosophy

In design terms we should stop and spend time on the implications of this first act of creating the *Vesica Piscis*, since its powerful metaphysical implications remain implicit in any design using it. For a start, as Schneider nicely pointed out, all bilateral compositions are based on the paradigm of a central shield area flanked by supporters in heraldic fashion on either side, used in Egypt and Mesopotamian art over at least three millennia. This means the Scarab, any heraldic Coat of Arms, or any other figure inside the central axis in the zone of the *Vesica Piscis (VP*) in some way represents the Axis of the World in different belief systems. Ultimately derived from the Ancient Near East thanks to the exposure of Europeans to the region at the time of the Crusades, the *Vesica Piscis* became the basis of the science of mediaeval heraldry on coats of arms and badges in

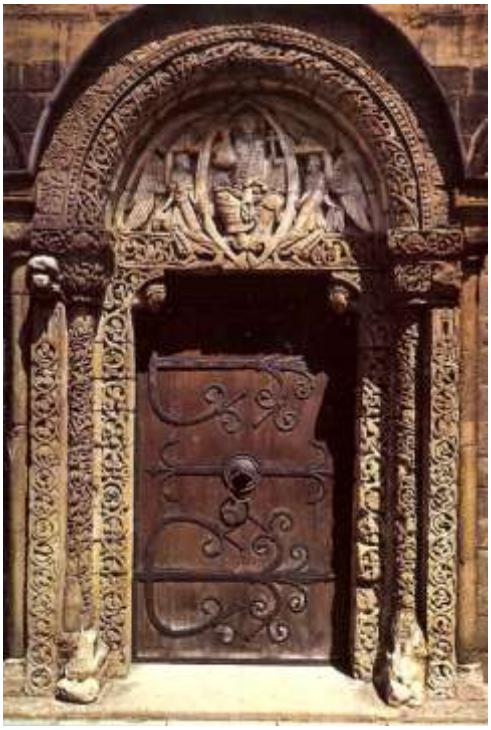
a **b** **c**

Ill. 2- 22: The underlying Vesica Piscis in the bilateral design of an Egyptian pendant formed of a scarab flanked by Isis and Nephthys (b) – and on the British coat of arms (c) – from Schneider. But the earliest examples go back to 5-3M Mesopotamian art: (a) shows a section of Dudu's plaque from Tello, Iraq

[3] All the painted chakra portraits are taken with thanks from S S Goswami ***Layayoga*** 1980

the Age of Chivalry. It is quite possible that some knights and their clerks saw original 3M examples of Mesopotamian design (**a** above) whilst in the Holy Land and lands beyond. There is no doubt that both Islamic and Gothic Art took up the baton of very ancient geometric traditions, applying them in a flowering of mosque and cathedral building in the Mediaeval period. In Britain it is amazing anything of it is left at all, following the dissolution of the monasteries by Henry VIII and the further iconoclastic depredations of Oliver Cromwell.

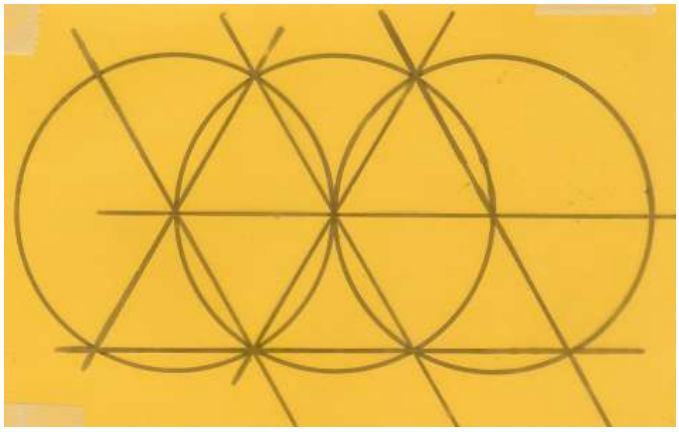
In the example of the Romanesque Tympanum at Ely below, the common use of the *Vesica Piscis* as the sacred space (*mandorla*) in which Christ or the Virgin Mary are framed is shown in the door tympanum at Ely cathedral, and even in its own right was crafted into a metal framework to secure the Glastonbury Holy Well lid - water being the Element of the Virgin.



Ill. 2- 23: Christ in Glory over the Prior's Door covered in metal tracery, Ely Cathedral (left); and the Chalice Well cover with metal tracery at the foot of Glastonbury Tor (right)

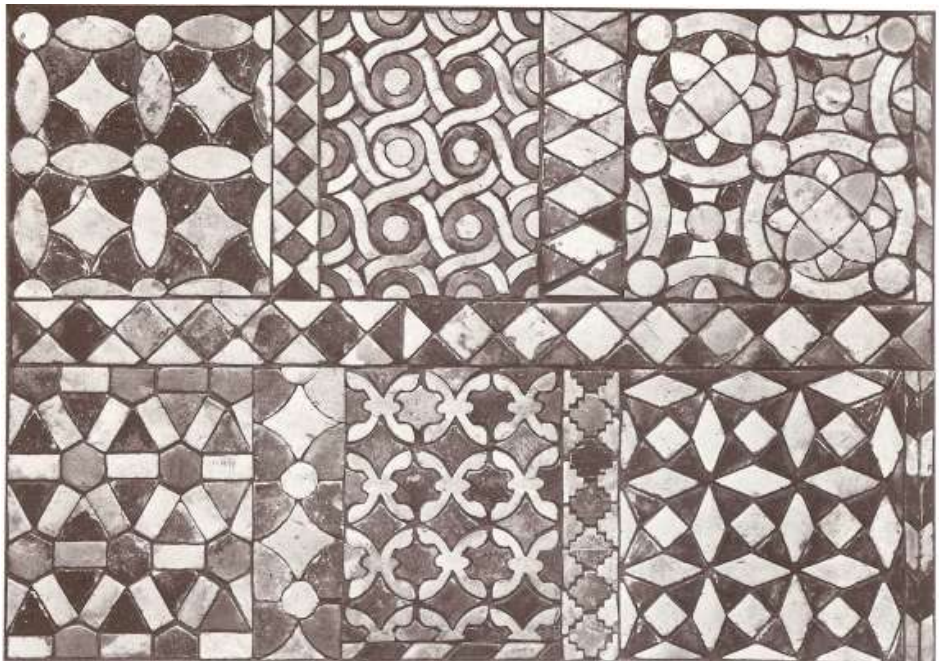
Sacred Geometry serves to communicate facets of a higher, intangible Reality, and the precedence of Point, Circle, and *Vesica Piscis* in relation to succeeding shapes relate to the prime level of Creation, and it provided the metaphysical rationale behind the use of the pointed arch in church and mosque architecture (see ***Book 11***). At times, as at Glastonbury Abbey, the canonical use of the Vesica consciously relies on the hidden presence of the womb of the Great Mother of the Universe as the governing outline embracing its smaller divisions, adding up to the miniature construction of Heaven on Earth that any true cathedral represents. We might see the connection of crossing points by the lines *from which all other geometrical shapes naturally develop* as generative acts of the Father Principle. From such potent, but simple, moves is generated the treasure trove of hidden geometry used in so many ways in world art, mirroring the process of Creation. However complex a

polygon or pattern might become, the originating Centre, Circles, Vesicae and Baseline always lie beneath, just as the Sun does not go away behind clouds on a rainy day – or God beneath the Creation.



Ill. 2- 24: Repeating circles and Vesicae connected by lines at their crossing points

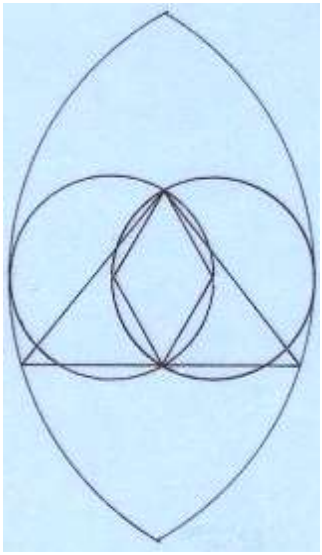
In our initial *Vesica*, we linked the two circle centres with such a directional impulse, or line. Looked at another way, there is bound to be a consequence to the tension between the two circle centres acting as poles: Gurdjieff and his pupil, Ouspenksy, called the equalizing balance in the reconciliation of both ends the 'Third Force' (=) which is neither passive (-) nor active (+). A good analogy for the phenomenon is electricity where, by connecting positive and negative poles a current results. This is the Third Force at work – a power not to be overlooked, because it explains the fertility of the coming together of the two circles of the *Vesica Piscis* in enabling the birth of new shapes, which can be seen already emerging in the drawing above. So throughout this book we are looking at how the Law of Three works, and below is a real life example which could well be a



Ill. 2- 25: 13C Section of Mosaic floor from Rievaulx Abbey (like Glastonbury Abbey, torn down at the time of the dissolution of the monasteries by Henry VIII) – now in the British Museum

collection of class exercises by the monks of Rievaulx, made into a tile pieces. In ***Book 1*** on ***Music*** we studied the ratio 1:2 through octave intervals between the note C, whose sounding diapason has harmonic side effects that could be called resonances of the Third Force (by the positive act (+) of striking the dormant key or string (-), sounds result (=)).Ouspensky showed how events like this could not happen without the polarity of + and – bringing about a result (=).At the same time, nothing can happen without the need to strike the piano key in the first place, the *need* also being the Third Force (=).

Looking back to ancient geometry, John Michell noticed how at the very heart of the Great Pyramid a three-dimensional Vesica Piscis can be picked out – precisely the zone of the King's and Queen's Chambers:



Ill. 2- 26: The Vesica Piscis at the heart of the Great Pyramid (c.2500 BC, contemporary with Stonehenge) – drawing by Josephine Munthali (the Great Pyramid features with the Queen's face on the British £50 note)

Amongst the buildings on the isthmus between the Ring of Brodgar (a perfect circle) and Stenness/Maes Howe dating to at least 3000BC, the most recent level revealed the thick stone walls of a temple predating Egypt's pyramids that had two standing stones either side of a doorway leading into a square space, the purpose of whose astronomical orientation is yet to be worked out (see ***Book 11*** and ***Ill. 2- 14***/***Ill. 2- 31***). It would have been topped by the corbelled stone tiles found all over the site - *forming a pyramid*.

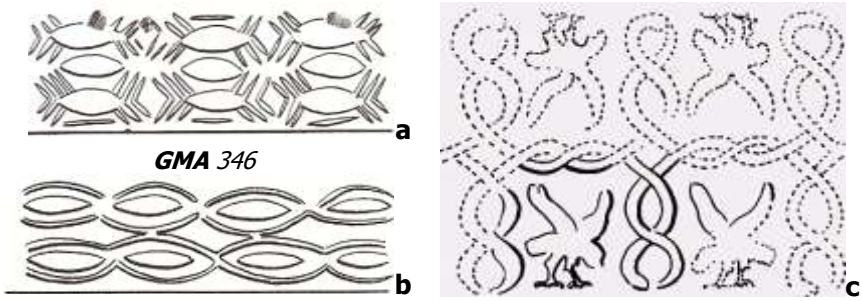
As on the Glastonbury well cover, Minoan seal designers (on seals usually no larger than 1cm wide) often used the *Vesica Piscis* as itself (the ivory seals, usually found in the great warrior tholos tombs, are the oldest):

a **b**

Amygdaloid carnelian seal and sealing, ***CMS IV****-301* *Ivory stamp seal* ***CMS II,1****-245*

Ill. 2- 27: 2M Minoan seals or sealings using the Vesica Piscis

Chains of repeating *Vesicae Piscis* account, I believe for the rows of eyes, fish, leaves or even the entwined serpents so common on the earliest seals, knife handles and palettes of 4-3M Susa and Egypt.



***GMA** 346* ***GMA** 348* ***GMA** pl.13bis, K*

Ill. 2- 28: A chain of Vesicae Piscis (VPs) may have provided the infrastructure for these motifs on 5-4M seals

From the examples of very ancient geometry cited so far, it is worth at this juncture making an attempt to sketch out what the overall picture looks like, before proceeding with our own exercises.

SUMMARY OVERVIEW OF GEOMETRY IN THE ANCIENT WORLD - AND PREVIEW OF NEXT STEPS

Just as from the Rielvaux floor patterns, or intricate geometry of illuminated manuscripts such as the Lindisfarne Gospels, we can deduce that some system of Geometry must have been taught to monks, craftsmen and architects in the comparatively recent Gothic period, so can we make similar deductions from the art of the really Ancient World – so far for Hyperborean Britain, Susa and Crete!

Since Thom, Critchlow, Michell and Macaulay showed the Greeks as far from the first to use what we might call pre-Christian or pre-Islamic geometry, today from our perspective as art historian of the ancient world we now have easily to hand from archaeological records alone hundreds of instances of the use of precise geometry. Already from the examples in this book a picture has emerged proving beyond doubt that in certain periods - at least since the Fifth Millennium BC - schools of geometry (possibly even just single teachers) of particular relevance to astronomers, architects and craftsmen came and went anonymously, notably:

Neolithic Britain (10-3M) under native Britons, Picts and Druids
Elam, Egypt and Mesopotamia[4] *(5-2M)*
Crete (3-2M)[5]
Assyria, Babylon and Persia (1M - examples yet to follow)

We have yet to see whether we can trace such activity ever further back in time. It is solid artefacts - rather than documents - that provide the evidence, revealing how millennia before writing began there were people around whose intellect we have totally underestimated (equally, we infer their absence where artefacts are bereft of such infrastructure or adornment). Indeed, such objects, large and small, reveal how far back the roots of the Masonic tradition must really go, its members consisting not only of teachers but also of the ordinary craftsmen who were taught geometric procedures for generating designs by the Masters of the many separate

[4] For convenience, all images of Mesopotamian seals refer to P.Amiet's **Glyptique Mesopotamienne Archaique** 1978 by **GMA** no.

[5] For brevity, all images of Minoan seals are taken from the many-volumed reference work, **Catalogue of Minoan and Mycenaean Seals** (**CMS**). For details of find-spots and Museums displaying them, please follow the **CMS** references given in the captions.

Guild Workshops. Just as for Europe we should not underestimate the depth of the Islamic geometric tradition in the context of their own indigenous protohistoric schools which at key stages during its pre-Islamic transmission account for the mighty religious structures of Egypt and the Levant, including the famed 1M Temple of Solomon to which Masons usually refer, often with Egyptian overtones. Plato himself benefited directly from oral traditions taught in the schools available in his time, not only those run by the Egyptian priesthood, which everyone knows about – but also that of the Zoroastrian Magi who even visited him in Athens (known about only from a handful of telling clues the scholar Peter Kingsley has gleaned from Neo-Classical writers[6]). According to more controversial records Zoroastrianism, emerging in the north Mesopotamian areas bordering on mountainous Central Asia[7]), goes back to 6,000BC, rather than 600BC, its priests famed for their knowledge of astronomy and geometry.

Our book on ***Architecture*** (***Book 11***) will expand on what masters of Geometry Neolithic Man already was (much as Renaissance Man five millennia later) in their erection of stone circles and carving of hand-held geometric stone balls of astonishing precision and complexity (see ***Book 0, Ill.0-6***). In contrast, in this book we have mostly gathered examples from the minor arts that prove by their work left behind that craftsmen and designers *must* have had tuition in geometry. In fact looking at the designs we have cited so far these men, too, seem to have tried out simple geometric designs, almost as exercises, before moving on to extraordinarily inventive embellishments or criss-crossing complication –following a similar journey to the one we are following.

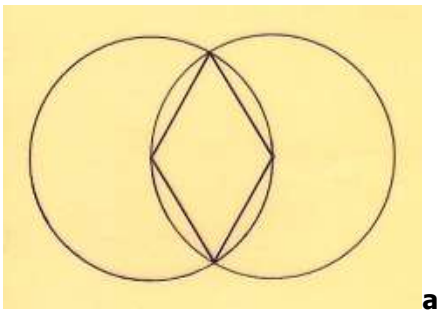
With such precedents in mind we deal first with straightforward shapes whose sides or radii are units in whole number relationships. Then a further set of line-lengths emerge from joining up other points which are called *irrational* because they are not at whole-number intervals from each other - not liked by Plato very much, but important, since it is these *irrational* spacings which lock shapes together and literally prevent the universe from falling apart! Amongst these we will concentrate on ϕ-the Golden Section, π-Pi and the $\sqrt{2}$ (root 2), $\sqrt{3}$ (root 3) and $\sqrt{5}$ (root 5) ratios deriving respectively from the diagonals (or radius) of pentagon, circle, square, triangle and double square (for a quick idea of the latter three see ***Ill. 2- 77*** and ***Ill. 2- 78***).

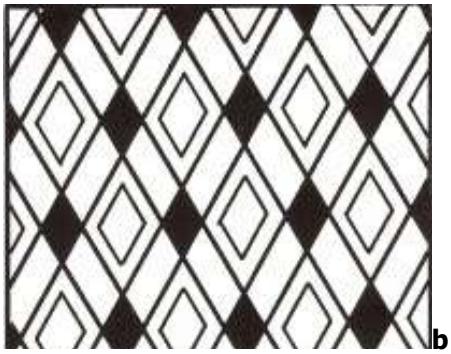
It is not too late, before you proceed, to first print off this book to provide the main core of your personal file on geometry, using dividers behind which to insert your own personal papers (exercises, articles from magazines, pictures you take with your camera or diary observations about geometry in your life). I would mark the dividers for each number from 1 to 13, though actually in my file their ordering goes 3-6-9, 4-8-12-16, then 5-10, ending with 7, 11 and 13 - with subsections for spirals and each irrational interspersed where you think most appropriate (in the same way you would list your Favourites on your computer at convenient points, depending on the way your mind works).

[6] References to his papers are given in Chapter 6 of my research on the Ancient Near Eastern Canon of Art at www.layish.co.uk .
[7] Peter Kingsley recently unearthed important statements about Plato's last night with a Zoroastrian magus as his death approached.

START OF THE JOURNEY PROPER: THREE AND THE BIRTH OF THE TRIANGLE

In the next cluster of illustrations we look at the first angular geometric shape we have already noticed as implicit in the two ends of the *Vesica Piscis*. Within it, a lozenge-can be picked out with a ruler ***(a),*** made up of two equilateral triangles. Repeating the process provides a triangular lattice based on many *Vesicae Piscis* ***(b)*** which simply involves extending the lines. If you are making grids the secret is to have a long ruler and extend any line joining points as far across the page as you can, so that a net emerges with the minimum of effort.


a


b


c

Minoan Ivory stamp seal ***CMS II,1****-72*

Ill. 2- 29: (a) Within the Vesica a lozenge can be drawn, and from this a three-fold lattice can be created and different aspects of it emphasized to make interesting patterns (b) - or a single design (c)

For single objects something like the cute triangular Minoan ivory fly (*below*) with a very simple stamp seal design on its underside uses one such equilateral triangle as the template for its shape, the smaller triangles of its wings emphasized by hatching.

Ill. 2- 30: Ivory fly seal CMS II,1-379

Zig-zags and diamonds are usually the *first* patterns a child makes freehand – and there are endless examples of the earliest pottery decorated with these by early man in the ancient Near East, going back even to the 10-9M: certainly on many clay sealings from Susa dating to the 5M BC there are examples of zig-zag or diamond patterns. The three-foot wide English Bronze Age stone below, found in a bed of ash in the aftermath of a four-day peat fire on Flyingdales Moor, N.Yorkshire near Ravenscar (interpreted as representing a landscape!) is dramatic in its use of lozenges and triangles – especially since other such stones in northern England,

Ill. 2- 31: Bronze Age zig-zags on a big sandstone slab exposed after a moorland fire (left) – Daily Mail 21 Dec. 2004; rows of zigzags on stones found in the Ness of Brodgar temple complex, Orkney (right)

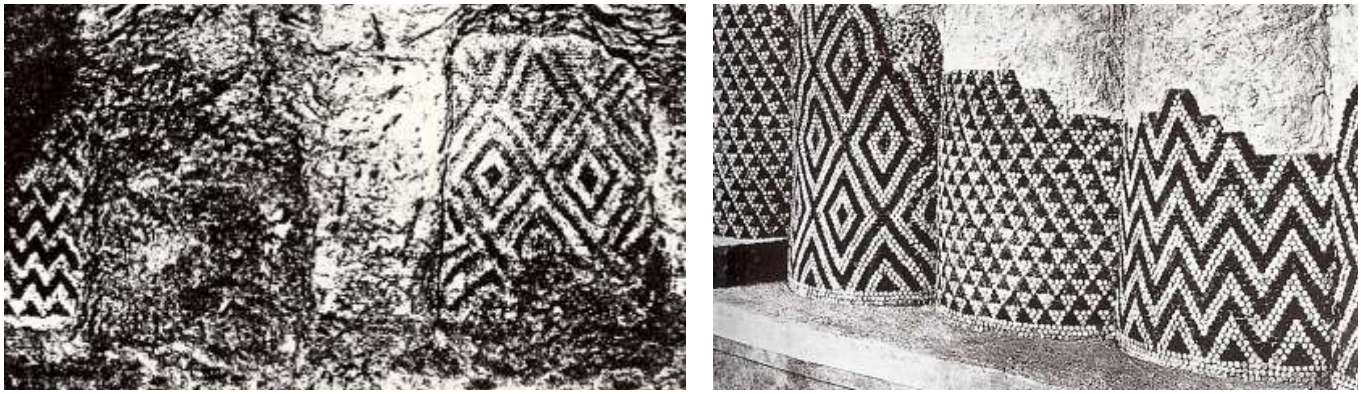
Orkney and Wales were usually carved with concentric circles, cups and spirals. We really do not know whether these were representational of landscape, just patterns - or had symbolic meaning.

Clay button fixing from Susa: ***GMA*** *102*

Ill. 2- 32: (left) Stone 16 (3M) at Barclodiad y Gawres Passage Grave, Wales – Minerva magazine June 2011

When it comes to the lozenge at the centre of the 3M Neolithic menhir from Wales above, it seems to have been deliberately placed on the belly area of an upright stone which has considerable human presence (with another on the pubic zone). Over 8,000 sites in Britain inspected by English Heritage and other Ancient Monuments groups are turning up hundreds of heretofore unnoticed examples like it, some going back to the 10M. We contrast it with a piece of 5M pottery from Susa (Susa I period) which used to have a fixing attachment on the back, as for a button. We can see how when not simply decorative, there is a huge possible range of symbolic intention behind the use of similar-looking zig-zags and lozenges which it is not always possible to unlock. One thing we have established, though, is that geometric activity can be traced back now to the 10M BC!

Wall mosaics using zig-zags and lozenges covered the mud pilasters of the E-Anna Precinct, Uruk, now preserved in the Berlin Museum (below left). A reconstruction was shown in the ***Art of Cities*** exhibition at the Metropolitan Museum in 1994, from whose catalogue the picture comes:



Ill. 2- 33: Zig-zags and lozenges adorned and weatherproofed the mud walls of the 4M Sumerian E-Anna precinct, (left) – its reconstruction was shown in the Art of Cities exhibition, Metropolitan Museum (right)

It seems quite clear from some of the beautifully bold yet simple designs on stone artefacts from Uruk in this period that a design workforce was under instruction, experimenting with the simplest forms of geometry, and not seen in Egypt at the time:

Ill. 2- 34: Spouted black limestone vessel inlaid with white calcite and mother of pearl eyes, bands, lozenges, squares and rosettes glued with bitumen (top left) and inlay groups found loose (bottom row) - from Ernst Heinrich's Kleinfunde aus den Archaischen Tempelschichten in Uruk 1936;(top right) 3M bowl, Khafaje, PKG X

We end this section with Jenny's evocative photo of a triangle with spherical ends emerging from a film of water.

Ill. 2- 35: Water vibrating as a triangle with three spherical corners - Jenny 143

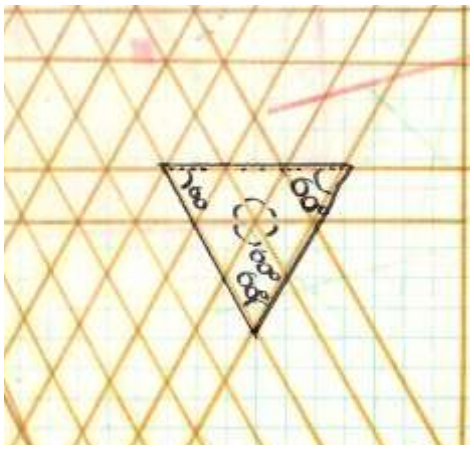
Perhaps because Jenny did not use water as a medium all that much, it inspired Lauterwasser (following his own surname, perhaps) to make a whole book devoted to the effects of sound on water, and we remember again the Biblical line about God moving over the face of the Waters at the start of the Creation. We remember also the central place the Law of Three takes in Gurdjieff and Ouspensky's philosophy system – all of which seem to confirm why the Trinity, and Water, play such an important part in most religions.

Add your own examples to your file.

Made up of three sides, the triangle is the most flexible of all geometric shapes, and doubles into hexagons, triples into nonagons and quadruples into dodecagons (twelve-sided polygons) - the nonagon being slightly more tricky to construct than hexagons and dodecagons. But before going to the hexagon we should make a small diversion to look at the $\sqrt{3}$ ratio, since it is present as the inner diagonals of any equilateral triangle or its multiplied forms.

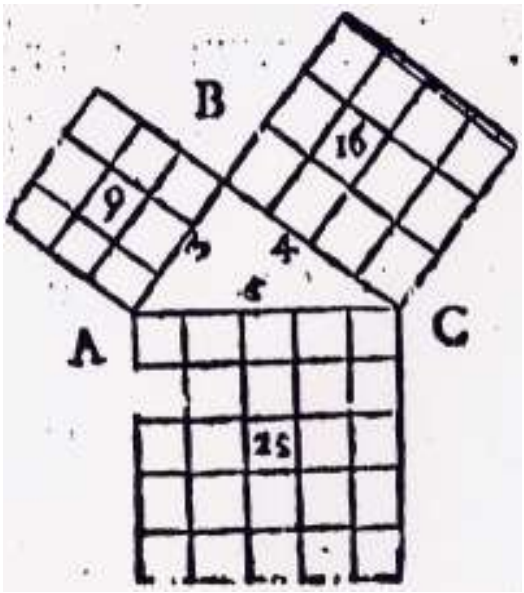
IRRATIONAL RATIOS: THE TRIANGLE AND ROOT 3 (√3)

From a school exercise based on a triangular web (below) a protractor at the corners measures the angle for this kind of repeating equilateral triangle as 60º at each corner, enabling harmonic triangular or hexagonal patterns to fit easily into each other, and from it we can consider our first irrational proportion:



Ill. 2- 36: The 60° angle of the equilateral triangle

The irrational proportions generated from triangles rely on Pythagoras' formula, which in the case of the 3-4-5 triangle below set out in an early European printed manuscript (already known about in ancient China and in Babylon) is nicely demonstrable simply by adding up the number of small squares. The formula states that the

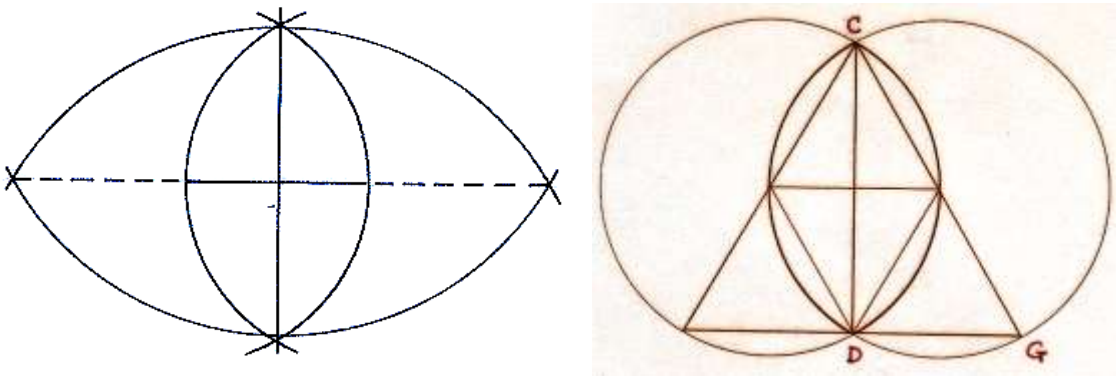


Ill. 2- 37: Pythagoras' Theorem provable by the hypotenuse squared equalling the sum of the squares of the other two sides

LENGTH OF THE HYPOTENUSE - the side (5) opposite the right-angle - SQUARED (i.e. multiplied by itself = 25) IS **EQUAL** TO THE SUM OF THE SQUARES OF THE LENGTHS (9 + 16) OF THE OTHER TWO SIDES (3, 4). This formula is applicable to any right-angled triangle, but only with a 3-4-5 triangle do we get a result with whole-numbers. On other triangles

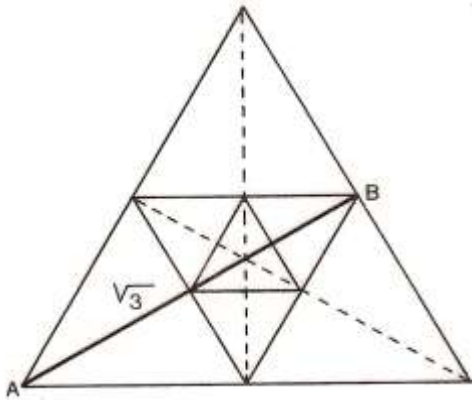
we have to express the length of the hypotenuse by the square root symbol, √ to get back to the original length, since numerically the √3 ratio is 1:1.7320508!

Root 3 (√3) is related specifically to the equilateral triangle itself which itself is made up of two 3-4-5 triangles (the Vesica Piscis lozenge itself consists of four smaller 3-4-5 triangles (below). Thus we can demonstrate the √3 ratio starting with the Vesic by extending the hypotenuses of the small triangles within the Vesica (below left) to create a large equilateral triangle containing four smaller equilateral triangles. Using the axis of the original Vesica (CD), it divides the large equilateral triangle into two main right-angled triangles, whose shorter sides express the relationship between the width and height of the *Vesica Piscis* itself, given the sides of all the miniature equilateral triangles are all the same length.



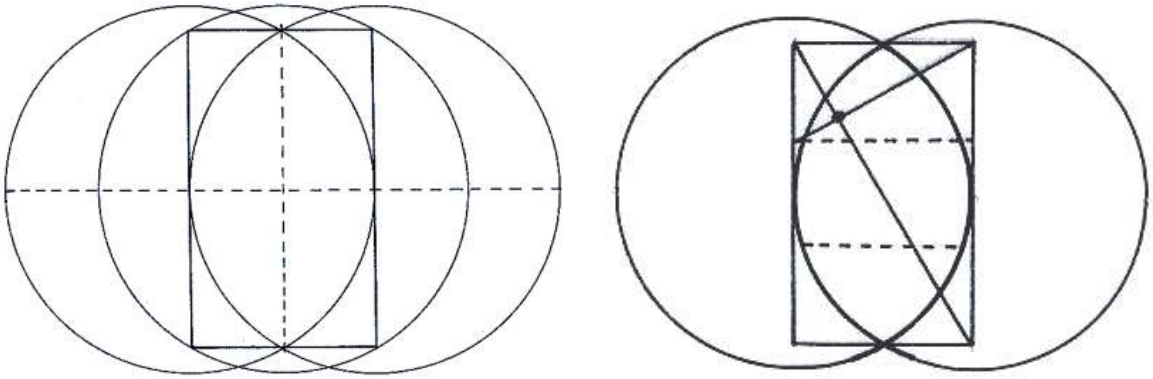
Ill. 2- 38: (left) Height –v- width of the Vesica Piscis, and (right) Pythagoras' theorem applied to triangle CDG

If we then concentrate on the right-hand triangle CDG, the value of √3 is discovered by a reverse application of Pythagoras' theorem as follows: since the sides of the small equilateral triangles are the unit of measure, we can see straight away that its hypotenuse and base consist of two units and one unit respectively. To find the height of CD means that CD (not yet known) + DG (1 squared side unit x 1 = 1) is equal to CG (2 squared side units x 2 = 4). This means we take DG (1) from CG (4) in order to find out what CD is, i.e. 3 squared side units, and therefore the actual height of CD *un*squared is *Root* 3 (√3). The next diagram expresses the ratio from a different positioning, using the same rationale (it can be ignored if you've 'got' the reasoning already):



Ill. 2- 39: AB is the √3 ratio (as demonstrated through the four smaller triangles in the previous illustration)

If we make a rectangle (below left) with its short side (as DG above) in a √3 ratio to its long side (as CD above) *expressing in fact the width –v- height of the Vesica* in ***Ill. 2- 38***), such a rectangle has the property that if divided into 3, each sub-rectangle is a smaller replica of its parent (below right) and the crossing point of the lesser with the greater diagonal of a √3 rectangle gives the traditional position of the eye of the fish to which the term *Vesica Piscis* refers (below right).

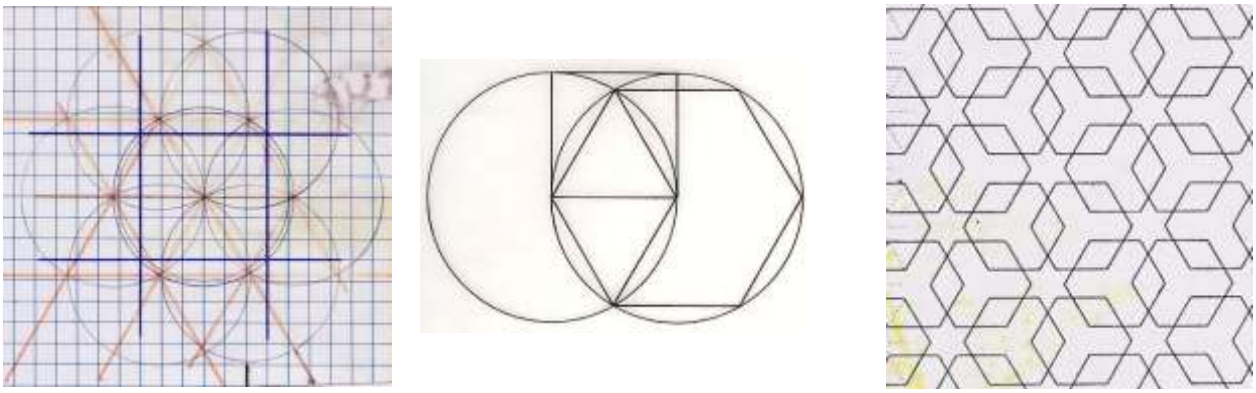


Ill. 2- 40: (left) the √3 rectangle and (right) the eye of the fish

We will not deal with examples of √3 in nature or the arts in this book, but traditionally, as Keith Critchlow showed with Glastonbury Abbey, the Root 3 proportion was used everywhere in Gothic cathedrals, as we will demonstrate in ***Book 11***) where √3 rectangles are the hidden binding elements of their triangular constructions – and all ultimately generated by the *Vesica Piscis*. We have already mentioned in ***Book 1*** the different proportions of paper or book sizes we use every day ***(Ill. 1-13***) and in this book we consider especially those rectangles regulated by the irrational proportions, some in common everyday use.

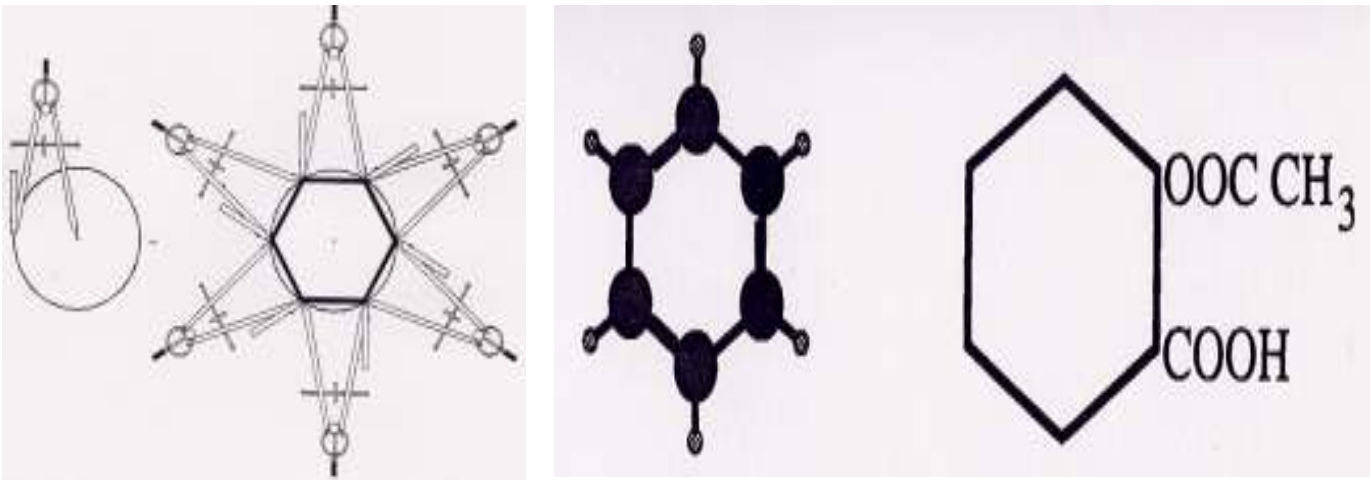
THE HEXAGON: STABLE SIX-PACK

We saw from the triangular net created in ***Ill. 2- 36*** that clusters of triangles fall into hexagon shapes, the relation of the hexagon to the *Vesica* made clear from the centre diagram below. The six-petalled version drawn inside a circle is one of the most popular school-child exercises (below left), and the hexagon's petalled or stellated nature can be emphasized according to choice in patterns of endless variety.



Ill. 2- 41: (left) School exercise kept from childhood showing the hexagon made up of seven intersecting circles (left) and sophisticated Islamic pattern counterchanging straight hexagons with stellated versions

The school-boy way of 'getting' the hexagon, of course, is to walk the compasses round the circle with the same radius (below left). Would Kékulé have discovered the hexagonal Benzine ring (foundation of all other hexagon-based organic chemical structures like Vitamin C or aspirin, the ones illustrated below) if he had not practiced geometry as a child? In fact, he *dreamed* of an *ouroboros* (see frontispiece logo) which led him to think of a circle-type molecule and thus he arrived at a solution. His higher mind had perceived the structural pattern that through vibration engenders the substance, just as in Jenny's experiments.

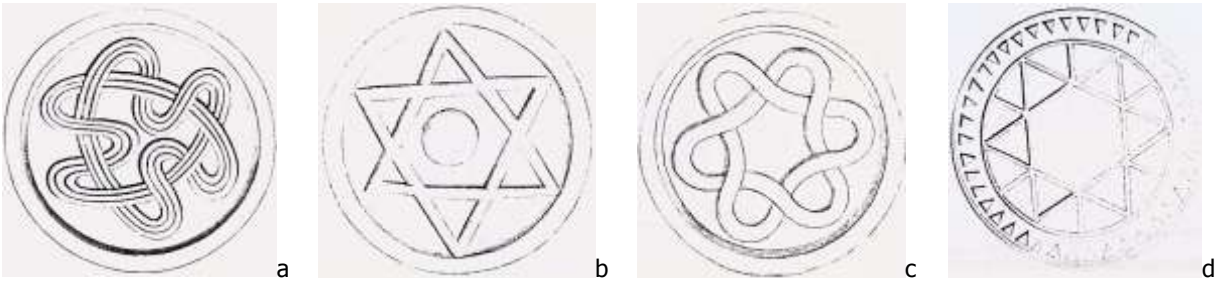


Ill. 2- 42: (left) 'Walking' the compass round the circle (middle) Vitamin C and (right) Aspirin molecules

As the Star of David or Solomon's Seal, the hexagon can be expressed as two interpenetrating triangles,

Ill. 2- 43: Silver Jewish neck pendant uses Solomon's Seal to frame the Tablets of the Law and Ten Commandments

though it is associated with other traditions too (Hindus call it the Wheel of Shiva). Mostly in the eastern Mediterranean, the hexagon was especially widespread in sophisticated variations on seal designs in the 2M

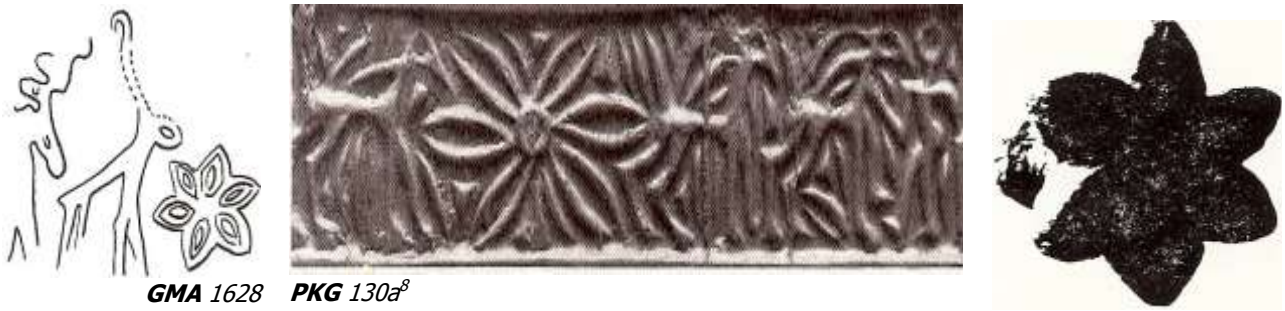


a b c d

CMS II,5-*162 (Phaestos)* ***CMS II,5-****141 (Phaestos)* ***CMS II,5-****152 (Phaestos)* ***CMS V****-476 (Kea)*

Ill. 2- 44: Sophisticated circular and straight versions of star hexagons on Minoan sealings

(especially Crete). I had to look hard to find overt Mesopotamian examples of its use, and only found a handful in key reference books with thousands of illustrations – one from 5M Susiana, the second a 3M shell seal from Sumerian Khafaje (both below), also used in six-petalled form as wall-studs on the Uruk temple (below right).

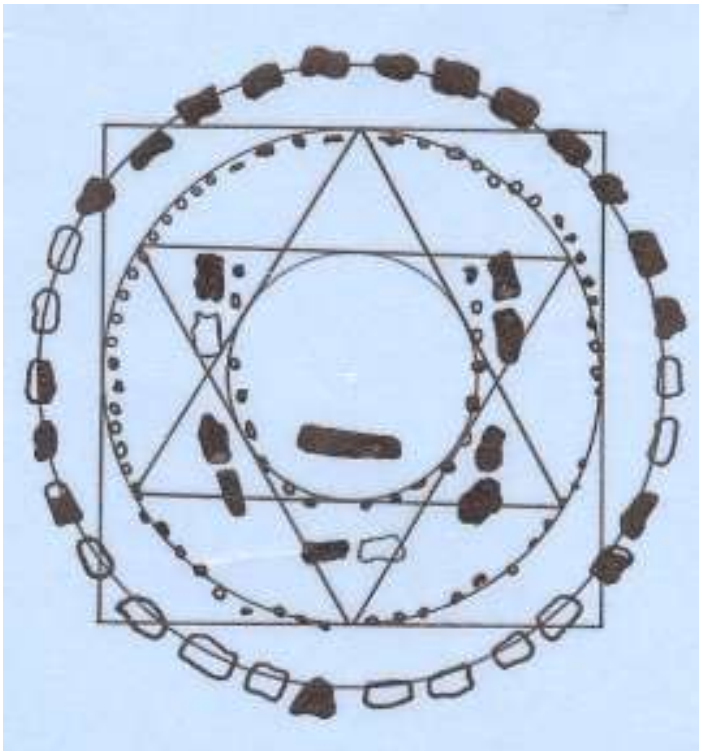


GMA *1628* ***PKG*** *130a*[8]

Ill. 2- 45: Sealings showing animals and a six-petalled flower from Susa (left) and Sumer (middle and right)

[8] I here introduce another wonderful reference book with hundreds of useful illustrations which I will refer to by the label ***PKG***: editor Winfried Orthmann's ***Der Alte Orient***, (***Propyläen KunstGeschichte*** Vol 18) 1975

The regular hexagon has also been spotted lurking within the ground plan of Stonehenge, one trilithon per side, plus one empty side where the observer stands to watch Summer sunrise or Winter sunset:



Ill. 2- 46: Plan of Stonehenge – drawing Josephine Munthali, after Ketih Critchlow and John Michell

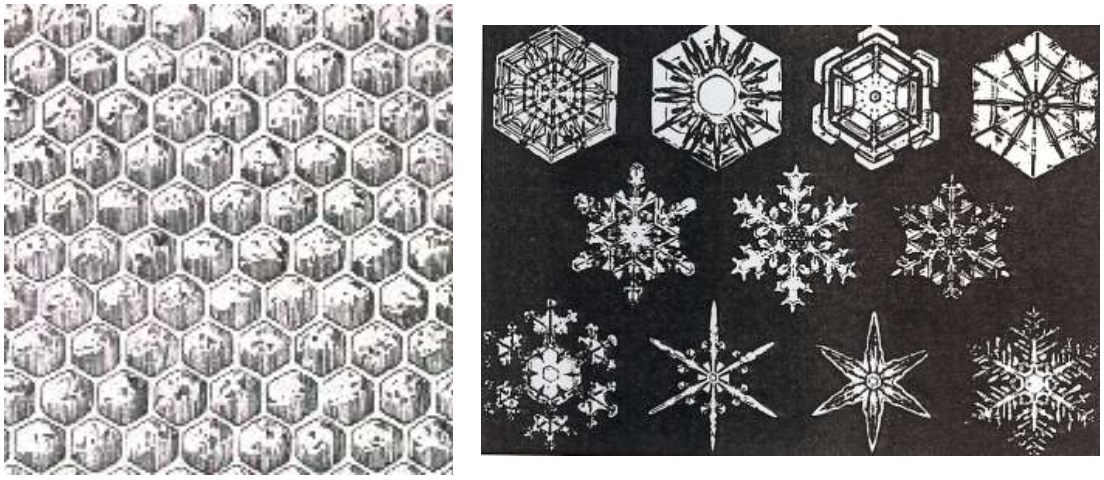
THE SEX CHAKRA

Seen as two interpenetrating equilateral triangles, it is not for nothing that on a basic level 'six' and 'sex' are in essence the same word. Ease of reproduction is certainly to be associated with its simple geometric construction. So it is not surprising that the second chakra of our body tree, up one step from the four-petalled root chakra (***Ill. 2- 70***), is said by the seers to have six petals. We should understand it as the centre governing

Ill. 2- 47: The six-petalled sex and movement chakra (swadhisthana)

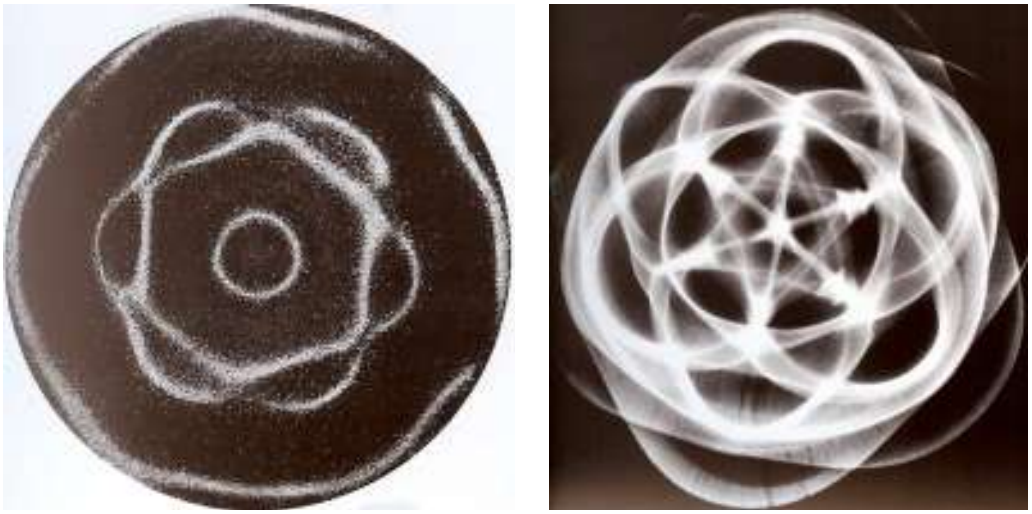
not only sex, but all rhythmic bodily movement both internal (e.g. the digestive system) as well as external body movement, especially legs, arms and lower body trunk up to the navel chakra, including sexual activity. Ordinary mortals are so governed by this chakra that they are the kind of person who lives purely on the animal level, to eat, get, beget and sleep. But when coordinated successfully with the whole 'lighting system' of the chakra tree it can be regulated within the perspective of mankind's higher needs and linked with love and intelligence.

The best-known appearance of the pure hexagon in nature is in honeycombs and snow crystals:



Ill. 2- 48: (left) Honeycomb cells, all uniform in order to fit into against other; (right) examples of snow crystals (no two are ever the same) - from Schneider

You must surely have collected some examples yourself. Jenny's ***Kymatik*** shows a small number of hexagonal examples as they fluctuate temporarily between pentagonal and heptagonal states: because it is so regular it does not retain its form for very long, breaking up easily because so adaptable.



Jenny 68 *Jenny 127*

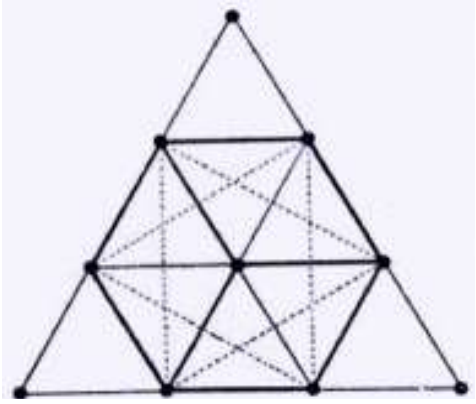
Ill. 2- 49: Sand on a drum temporarily adopts a hexagonal shape (left) and sound applied to liquid when lit by a strobe lamp also shows flowered and stellated renditions of the hexagon (with embedded Solomon's Seal)

THE HEPTAGON/SEPTAGON

This is where we insert an important polygon - the next one up from the hexagon - and being an odd, prime number, rarely to be found in pattern webs (heptagonal tiling is possible with irregularly-sided heptagons of different sizes, but mixing with other shapes is usually not possible. Yet 7 is one of the most important numbers regulating our lives, mostly due to the cycle of the Moon being divided up into four weeks (or two fortnights), and the week itself being a sequence of seven days that we take for granted – this goes back to 3M Sumerian culture when the divine *Sibitti* was worshipped as a God (see ***Book 1***, ***Ill.1-32*** for the 7 Planets and Metals). 7 divided into 1 results in a recurring decimal which repeats the same digits into Infinity: 0.142857142857142857.

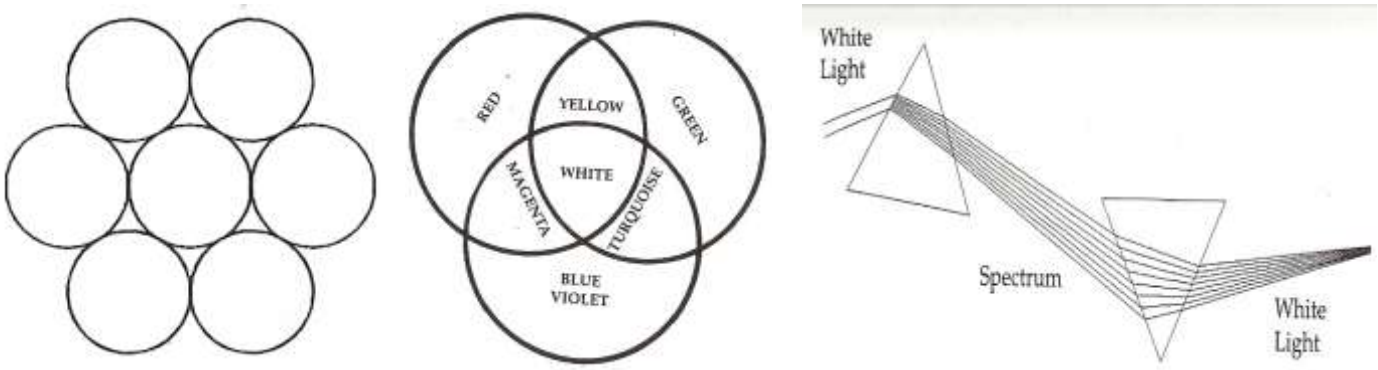
We have already referred to the importance of Seven in our cosmology, starting with Genesis which divides the process of the Creation of the World into Seven Eras (Days), often expressed as six circles within a hexagon with a seventh, central circle representing the Day of Rest. Even though in essence there are three pairs of primary colours and their complementaries (illustrated below), the Biblical metaphysic led even a scientist like Isaac Newton to give the number of prismatic colours as Seven – similarly, although there are several more minor chakras to be identified in the human body, the Hindu system homes in on seven principal chakras (***Ill. 2-129***) which themselves tie in with the Seven notes of the octave (the eighth being the start of the next one).

Traditonally there are six directions of space (as understood by the ancient Chinese): above, below, forwards, backwards, to the left and to the right of a central starting point, which itself is the seventh (and hidden) direction within, as it were, an invisible Cube: if you look carefully at the seemingly flat triangular web below, you start to see a cube coalesce out of it, expressing the six directions radiating from the seventh centre-point (coinciding in this view with one of the corners). It makes one look at the importance of the Cube/Ka'aba in a different light, as an esoteric form of the Six Days of Creation and the Seventh Day of Rest at the centre.



Ill. 2- 50: The Cube and its centre esoterically represent the Six Days of Creation and the Seventh Day of Rest

This process is explored in terms of sphere packing by Keith Critchlow in ***Order in Space*** (next illustration, below left):

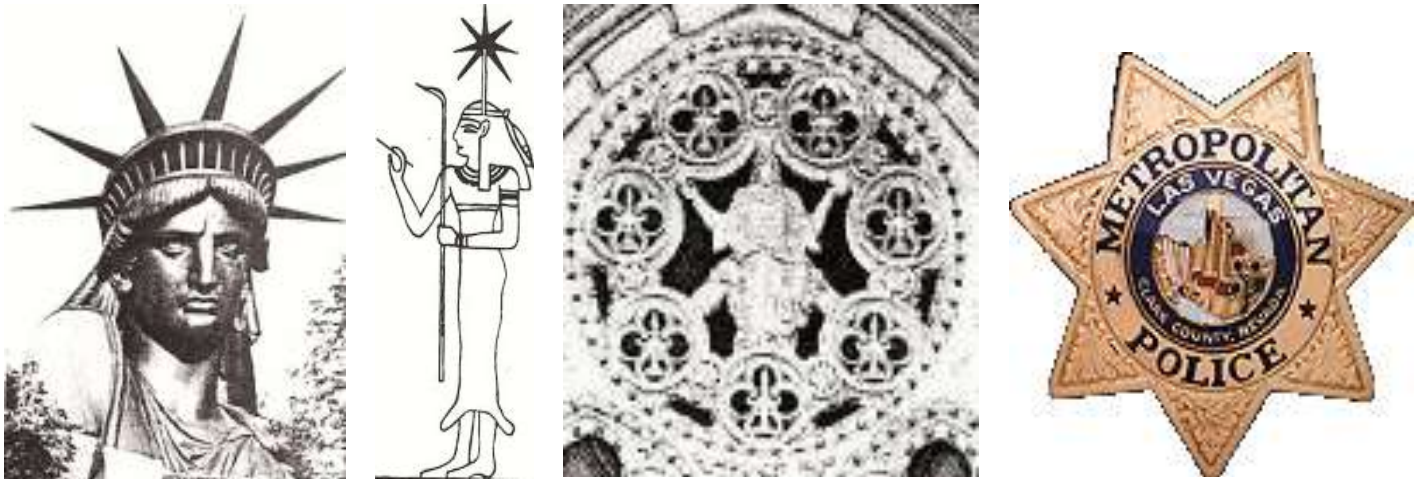


Ill. 2- 51: The Seven Days of Creation, the Six Colours centred on White - and the 7-fold Spectrum

In Britain's recent coinage the heptagon is used on its 50P and 20P pieces,

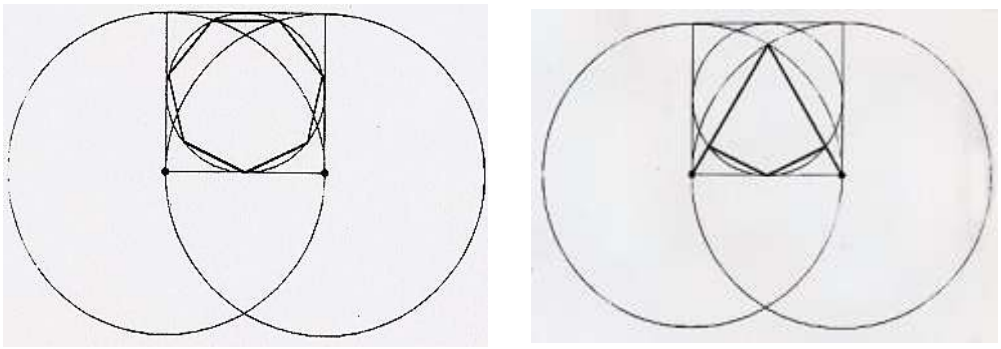
Ill. 2- 52: The 50P and 20P coins either side of a statue of Athena with Gorgon head framed by a heptagon

whilst in the States it is interesting to see this polygon appearing very publicly in both New York (on two monuments, in one case stellated) and (also in star form) as Las Vegas as the Police Department logo (below)! The link between Britannia, the Goddess Athena and the Statue of Liberty is interesting: on a statue of Athena Schneider noticed the head of the Gorgon on her chest is tightly framed by a heptagon (apologies that the latter image is not clearer). We are reminded also that the Egyptian Goddess of writing and temple surveying, Seshat, is always shown with a seven-star headdress.



Ill. 2- 53: Headdress of the Statue of Liberty; Seshat; Rose window in St John the Divine, N.Y. (all from Schneider) - and Las Vegas Metropolitan Police Department badge

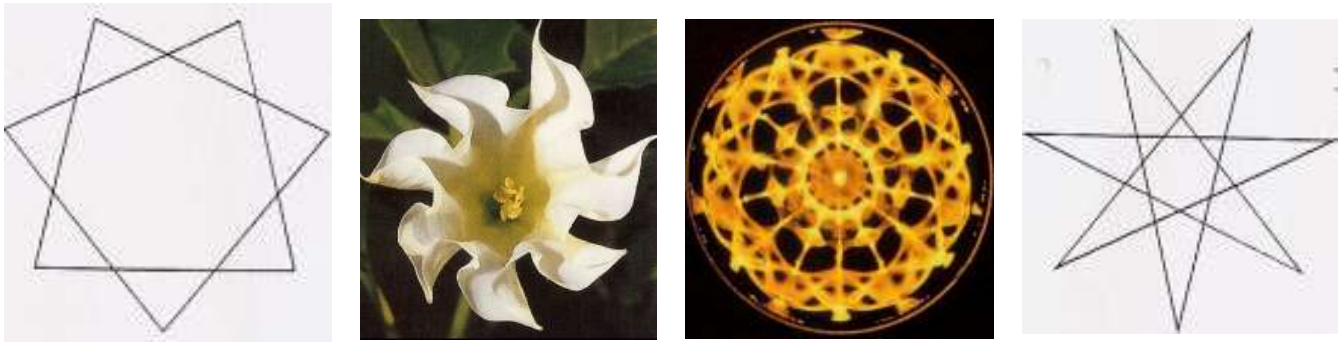
The construction of an accurate heptagon is not strictly possible via the Vesica Piscis, though convenient methods for drawing out two reasonable approximations are given by Schneider below - the side of the polygon being obtainable either from the small circle within the top square, where it crosses the major circles of the Vesica Piscis – or from the mid-point of the triangle within that smaller circle:



Ill. 2- 54: Two methods for a rough construction of the heptagon from the Vesica Piscis – from Schneider

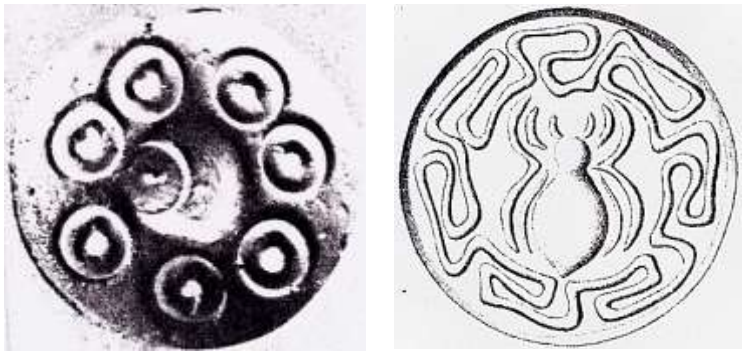
The more complex approaches leading to absolute precision we leave you to look up from the Classics Book List!

The heptagon appears rarely in flowers, though the Gimson Weed is well known for having a seven-fold lily-type flower, and as regards vibration patterns it is Lauterwasser who has come up with the most striking images:



Ill. 2- 55: Stellated heptagons frame the Gimson weed flower and a water image from Lauterwasser fig.99-7

I started this section thinking the Minoans would not have reached the level of 'doing' heptagons, and then found two, one basic and the other stunning in its sophistication, contrasted at the centre by a 6-limbed insect:

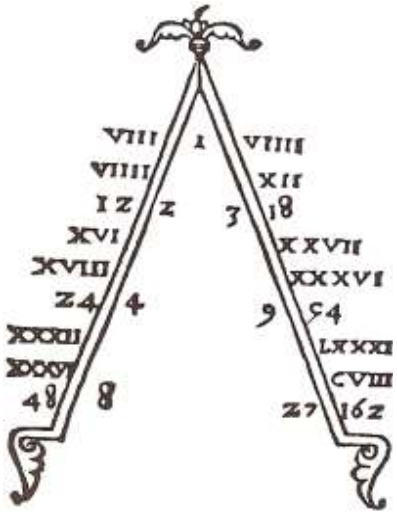


CMS II,3-*323 of steatite (sold in Palaekastro)* ***CMS V-****519 (clay sealing found near terrace wall of Asine)*

Ill. 2- 56: Heptagonal designs on 3/2M Minoan stamp seals

Getting back to our main story line of developments out of the triangle, we could simply jump to the nonagon (nine-sided polygon, but we would prefer to deal with it as one step on from the octagon. We could also at this point jump to the dodecagon (twelve-sided polygon) by doubling our hexagonal construction. *But* since the twelve-sided shape is the first polygon to reconcile triangles with squares (3 x 4 = 12), I think we should look at the square first – mainly also because it is the next shape up from the triangle.

We first used the *Vesica* as the mother of triangles *(Ad Triangulum* is the mediaeval term quoted by Critchlow for triangle-based geometry) from which we can also derive hexagons, nonagons, dodecagons or any other shape divisible by 3. In other words, we follow the three-fold side of the Lambda, described by Plato (***Book 1***,



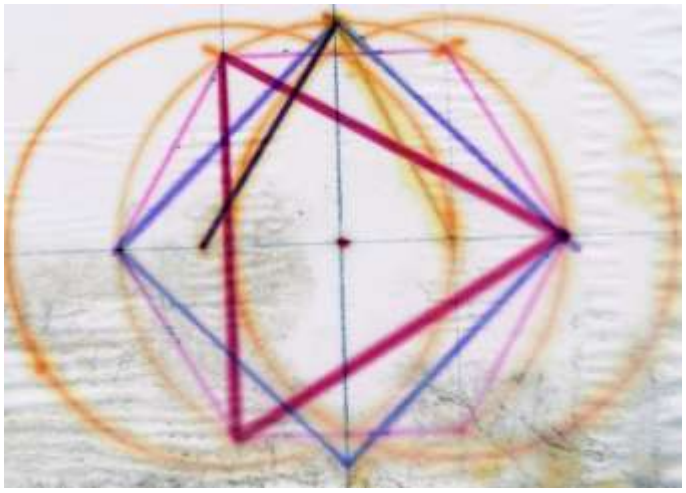
Ill. 2- 57: Follow the progressions of the Arabic numerals on either side of the lambda shape (Λ) from 1

Ill. 1-26/27). Now if we are to use it as the mother of *squares* (*Ad Quadratum)* from which to derive octagons, sixteen-sided polygons and onwards, we follow the other arm of the Lambda, following cubed, four-fold progressions. By establishing the cross inherent in the vesica (***Ill. 2- 20***) the whole family of fourfold shapes or nets can be progressed from it, as in the doubling process going on in the halibut cell cluster below.

Ill. 2- 58: Fertilised halibut eggs split from 1 to 2 and then double to 4 cells in 24 hours

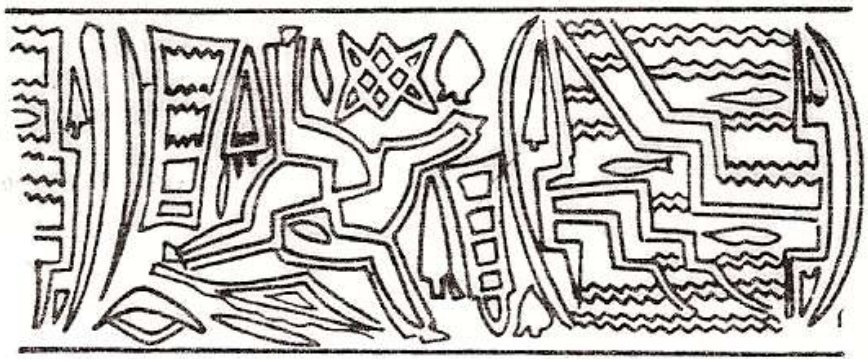
THE IRRECONCILABLE SQUARE

The square is usually irreconcilable with the triangle, other than in special cases. (In astrology, planets square to each other indicate conflict, but when triangular to each other (in trine, or sextile) harmonious outcomes are signified.) The somewhat rain-washed exercise I did in early days (below) shows concentric triangle, square and hexagon in a circle to show you what I mean. Triangle and hexagon fit neatly into each other, but the square



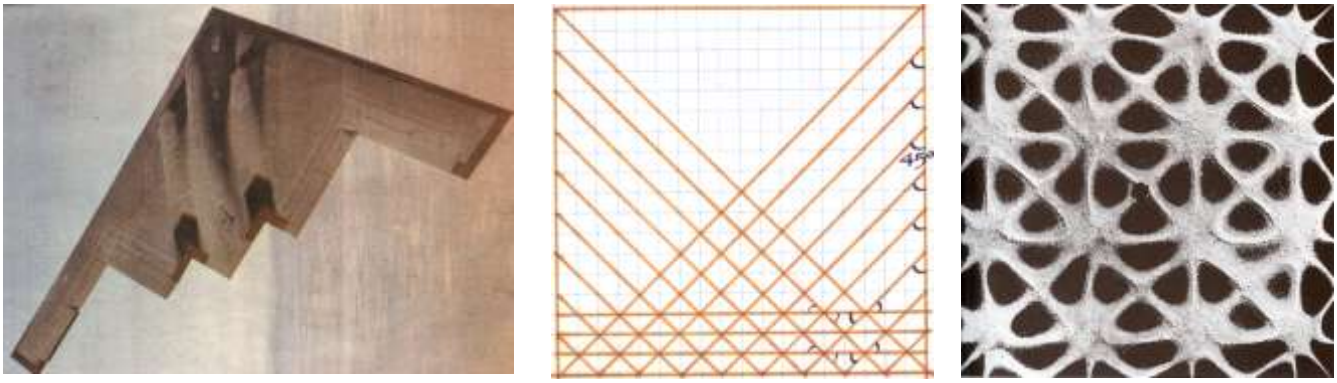
Ill. 2- 59: Triangle and square do not naturally dovetail into each other

with its 90° corners pushes beyond them on one or two sides and cannot dovetail. This is because its governing inner triangles are not equilateral, their lower corners being at 45° (***Ill. 2- 61***, middle). Starting with the swastika element of the 5M seal design from Susa below which uses the cross as starting point (the other lines, zig-zags and squared grids almost look like doodles playing with the properties of the square):



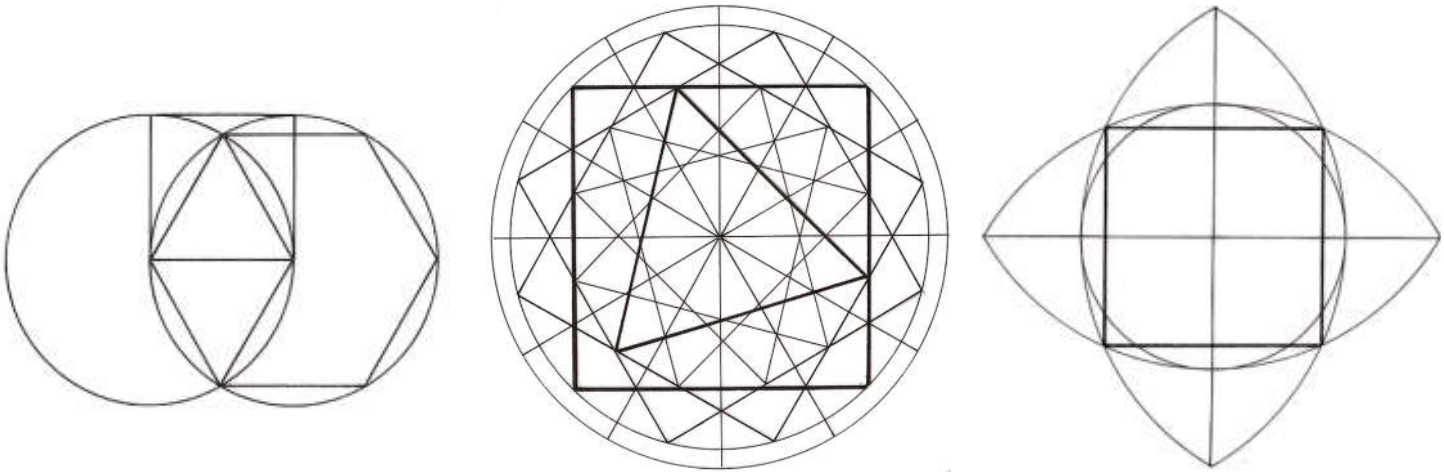
Ill. 2- 60: The internal angle of the inner triangles of the square are 45°, or half the 90° right-angle: here, a seal designer from 4M Susa played around with that grid, animating it into a swastika of four bull-legs

In contrast, in a brilliant example of modern engineering design, the Stealth aircraft used in the Iraq War by the US Air Force is quite clearly based on a square net, with its 90° square end as travelling axis turned to 45°. And if we turn to Jenny's experiments for examples of square ordering, he photographed many examples of sand, glycerine or liquid falling into such coordinates, as in the example below right.



Ill. 2- 61: Not only does the paint, but the very shape of the Stealth aircraft also makes it undetectable by radar; the diagonals of a square run at 45° (middle); sand takes up the same grid: Jenny 37 (right)

Making a grid of triangles with superimposed grid of squares of same side-length shows how incompatible the two fields are: below left and middle are two well-known constructions demonstrating the shortfall between the two shapes (however we go about it, one apex of the triangle falls short of the side or corner of the square)**:**

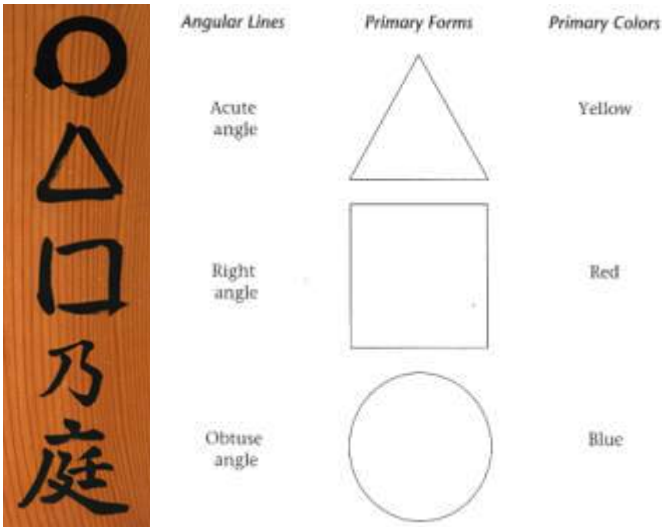


Ill. 2- 62: Square and triangle with same side-length cannot dovetail (left/middle); only by centring the square in two Vesicae at 90° is it possible to construct a square - drawings by Josephine Munthali

They clash because not divisible into each other (3 into 4 does not go). A reconciliation between *circle* and square can be achieved within two Vesicae at right angles to each other - demonstrated top right) –a construction used in establishing the ground plan of the basic Hindu temple, using ropes and sticks, where the square takes up a central position halfway between the Vesicae's four triangles. Try out these constructions.

In fact, it was one of the quests of geometers to find a way to square the circle – in other words to draw a square with an area exactly the same as a corresponding circle. The construction above right **Error! Reference source not found.** shows one way of doing it to give a very close approximation, but to do it absolutely precisely is unachievable, in the same way that the precise quantity for Pi (π)is so elusive. In a contrasting tradition where the quantitative is less important than the qualitative, the Japanese Zen painter's exercise was, in a state of calm after long meditation, to dash down with an ink brush the shapes of circle, triangle and square

after hours of contemplating their pure archetypes mentally - with no worries at all about making them fit into each other! In Zen Buddhism the trio simply signifies in intuitive mode the nature of the entire Universe, and the panel below left is hung in a Japanese temple, much as we might use an image of Christ on the Cross in a church. It is interesting to further contrast the Japanese approach with Kandinsky's thoughts on these same shapes which he saw, according to sharpness or openness of angle, as expressing the nature of the primary colours as well.



Ill. 2- 63: (left) Brush painting on wood in a Zen temple, Kyoto, compared to Kandinsky's thought that geometry and colour are dimensions of each other

The 3-2M Minoan seal cutters came up with simple, yet effective designs when they used combinations of squares and crosses on their stamp seal designs:

CMS II,5 *sealing from Phaestos (one of 45)*

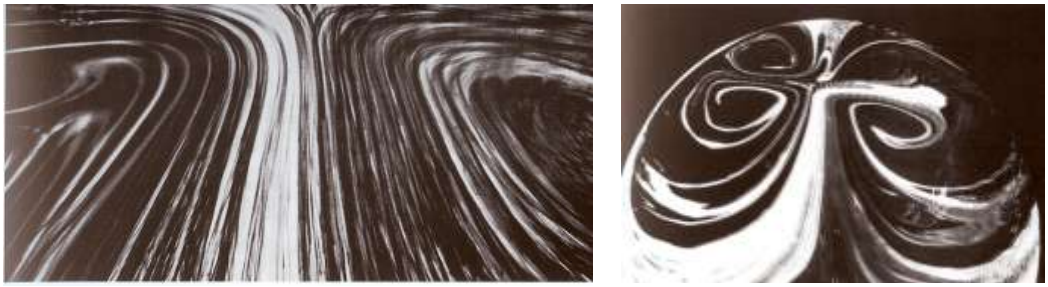
CMS II,1 *from Ajia Triada Tholos A, ivory*

CMS II, 2 *from the Palace of Knossos, brown jasper*

CMS II,2 *unprovenanced, East Crete, black steatite*

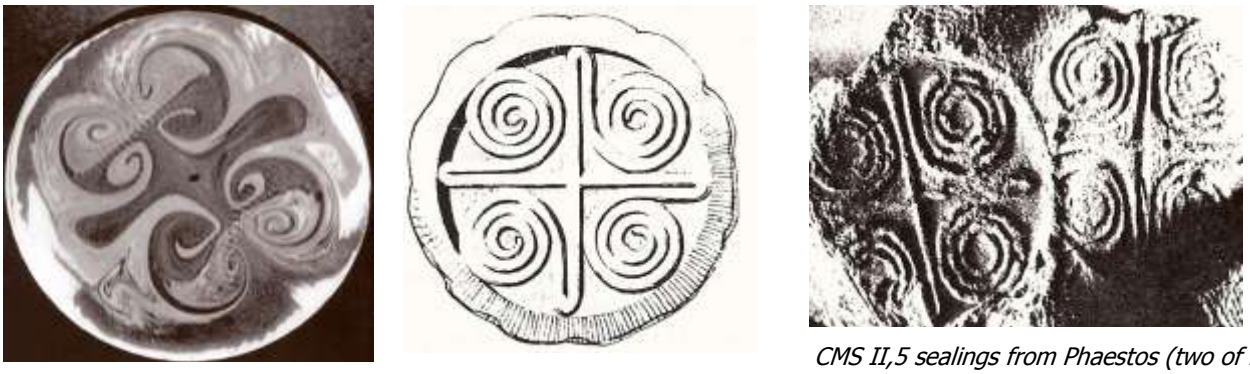
Ill. 2- 64: Third and Second-millennium Minoan stamp seals – Herakleon Museum

Interestingly, they brought in circles with squares but not surprisingly did not combine squares with triangles. Some of their designs (next two illustrations) can be compared with a group of Jenny's photographs in which, using a thin film of water with a few drops of dye added, four-fold currents become apparent when attached to a sound source:



Ill. 2- 65: Fourfold currents in water – Jenny 62/63

Exactly such circular motions round the crossing axes were picked up by the Minoan seal designers:



CMS II,5 sealings from Phaestos (two of four)

Ill. 2- 66: (left) Jenny 61 compared to 2M sealings from Phaestos, Crete (middle and right)

Such examples provide strong evidence, long before Pythagoras, Euclid or Plato, of a systematic interest not only in the core shapes of geometry but also - in the creative Minoan context - in making inventive, often organic, embellishments to the simplest of figures such as square or cross - take the examples below:

CMS II,1 *84 sealing from Ajia Triada, Tholos A*

CMS IV *31D seal of blue chalcedony and sealing – Heraklion Museum, Metaxas Collection*

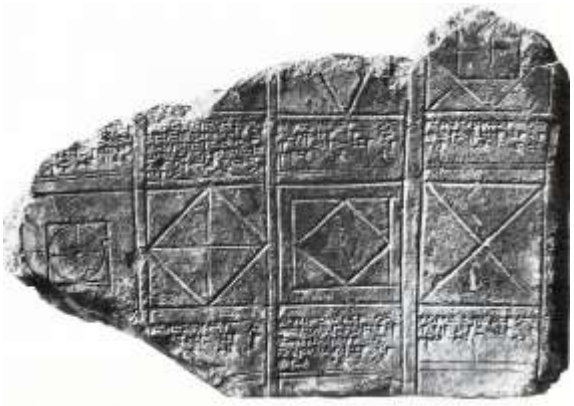
CMS II,1 *73 partial sealing from Ajia Triada, Tholos A*

Ill. 2- 67: Circular and vegetal embellishments to the square, seen on seals from Early Minoan tholos tombs

The Babylonians a millennium later with their more 'mental' approach[9] explored the properties of the square in terms of the mathematical problems of pure geometry[10]:

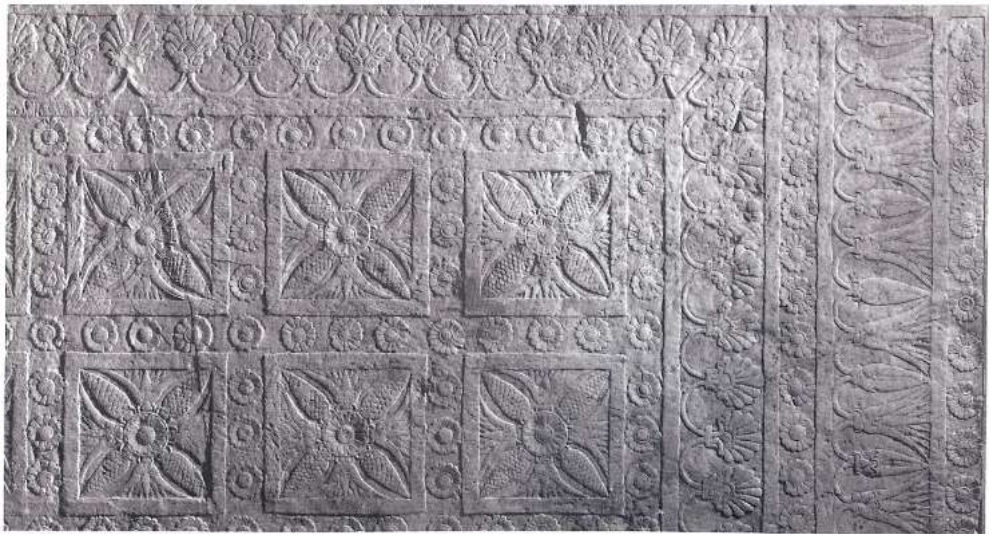
[9] See Eleanor Robson 'The Uses of Mathematics in Ancient Iraq 6000-600BC' in H. Selin (ed.) **Mathematics across Cultures: the History of Non-Western Mathematics** 2000, 93–113 (she does not analyse the principles of geometry).

[10] See Anne D Kilmer 'Sumerian anad Akkadian Names for Designs and Geometric Shapes' in Ann C Gunter (ed.) **Investigating Artistic Environments in the Ancient Near East** Washington DC 1990,



Ill. 2- 68: Clay tablet with Babylonian treatise on the properties of the square and √2 – British Museum

Below, the paving stone for the top step of the dais under the seat in an Assyrian throne room has been carved to resemble a carpet with four-petalled flowers, tantalizing evidence of how a royal carpet must have looked[11] in the 9C BC – and moth-proof too! (The Assyrians had a long heritage of excellence in all textiles.)



Ill. 2- 69: Neo-Assyrian dais stone simulating a carpet whose patterns are based on nets of very small circles inside larger ones governing the four-petalled florets placed square to each other – British Museum

Four-petalled flowers do not occur very often in nature, so look out for examples to photo, such as clematis!

THE ROOT CHAKRA

In the Indian Yoga system the four-petalled chakra lies at the root of the spine, providing a stable base, or essential pedestal for the tree of the nervous system with all its gates connecting the chakras to higher worlds (***Ill. 2- 129***). This is very much the nature of the square overall, providing a firm and stable foundation on all levels – hence the importance of the Setsquare and Compasses in Masonic symbolism, related not only to the many mentions in the Bible of 'laying out the frame' or 'stretching out a line' on Jerusalem (***Ezekiel 40, 2/Zechariah 1,16***), but also to the representations in Egyptian temples of Seshat 'stretching the cord'.

[11] See Stephanie Dalley's fascinating paper, 'Ancient Assyrian Textiles and the Origins of Carpet Design' in **Iran XXIX** 117-135

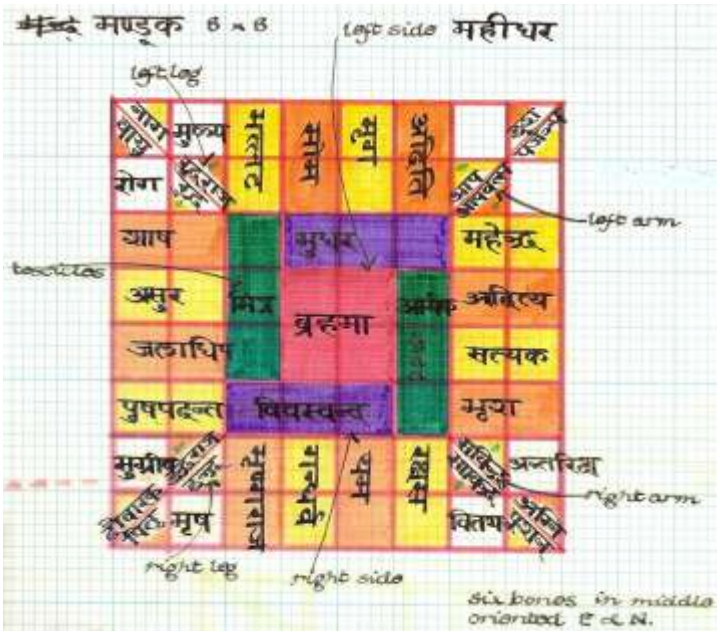
Ill. 2- 70: The four-petalled Root Chakra at the base of the spine

The stability of the square was canonical in ground plans for temples in the Hindu tradition (***Ill. 2- 62***, *right*) and the ***Sulva-sutras*** (treatises on temple layout) specify an entire range of acceptable square sizes from infinitely small shrines to the largest sizes (the largest 9 of the 32 not illustrated), each with their own particular name:

Ill. 2- 71: The first 23 of the 32 temple ground plans in the Hindu Temple Canon, each with a specific name

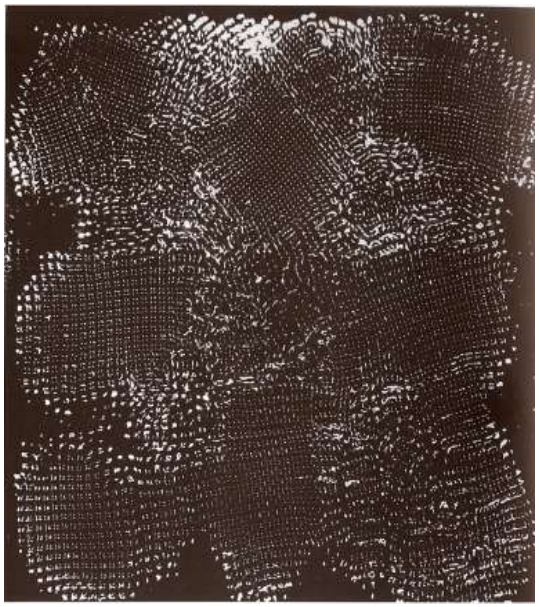
I copied these out from the ***Mayamatā*** thirty years ago, stored it in my airing cupboard and rediscovered it when writing this book – hence the damp damage on the corners – but a good example of keeping stuff you originally put in your own dossier without fully understanding it, forgetting it for decades and then looking the material again with new eyes. The words in Sanskṛt are the names given to each size of ground plan which

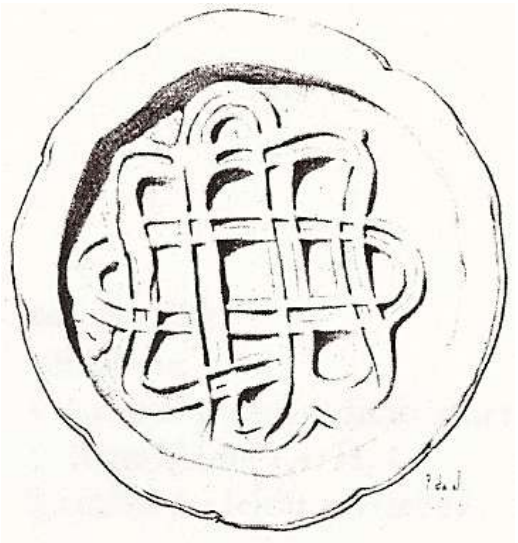
would be subdivided into parts thought of as representing a human body squashed into the square, as in the 8 x 8 plan below (more of this in ***Book 11***), and is the same idea as putting the Body of Christ into the ground plan geometry of a Gothic cathedral. Note that the centre square/navel represents the Void of Brahman – to me exactly the parallel to the Black Hole of modern Physics, the gate of access between parallel worlds:



Ill. 2- 72: Rough sketch of the Vastu-Puruṣa (Ground Plan as Human in spreadeagled position) of the Hindu Temple, from a Sanskṛt treatise: each square represents a different part of the body

Hans Jenny experimented with Classical Music as a sound source for some of his experiments, and the way glycerine falls into a square grid for Bach perfectly fits the composer's methodical progressions. The interchange





CMS II,1 *from Ajios Onouphrios Tholos, steatite*

Ill. 2- 73: The mandala arising from Bar 29 of Bach's Toccata and Fugue in D Minor, 1st movement (Jenny 71); compared to a similar nine-square arrangement on a 3M Minoan seal

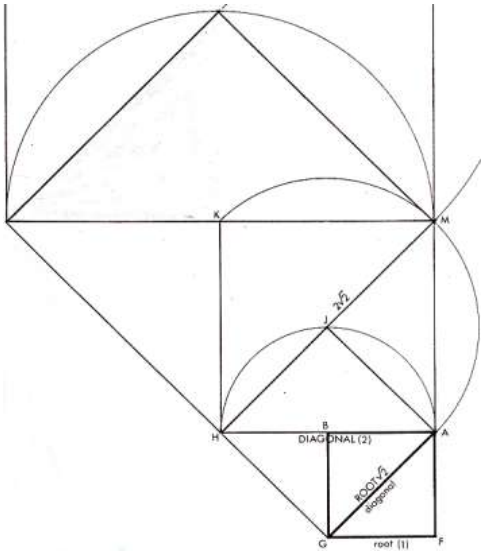
between directional lines becomes more and more complex until all the energy is spent. This is as true of music played, shapes formed, the unfolding of events, or even the effects of words (which is how the sacred languages of religion work, or at a lower level, magical spells). So we must always bear in mind Jenny's proofs that resonance lies behind geometry – we study Rupert Sheldrake's theories of Morphic Resonance in ***Book 6***.

Before moving on from the square, this is the moment to consider the next irrational proportion, inherent in the square's diagonal.

THE SQUARE - AND ROOT 2 (√2) AND ROOT 5 (√5) RATIOS

One of Critchlow's most gifted pupils, Robert Lawlor, believes the Roots are constants representing the transforming processes of physical genesis, and calls √2 (1:1.4142) the Generative Principle; √3 (1:1.7320508) the Formative Principle; and √5 (2:22360679) the Regenerative Principle (along the lines of the three Hindu Gods of Creation, Preservation and Destruction - Viṣṇu, Brahman and Shiva - though bear in mind that for Shiva he changes the God of Destruction to the God of Regeneration (via destruction perhaps! You will gather from what I have written so far that I see such high-level principles as operating from the generative Point, mothering Circle and co-generative Vesica Piscis - and I understand the Roots more as powers that hold things together cross-referentially at the next level, after complex formations have started to erupt.

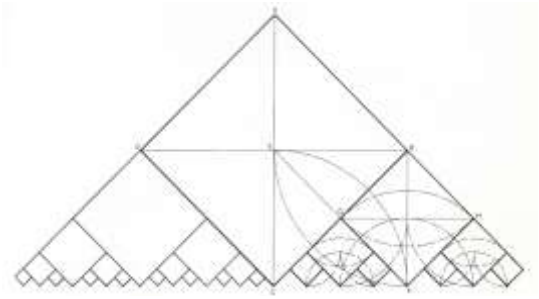
Both √2 and √5 arise from squares (a single and a double-square respectively). Root 2 arises from the diagonal of a square, which divides it into two right-angled triangles with its smaller corners at 45° (see also ***Ill. 2- 68***).



Ill. 2- 74: The Root 2 Ratio – and the Root 2 progression – from Lawlor

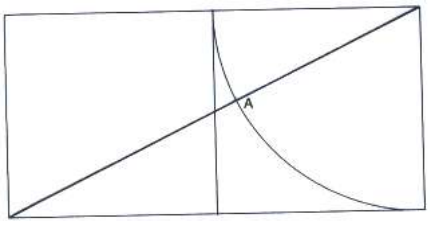
You know each side of the square is a unit of 1, and that each squared (1 x 1) is 1. Adding 1 and 1 makes 2, so giving the *squared* length for the hypotenuse (the square's diagonal) means its actual length must be the square root of 2, or √2. This turns out to be the irrational proportion of 1:1.4142 (the seed square in the illustration above can be progressed arithmetically to larger sizes of itself on successive √2 diagonals. The Root 2

proportion is found everywhere in fourfold constructions, binding the squares together, but with cleavages. The same progression as seen below in its bare bones underlies the outline of the Stealth aircraft (***Ill. 2- 61***):



Ill. 2- 75: The Root 2 progression repeated bilaterally and diagonally

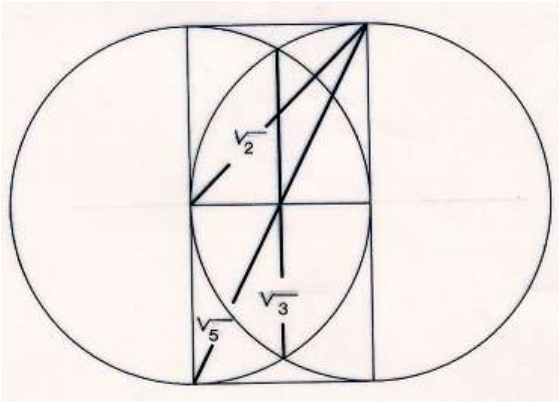
The √5 proportion applies the Pythagoras theorem in forward direction (rather than in reverse, as with √3 in equilateral triangles), whereby the diagonal on a *double* square comes out as 5 squared, or √5, as a result of



Ill. 2- 76: The Root 5 ratio

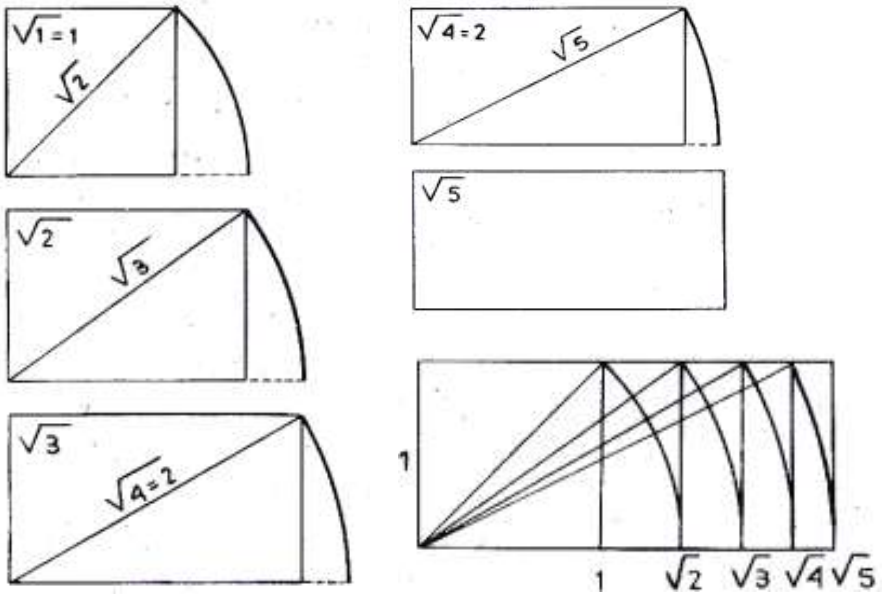
the squares on the base (1) being added to that of the upright side (2 x 2 = 4). This is the third important irrational ratio, and can be indirectly related to the pentagon, as we will eventually see, but to keep our minds uncluttered we will not dwell on it further, nor on Root 4 - √4.

The relationship between the three irrational ratios we have looked at so far is neatly expressed below within the same *Vesica Piscis* (of course we also take π for granted in the background). These are the constants that bind together most crystalline volumetric solids, giving the inner lines of force holding together the construction of the five Platonic solids and the 13 Archimedean Solids which are the only possible *three-dimensional* mathematical models made up of triangles, squares - and pentagons, bringing in the Golden Section which we



Ill. 2- 77: The Root 2, Root 3 and Root 5 ratios in relation to each other and to the Vesica Piscis

have yet to study - (see ***Book 5*** on three-dimensional forms, such as molecules – and of course ***Book 11*** on architecture). Looking around you, especially when standing inside a great architectural masterpiece, and you will soon spot these irrationals at work in one form or another by initially identifying its use of triangles and squares: individually they are analysed in detail in Lawlor's **Sacred Geometry**, Workbooks 1, 2 and 3.



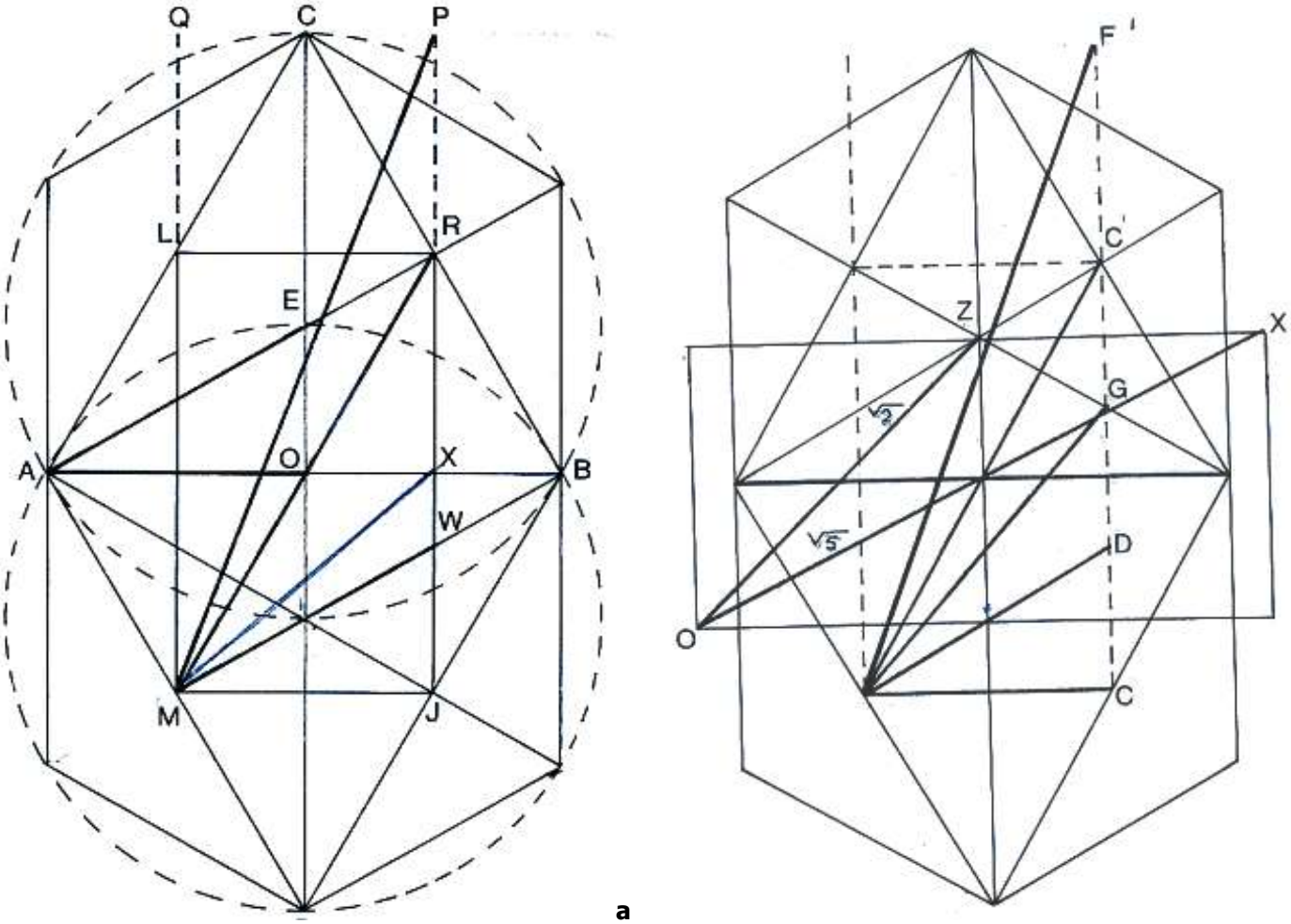
Ill. 2- 78: √2, √3, √4 and √5 Rectangles successively drawn out of each other – from Doczi pl.xlvi

Above, Doczi usefully summarised how √2, √3, √4 and √5 rectangles can be drawn off successive hypotenuses – an exercise repeated by Keith Critchlow in ***Order in Space***. All that is left to include now is the construction of the Golden Rectangle, following our study of the pentagon.

The irrationals - **ø,** π,√2, √3, and √5 – are so called because they are not reducible to whole numbers, but in geometric terms they do not need to be quantified in any case, which is the beauty of geometry as a proportional and musical system since it reveals mysteries through shape alone that arithmetic cannot. They open the door to a higher level of Number at work where laws binding separate bodies together are simply seen as tangible ratios whose differences with a bit of practice become obvious. However, there is one more irrational we will consider later - so tremendous that an entire book (***Book 13***) is devoted to it!

The interest of arithmetical harmony based on whole-number intervals, if the only kind available, would soon pall (like only listening to music based on diapasons and fifths (as in folk music). As established in the last book, the complete series of proportions in the normal musical scale neatly summarized by the three-fold and four-fold arms of the Lambda is an arithmetical way of representing the leaps by which energy radiates, whereas geometric nets – a key feature of Islamic art - provide pictures of vibration in terms of shapes. By drawing them or just looking at them one experiences the values of energy interchange and of patterns set up in the environment such as ripples in a pond, making us realize we live in a constant web of such vibrations in our daily life, many of them dissonant and harmful.

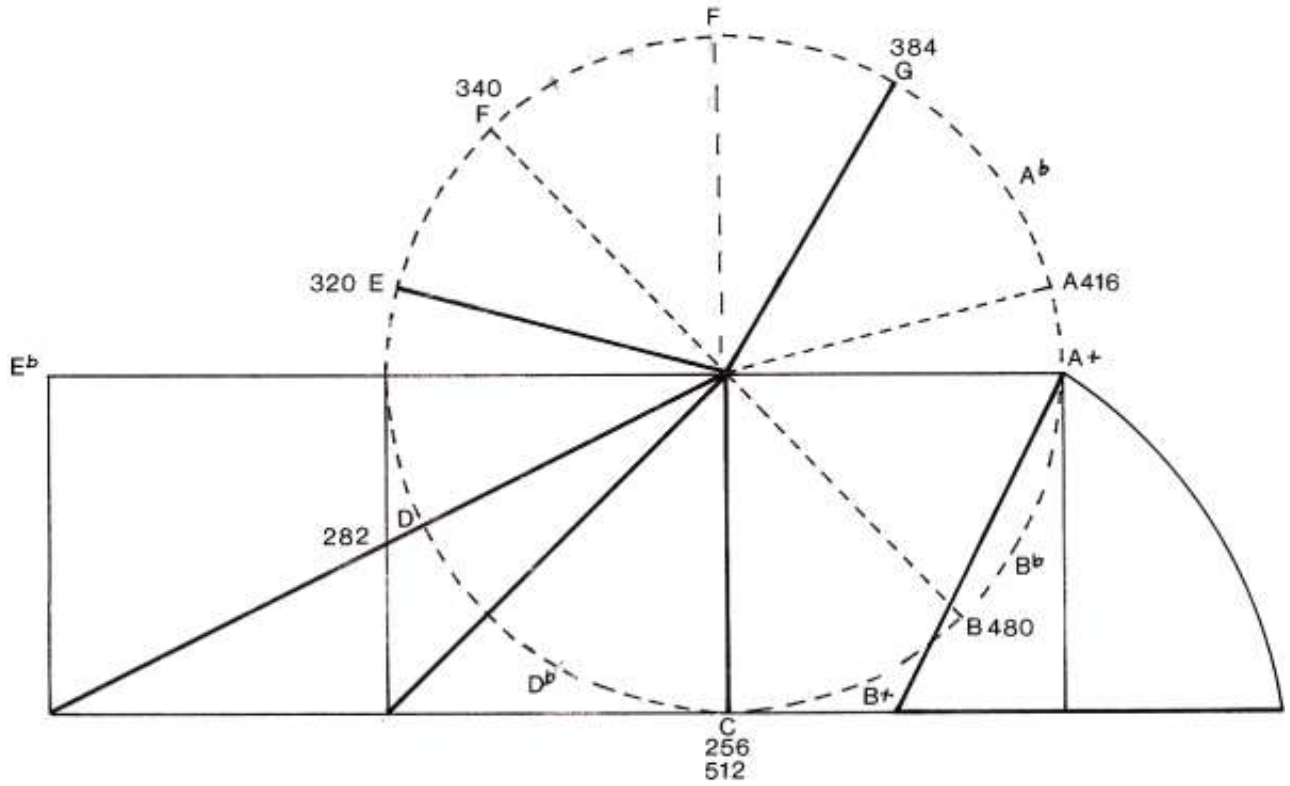
It is the interplay of shapes through the cross-currents of the irrationals that creates symphonic effects, and for those who like to have a diagrammatic formula for such interplay in terms of string-lengths on a musical instrument, you could follow in the steps of Mark Pawson[12] by drawing out the following two diagrams, where from a hexagon inside a large rhomboid *Vesica*, all the roots and plain musical ratios are spelled out like a quiverful of arrows. But if you find this confusing, leave it out, and simply note that each root is not only a



Ill. 2- 79: (a) AO/MJ = middle C; AE/MW – D; MX – G; MR – top C; MP – top F
(b) A √5 rectangle overlays (a), showing angles and lengths of the notes C;D;G; top C and top F from previous diagram now contrasted with the √2, √3, and √5 lengths

length, but can also be appreciated as an *angle*. In the next drawing the irrationals are superimposed over Kayser's Tone Circle to show more overtly how they can be related to the octave in such terms. Remember: it is all to do with string-length: the string-length *is* the note, and the roots interleaved with the octave lengths fill in some of the minor and flat keys – just get a sense of the overall idea, rather than trying to match it note for note necessarily!

[12] Mark Pawson, 'The Gothic Arch in Sacred Architecture' ***RILKO Newsletter 19*** fig. 2-10 (redrawn by Josephine Munthali)

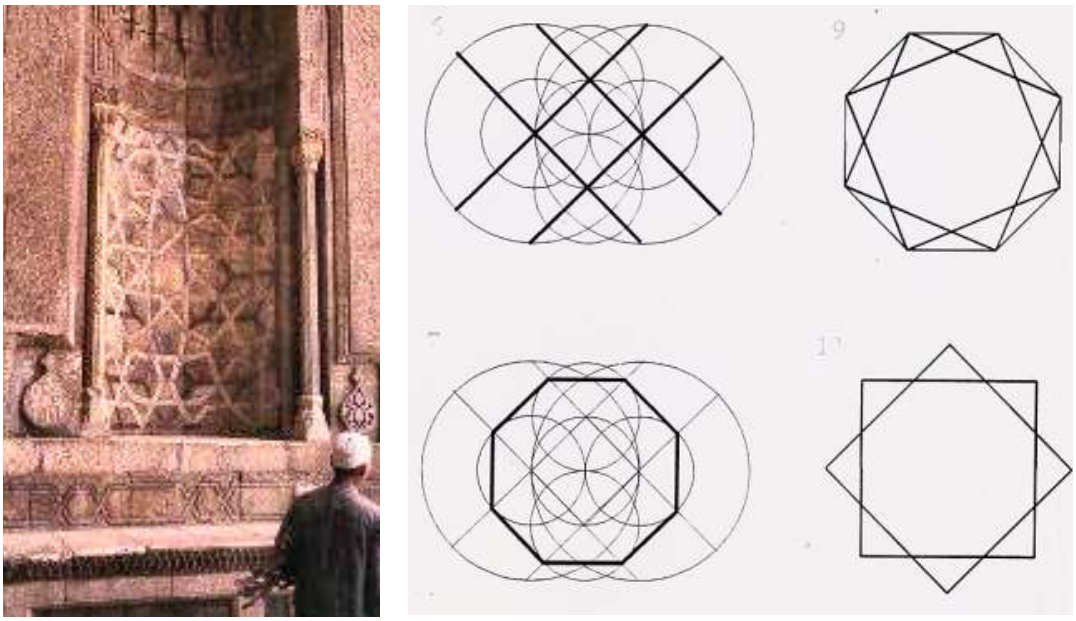


Ill. 2- 80: The notes and relevant khtz frequency numbers of Kayser's Tone Circle (see Book 1) are related to the √2, √3, and √5 Irrationals in the constructions at the bottom placed over it – drawn by Josephine Munthali

Now we can return to an exploration of the multiplication of the square in polygons and patterns – most notably the Octagon and Dodecagon.

THE OCTAGON

The octagon results from a square doubled on itself – as in the centre feature of the mihrab (niche indicating the direction of Mecca) in a Cairo mosque (below) - thus its construction starts with a square:



Ill. 2- 81: The octagon is the central feature of this inlaid miḥrab in the Sultan Hasan Mosque, Cairo (left); the octagon is generated from the extended diagonals of the square midway down the Vesica Piscis (right)

Sixteen-sided shapes are also easily constructed by doubling it, as seen in other parts of the same mosque:

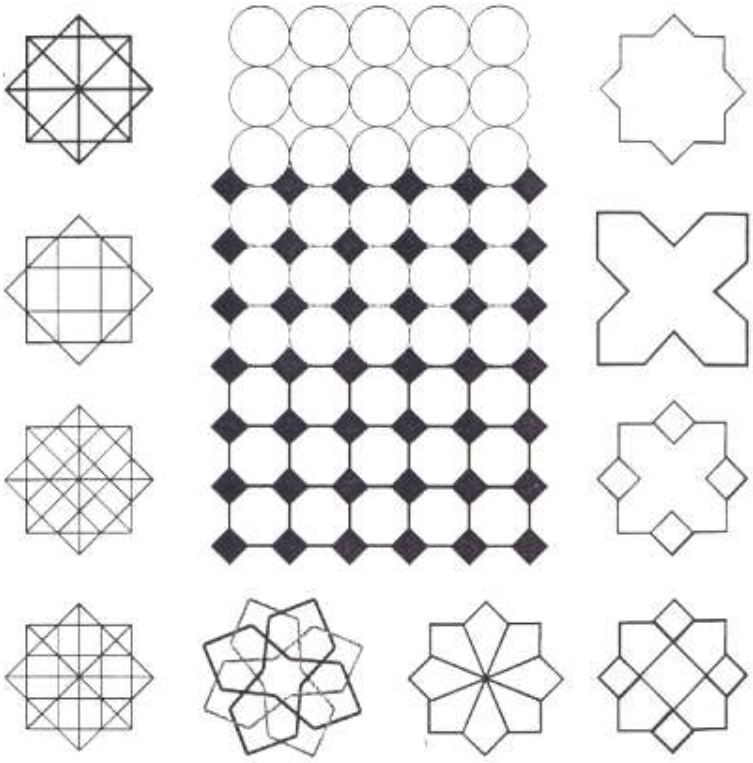
Ill. 2- 82: Wall mosaic and carved wooden door in the Sultan Hasan mosque using sixteen-sided nets; the middle picture shows the organic evolution of an eight- to sixteen-sided form as traced in a sand-tray by an oscillating pendulum within one containing Vesica Piscis – actually the record of the successive seismic vibrations of a earth tremor in Seattle – London Metro newspaper 15 March 2001

THE THROAT CHAKRA

Here we can bring in the sixteen-petalled chakra, interestingly lying at the throat centre, the instrument that taps into and voices the harmonics of higher worlds. It is also strongly affected by what happens at the other chakras, so for instance a strong sex chakra gives a deeper voice, or a loving heart chakra gives subtle modulations to its timbre. The syllables given on its petals are vowels, semi-vowels and diphthongs – no consonants: in other words, pure sound in all its resonances is the gift of the throat:

Ill. 2- 83: The sixteen-petalled throat chakra

However, we stay with the Octagon, whose variety of combinations has always had high design potential,

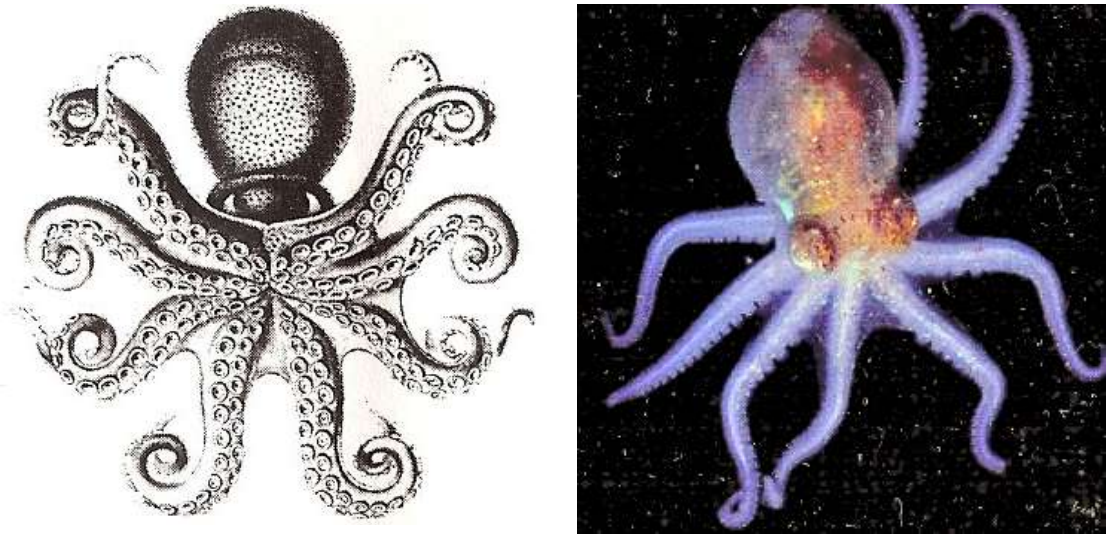


Ill. 2- 84: Permutations of the octagon for tiles and pattern webs – from Schneider

apart from its metaphysical significance as the number of renewal and resurrection, since in the Octave the eighth note is the last note of one sequence and the first note of a new one. Where 7 in the form of the heptagon is seen as a Virgin number keeping to itself and indivisible by others, the octagon is open to many permutations and combinations with other shapes – a favourite in Islamic art –you must have your own

examples for the file. At the same time, Schneider points out, 8 is 2 x 2 x 2, the only number apart from 1 divisible by the same number repeated, hence there is a return to a new dimension of Unity in reaching 'eightness' (a line from the Egyptian (Hermopolitan) Creation myth runs, *I am One that transforms into Two; I am Two that transforms into Four; I am Four that transforms into Eight - after this, I am One again*).

In its organic manifestation, the octagon turns up in such flowers as clematis, but perhaps most notably in both



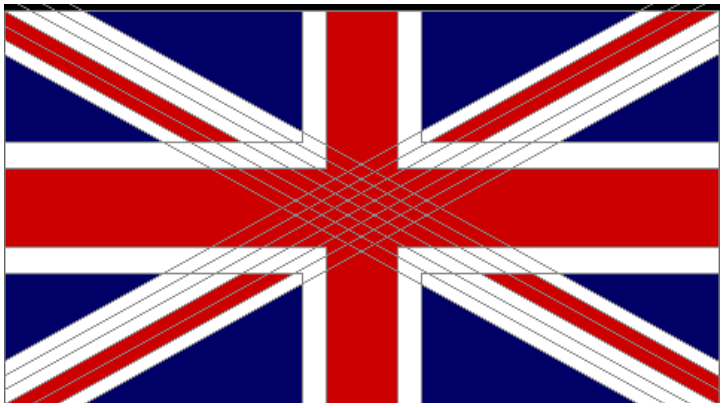
Ill. 2- 85: Eight-legged creatures embodying the Octave: the octopus

the octopus, squid and spider: the latter can have four, six or eight eyes too (the octopus always has two).

Ill. 2- 86: Eight-legged creatures embodying the Octave: the spider and possible eye-sets of 4, 6 or 8

In the ancient world both these creatures were beloved of the Minoans on their painted pottery (the spider also features often on small Sumerian seals thought to belong to weavers). Apart from being decorative, these arthropods could sometimes signify the eightfold zodiac as used generally in the Ancient Near East from Sumerian times, until superseded by the ten- and twelve-fold zodiacs of 1M Babylon, the eight-year Venus Cycle being the reason for its 8 sections, as seen in the Assyrian clay planisphere below left. The eight-fold division of the sky was also associated with the Virgin Goddess Athena, one of whose rarer attributes is the spindle since,

like the female spider, with self-generated threads she divides the sky into an eight-armed web. The eight-spoked wheel of Nemesis is a more threatening aspect of Athena which concentrates on the Great Return of

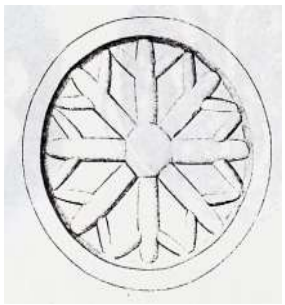


Ill. 2- 87: Damaged clay planisphere - known as Astrolabe K - divided into 8 sectors (British Museum); the British flag has the same connotations, since eight divisions appear on Athena/Britannia's shield (Ill. 2- 52)

Time to its starting point – embodiment of the process acted out in Greek tragedy, that the consequences of a man or woman's actions will always catch up with them eventually - with retribution unavoidable.

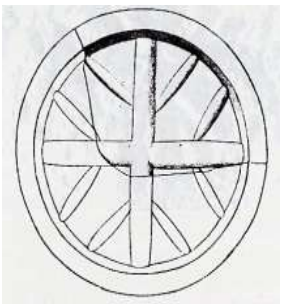
With its diverse design potential it is not surprising the Minoans experimented with the geometry of the octagon very much earlier - and in a variety of ways – from simple to complex and in tessellated and floral renditions. Tholos A again features as a source due to the high incidence of geometric seals found in that particular tomb:

CMS II,1 *21 Ivory stamp seal and sealing from Ajia Triada, Tholos A*



CMS II,5 *74 sealing from Phaestos*

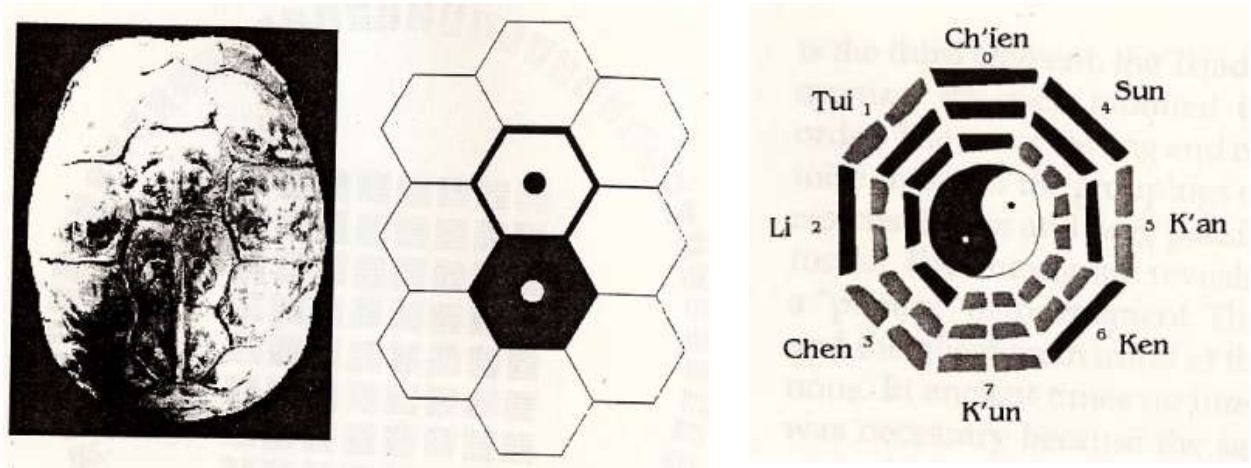
CMS II,1 *85 sealing from Ajia Triada, Tholos A*



CMS II,5 *71 sealing from Phaestos*

Ill. 2- 88: 3M Minoan stamp seals now in the Herakleon Museum, Crete (a notable earthquake area)

Returning to the Greek idea of Nemesis and the eight-spoked wheel, it is interesting to remember that the sounding box for Apollo's lyre was originally said to be a tortoise shell (more of this in another book). The inevitability of Fate was described by the legendary first ruler of China, Fu His, the inventor of the I Ching in 2825 BC, as the consequences of the pull and alternation between the polarity of Ying and Yang, summing it up diagrammatically by the use of the hexagonal tessellations of a tortoise shell with a black and a white centre surrounded by eight hexagons that sum up the principles of change in the universe – more familiarly canonized in the octagonal layout of the eight main trigrams in the image below right.



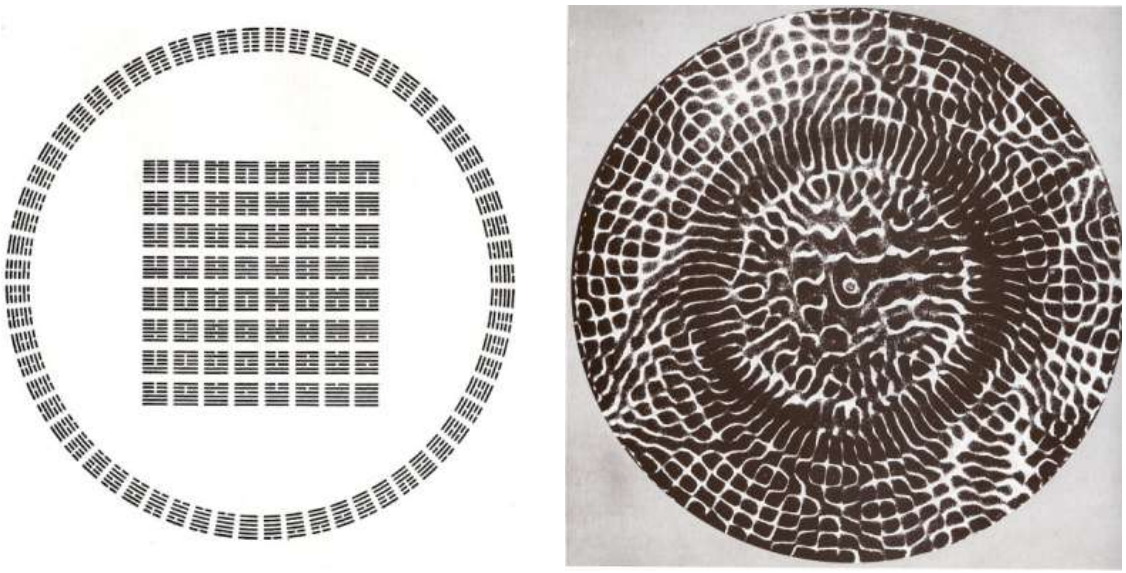
Ill. 2- 89: The I Ching system of divination, originally based on the inner octagon of tortoise shell facets

Confucius commented: *Change has an absolute limit: this produces two modes: the two modes produce four forms, and the four forms produce eight trigrams: the eight trigrams determine fortune and misfortune*.

It is in the Far East that Eight is particularly celebrated (8 is certainly a lucky number for the Chinese) perhaps because the Eightfold Path of Buddhism accords with it:

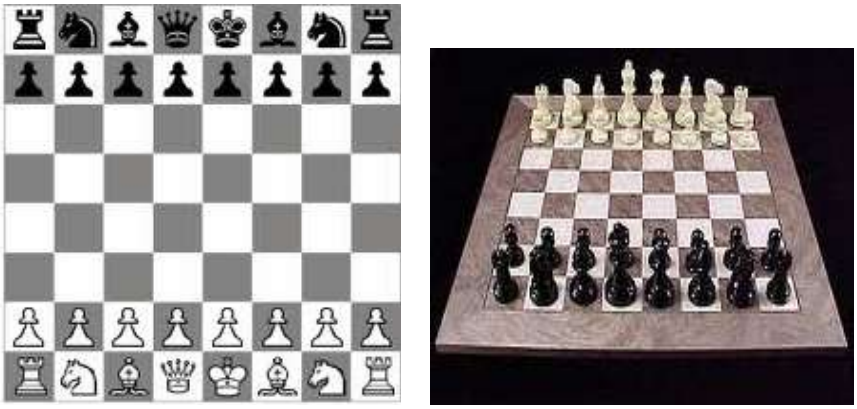
- ***RIGHT VIEWS***
- ***RIGHT INTENTION***
- ***RIGHT SPEECH***
- ***RIGHT ACTION***
- ***RIGHT LIVELIHOOD***
- ***RIGHT EFFORT***
- ***RIGHT MINDFULNESS***
- ***RIGHT CONCENTRATION***

This set of moral precepts is on a different plane from the dimensions of 8 used in the I Ching for divination to answer questions, where the Eight Trigrams are multiplied (8 x 8) to create the full complement of the 64 Changes to provide the ultimate number of possibilities. Similarly Hinduism allows for 64 Arts, or Rangas, ranging not only from singing to painting, or dancing to acting, but also covering a host of minor arts. These possibilities are nicely expressed in Jenny's detailed photograph latent with 4, 8, 16, 32 or 64 combinations.



Ill. 2- 90: The 64 changes of the I Ching laid out in an 8 x 8 square within their repeat as a circle (left), while Jenny 41 shows an inner square in the process of multiplying itself (right)

All this makes us look at the cosmic implications of chess, invented in the India/Iran region, which I leave to you to follow up if interested, since a huge amount of material is available about its manifold symbolism.



Ill. 2- 91: The 8 x 8 square chessboard whose pieces each have particular roles and allowed movements

Schneider writes, 'Modern science is finding this arrangement in fields as diverse as computer design and biotechnology, where investigations into the genetic code have revealed DNA to be composed of 64 'codons', or genetic 'words'. Eight being the quintessential representative of the doubling process, he points to an intimate interface between 7 and 8 in the following exercise that you could try yourself. Using a calculator (one that allows for many decimal places), divide 1 by 49 (= 7 x 7). The result is 'an endless decimal built on the process of doubling' - which you could go on filling in yourself – revealing a hidden eight-fold process going on, somehow linked to the sevens inherent in 49:

0.020408163264128256 etc.

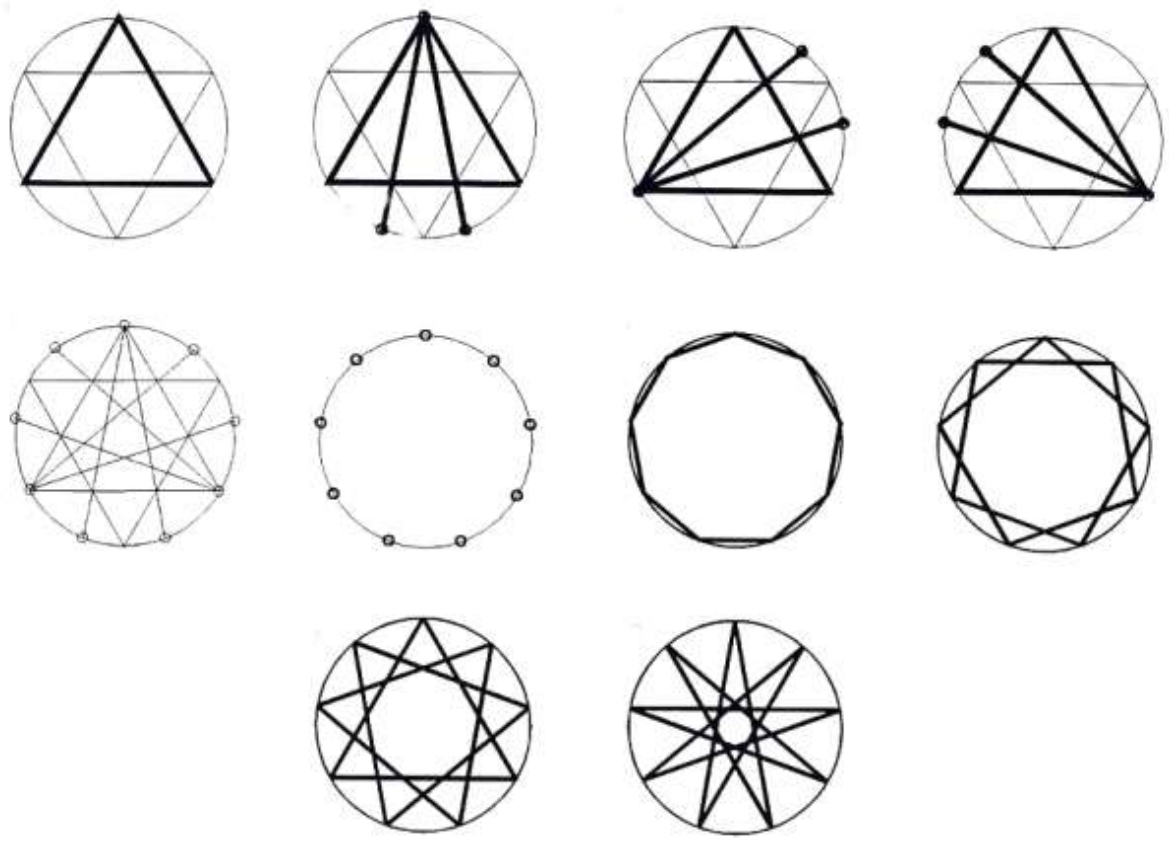
It appears to be something to do with 7 multiplied by itself, in the same way we have looked at 8 multiplied by itself as the outer limit of manageable doubling, as seen for the I Ching, Chess or DNA.

What now if we consider the next polygon up from eight, that breaks open its stability, yet is fully harmonic in its own way, being the triplication of the triangle (3 x 3) – the Nonagon (more correctly, the Enneagon).

THE NONAGON AND THE ENNEAGRAM

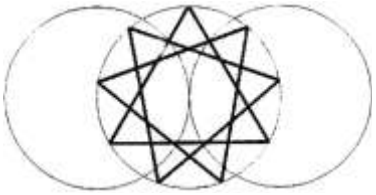
Nine multiplied by itself (9 x 9 = 27) was considered by Plato to be 'the Nuptial Number' – expressing completion in a good marriage and (arising as 9 does from the first progeny, the triangle) triply auspicious and yet still innocent (it ties in, too, with the π ratio of 27:2). Yet his account of the Nuptial Number in ***Timaeus*** is put forward in highly obscure terms in another of his mathematical myths - one whose lost code recent scholars have tried to crack - for it was taken for granted by Plato's peers in Classical times. After considering the nature of the Nonagon we will try to get some idea of what his myth is about at the end of this section.

First we should think about the metaphysical significance of number 9, or Nineness, because it is the limit of dimensions Number can reach before 10, the number Pythagoreans saw as a return to Oneness on a different level. There are many sayings and myths (conveniently collected together by Schneider) that express this: we say a cat has nine lives (the most it is possible to have); we pursue an issue 'to the nth degree'; that a woman is 'dressed to the nines', or that in terms of effort someone 'goes the whole nine yards' – all signifying the most complete outreach possible, and thus a state of full fruition or completion. This gives us a foretaste of the nature of Plato's myth, which is about the fullest extent the Universe can reach - and in miniature the fullest possible extent also of a human life.



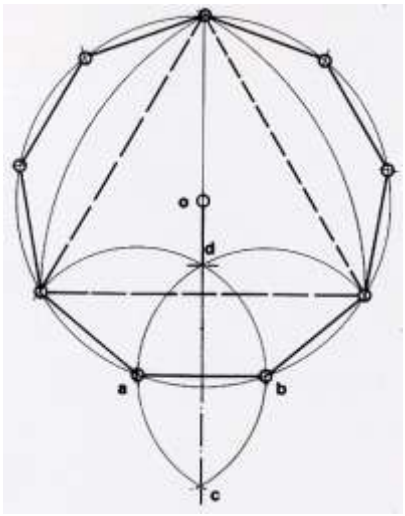
Ill. 2- 92: Manifestations of the nonagon showing the centrality of the initiatory triangle – from Schneider

The stages of construction and alternative stellations for the nine-sided figure above speak for themselves, some of which you may wish to draw out for yourself: they leave out the relationship of the Vesica Piscis beneath its construction, which is indirect, as below:



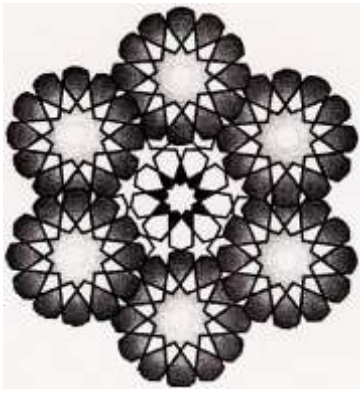
Ill. 2- 93: The nonagonal star, straddling two disjunct Vesicae – from Schneider

Keith Critchlow in ***Order in Space*** gives a fuller idea of the stages needed for its construction from intersecting circles, below. Remember, for reasons of space in the published book, not all circles or *Vesicae* involved are shown in full, so if you decide to draw your own nonagon from his method, use a very large piece of paper to allow room for them to appear in full! In essence, it derives from the top triangle of a large Vesica.



Ill. 2- 94: Method for construction the Enneagon – from Critchlow

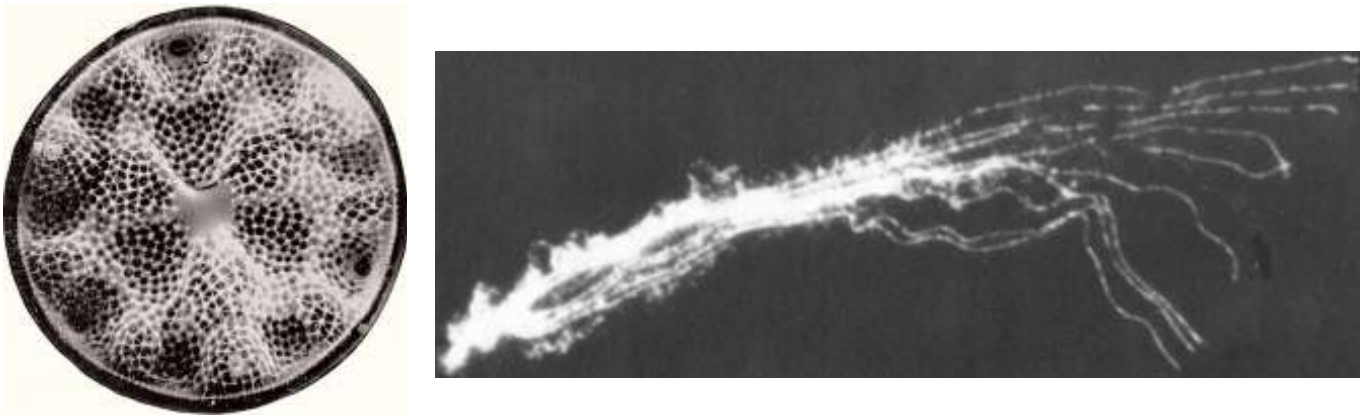
Patterns using the 9-fold net seem only to have been achieved in Islamic art, as below, where 5-pointed stars



Ill. 2- 95: A stellated Nonagon forms the heart of the Islamic tile arrangement above

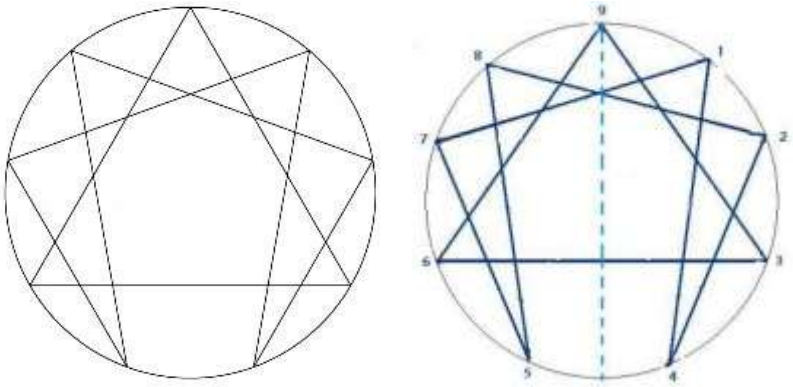
play a hinging role (the poet, Umar Khayyam, was famous as a geometer too, designing a variety of brick domelets for the Friday Mosque in Isfahan - see under Ardalan in the Classics Book List). Nine-sided figures appear in Jenny and Lauterwasser's experiments only as ephemeral phases on their way to the longer-lasting octagonal or decagonal shapes, and it is unusual to find instances of the use of the Enneagon in the arts of the ancient world. It was one of those polygons whose more esoteric dimensions were cultivated in secret in the pursuit of cosmological enlightenment – as in Plato's own case. In ancient China there were nine sacred rites, nine-story pagodas and nine classes of official: and at the ninth hour on the ninth day of the ninth month, the Double Yang, or 9 celestrial powers of Heaven, were specially honoured. In Plato, Diapason *is* the Double Yang.

Nine rarely appears in the structures of nature – but there are notable exceptions. Some diatoms, as below, are nonagons, whilst microtubules of the sperm flagellum are arranged in nine pairs round a central pair. On fertilization of the female ovum, as cell division begins it leaves its signature in the centriole which consists of a circle of nine tubes. We have heard of the ultimate whip, the cat o' nine tails, and we could understand the nine tails of the sperm as representing the only 9 possible dimensions needed for engendering. We are reminded, too, that it was the Hindus who used the system of just 9 digits and the zero, later known as Arabic numerals.



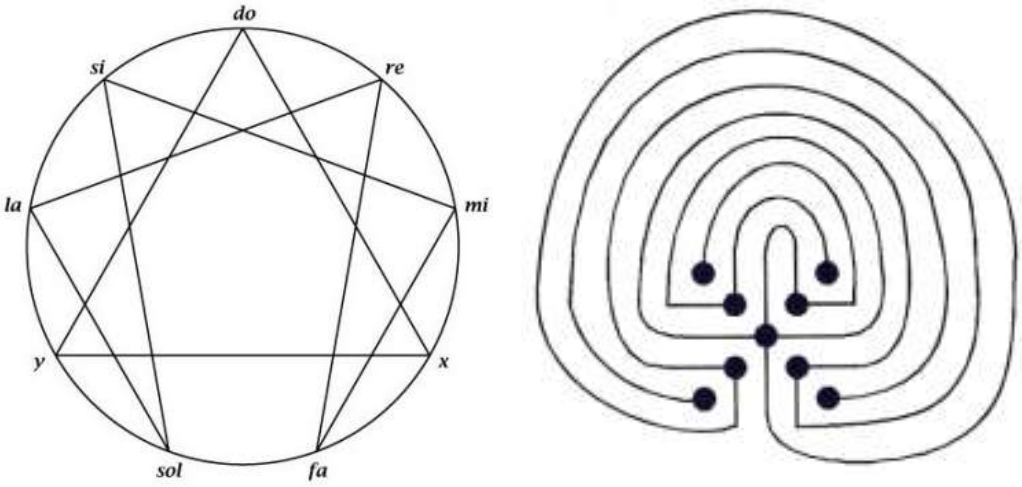
Ill. 2- 96: Unusual nonagon diatom – from IMAGES OF LIFE, Natural History Museum London (left); research photo showing the ninetail flagellum of a sperm cell (Proc. Nat. Acad. Sci. USA Vol. 85, April 1988 (right)

In Egypt (where even Plato spent time learning from its priests) it was canonical to describe the creation of the world as enacted by the Nine Gods of Creation (the Ennead): the pharaoh himself was described as 'coming forth from between the thighs of the divine Nine'. In Greece, the Nine Muses were considered by the followers of Apollo as almost more important than the Pantheon of The Twelve Gods (more about them in ***Book 10***, on ***Great Paintings***). Overall, Nine played a crucial, but hidden part in the Mysteries that dealt with those ultimate questions about how life's forms both manifest and then return to Source (Botticelli's ***Primavera*** is a painting with nine figures in it, intended precisely to enact as a drama that cycle of becoming and returning – ***Book 10*** will analyse it in detail). This is why 9 - and numbers or geometries related to it - plays a central role in Plato's Nuptial Number myth –picked up in Gurdjieff and Ouspensky's Philosophy system in the form of the Enneagram, used in their lectures to illustrate not only the workings of the Law of Three, but also the playing out of the



Ill. 2- 97: Versions of the Enneagram which emphasize the birth triangle separately from the other seven points - but numbered in sequence clockwise and completing at 9 at the top - the point marking the axis of division into active and passive halves.

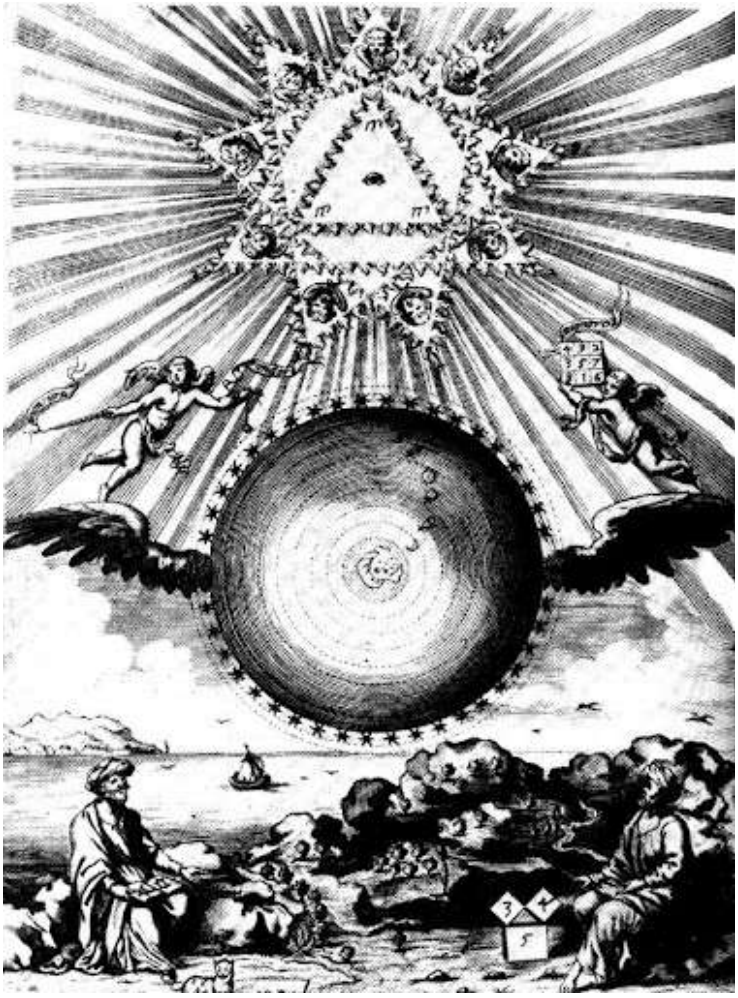
seven notes of the octave (as drawn out below left) in any process or event in life, which they saw as requiring two energy shocks from an outside agency at the semitone gaps (one active, one passive – ***x*** and ***y*** in the diagram) for the process to complete - making 9 stages in all (a new input of energy would also be needed to start a new octave). This was one of the more genuinely valuable applications of the Enneagram (which



Ill. 2- 98: Enneagram as the seven notes of the octave with two shock input points at x and y (left); labyrinth drawn from nine dots with left and right halves (right) – compare later with the Chartres Maze (Ill. 2- 107)

Gurdjieff claimed to have learned from a Central Asian master but, being such a trickster, could well have swotted up from a more prosaic source - even Plato's own writings. It is certainly true that there are moments in carrying out a project where a renewal of motivation by a teacher (active) or other factors as simple as having a good night's sleep (passive) are needed if a plan of action is not to be given up half-way. The Enneagram is widely used in the US now by Ouspensky groupies as a management tool to analyse human types. You will have noticed how Nine can also be expressed as a box of 3 x 3 squares or dots (see ***Ill. 2- 73***.). Arranged in a square cross of four triangles as in the illustration above right, the nine dots are the foundation for the best-known type

of labyrinth - where at every dot the pencil takes alternative left and right turns, giving a figure with an axial arrangement similar to the Enneagram, and reminiscent of the left and right halves of the brain.



Ill. 2- 99: Kircher's engraving of Plato's mathematical myth about the Nuptial Number

We finally return to Plato's coded mathematical myth about the Nuptial Number. In the 18C, mystics of Kircher's calibre were evidently aware the myth was woven round the Nonagon and the numbers 3, 9, 27 and the much higher numbers engendered from them – since his engraving above features an elaborate Enneagon in the sky, framing the inner triangle. The flying angel on the right holds the magic square for nine which has the

4	**9**	**2**
3	**5**	**7**
8	**1**	**6**

Ill. 2- 100: The numbers 1-9 in the 9-cell magic square, arranged to add up to 15 in each direction

numbers 1-9 in three rows of three (the digits in each parallel row or diagonally add up to 15), and the man on the ground to the right holds the Pythagorean 3-4-5 triangle - which also features in the myth. We cannot go into the wording of the myth and its number riddles in its full complexity here - for that please read James

Adams' ***The Nuptial Number of Plato*** (with an introduction by Keith Critchlow and published by *Kairos*) – but we can give an overview of Plato's main concerns, which centred on how the World was created and what constituted the ideal society and government to save it from decline. For this he saw it necessary to calculate both the length of the Life of the Universe and formation of a human and - with a nod to the Nine Muses and special mention of the gestation period for the human embryo (nine months) - after all his calculations (in essence revolving around the figures featured in Kircher's engraving) he came up with the sexagesimal totals (probably Zoroastrian in inspiration – see footnotes 6 and 7) of 36,000 years and 36,000 days respectively, concluding the *un*ravelling of the universe lasted as long again. The mathematics is cryptically given, without geometric figures, as would have happened in live discussion with his fellow Academicians. What he identified as the consequences of the fundamental interplay between the Same and the Different - the diapason/Ying Yang - his calculations mean the World will start all over again every 72,000 years.

As regards human society, he argued that right timing (*kairos*) on the part of *worthy* parents for the conception of babies was crucial if humans of high quality - thus a well-run State - were to be fostered. Due to the double process in creation of fruition and of decline, so conception should happen at fertile moments in the human *and* World life cycle - not at points of barrenness that produce degenerate beings who infect society and its government. If unworthy parents - who have ignored fine music and gymnastics - are allowed to procreate, even with right timing their progeny will cause degeneration. If barren timing (in both the cycle of the World and of human life) come into play, then society breaks down (today, this has not been preventable!).

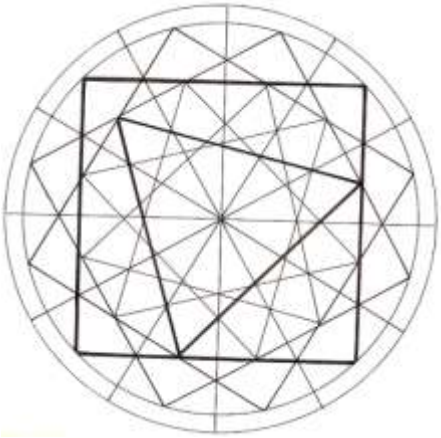
Because of Plato's convoluted presentation of his case, no wonder people in later generations have struggled to get at the fairly simple numbers actually involved – for our purposes we should simply be aware that the myth revolves around 9 and its left-hand and right-hand movements - which Gurdjieff fully understood. Nine does not lose its identity easily: the digits making up the product of nine multiplying any number will always add up to nine (e.g. 3 x 9 = 27 = 9). Any fraction in ninths can be expressed as recurring decimals, as follows:

9/9 (= 1)	**0.9999999**
8/9	0.8888888
7/9	0.7777777
6/9 (= 2/3)	0.6666666
5/9	0.5555555
4/9	0.4444444
3/9 (= 1/3)	0.3333333
2/9	0.2222222
1/9	0.1111111

Nine behaves in a magical and meaningful way quite distinct from the other numbers, lying at the heart of the realities – and mysteries - of Life, Resurrection and Eternity, giving a sense of completion and completeness.

TWELVE, THE ROUND TABLE OF THE ZODIAC

The twelveness of the dodecagon is closely associated in most people's minds with the twelve months of the year, the twelve signs of the zodiac – and also with Christ's twelve apostles and Arthur 's knights of the Round Table. It is the first polygon to reconcile triangle and square, since 4 x 3 = 12. Its relation to the Vesica Piscis is shown in Critchlow's master diagram for the polygons in ***Ill. 2- 15***. The stellated version can be made by spinning three equally spaced squares round the same centre - or four triangles nesting inside - as below.



Ill. 2- 101: Counterpoint between square and triangle in dodecagon construction already discussed in relation to the usual incompatibility between square and triangle (Ill. 2- 62) – Josephine Munthali after Critchlow

In fact, the first pattern in this book (***Ill. 2- 2***) uses stellated dodecagons as its hubs. As it is one of the most accommodating shapes for fitting around it triangles, squares and hexagons, it is not surprising that Plato particularly favoured the ratios 9:12 and 12:16 due to their inclusiveness of most 3 and 4 whole-number ratios. This kind of interrelationship of 2/3/4 and 6 and their multiples perfectly illustrates how harmony can be achieved if the right centre and right angles are found: the same in diplomacy and international affairs!

THE HEART CHAKRA

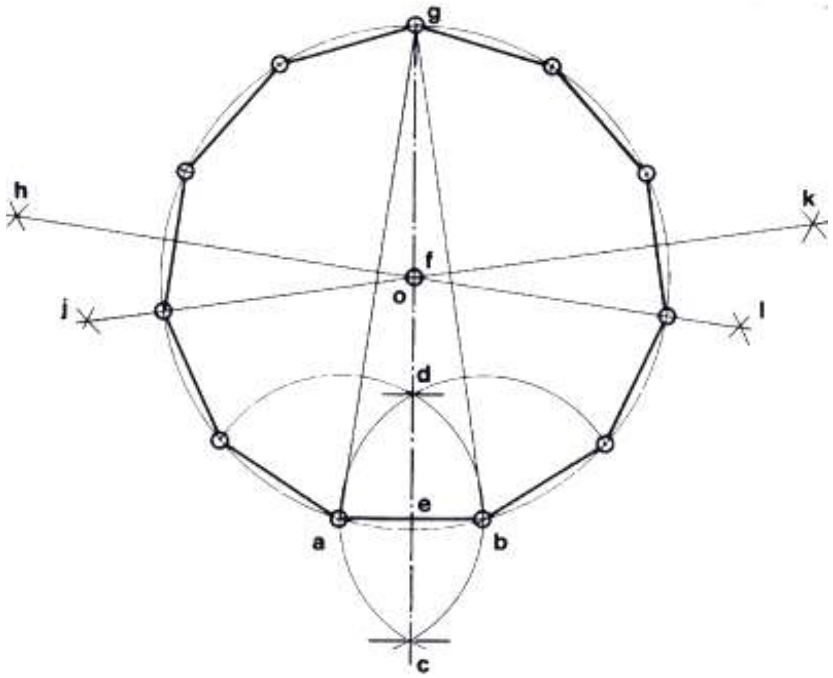
Ill. 2- 102: The twelve-petalled heart chakra Anahata

The twelve-petalled chakra in the Indian Yoga system stands at the heart centre and, being divisible by 2,3,4 and 6, the heart should be the chakra most interconnected to all the others. The painting of the chakra above particularly spells out at its centre its loving interrelationship with the six-fold sex chakra - reminding us in passing that the dodecagon can also be created by drawing out a second hexagon over the mid points of the first. Also implicit is the linkage between the 'Eye of the Heart' and the Third Eye of the Intellect (the two-petalled Brow chakra) – and of course to the four-fold Root chakra. The heart chakra can be experienced as a miniaturized zodiac within the human body, just like the stellated dodecagon in the pattern web, drawing in experiences, emotions and knowledge from the different levels and fitting them together. As with the other chakras, each petal is associated with a particular syllable, all of which end in 'm', or a hum, thence also associating it with the sixteen-petalled throat chakra through resonance.

At this point we will go no further in exploring all the implications of the dodecagon until we have enough room to do so in full detail in ***Book 7*** on ***Astrology and Colour*** (which also brings in semi-tonal music). We can, however, look quickly at the special properties either side of it of the 11-sided and 13-sided polygons.

THE ELEVEN- AND THIRTEEN-SIDED POLYGONS: CHARTRES MAZE

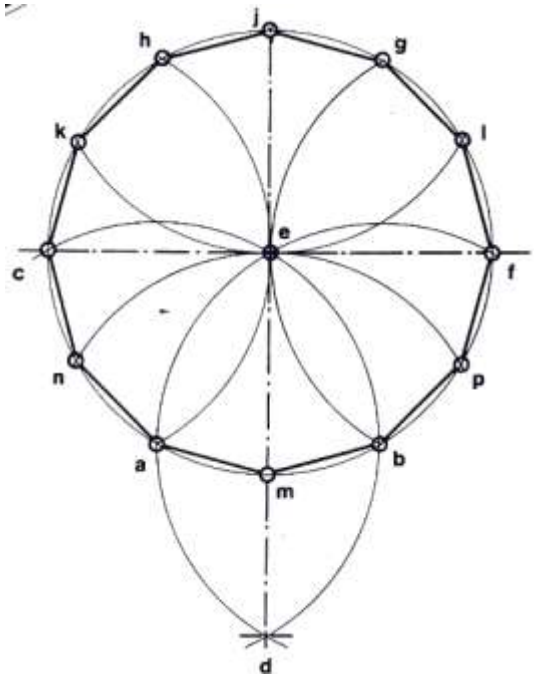
Eleven and thirteen come into play in Astronomy in particular in the process of squaring Solar with Lunar years, as the number of months just short of, or just beyond, the twelve-month Solar Year of 365¼ days. Below is Critchlow's construction for the eleven-sided polygon, 11 being a number significant for Chartres Maze.



Ill. 2- 103: The eleven-sided polygon – from Critchlow, Order in Space

Unless you need it for something specific I would not spend time trying to construct it: what is more important is to get the general idea that in myth, eleven out of the dozen are secure, whilst the final integrity of the

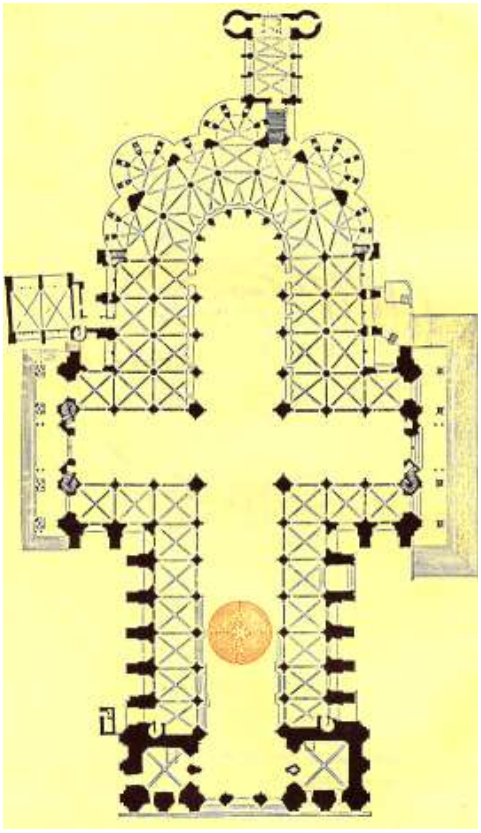
twelfth is open to doubt – hence Judas Iscariot is the twelfth disciple who betrays Christ, and Lancelot takes Arthur's Queen Guinevere. This is connected to the fact that sometimes an extra month had to be intercalated into the twelve-month year, as the thirteenth month (when enough 'bits left over' added up to an extra one).



Ill. 2- 104: The thirteen-sided polygon – from Critchlow, Order in Space

What this means is that often the dodecagon is too regular for the realities of existence. Thirteen (Keith Critchlow's construction is given above) is again involved in the same two cosmic stories, and really only unlucky if not understood - for it is the overlooked centre of the zodiac, where Christ or Arthur (the Great Bear) is seated as the Axis around which the Twelve Disciples, or Twelve Knights of the Round Table, revolve. In the ancient world, judging the accurate insertion of a 13th month to the year was also specialialised knowledge known only to an élite. The Sun and Moon's positions against key stars help to measure when to put the Year back on track on a fixed starting point (the 0° meridian) against the sky – which is aligned to bright stars such as Sirius, Orion, Aldebaran or the Great Bear. So a fuller understanding of the astronomical implications of both 11 and 13 and their polygons (as also the dodecagon just mentioned) needs to wait until ***Book s 7*** and ***11 -*** but we can make a beginning by seeing 13 as *the number of fine-tuning* – and to gain an sense of the special qualities of both numbers we can look at the crucial part they play geometrically in the Chartres Maze.

Jane Carroll and L Vaughn Lee, with the help of Keith Critchlow on the geometric side, discovered that Chartres Cathedral has measurements and numbers in it that are calendrical. Firstly, the west end towers are of different heights (unusual in cathedrals) – one has a lunar windvane at the top, and is 28 feet lower than the higher, right-hand one (365 feet high) which has a solar symbol on its weather-vane. In other words they are meant to represent the difference between the lunar and solar years. When the solar tower is, as it were, hinged down (as if cardboard) onto the ground plan, they found that it fits exactly into the length of the nave.



Ill. 2- 105: Ground plan of Chartres Cathedral and position of the Floor Labyrinth in red

Between the two towers of the West End is a twelve-fold rose window: again they discovered that if that façade were hinged down over the nave, the stellated dodecagon tracery would overlay the maze on the floor of the nave. The maze consists of 11 concentric paths inside 12 circles which the writers considered exactly corresponded to the cosmology of the Chartres School of the 7 planets, the zodiac, and three divine circles:

Ill. 2- 106: The cosmology of the eleven rings of the Chartres Maze precisely relate to Macrobius' Commentary on Cicero's DREAM OF SCIPIO - in the Chartres Library

After trial and error with the measurements of the sides of several odd-numbered polygons (illustrated in their little booklet) Keith Critchlow was able to determine that the *width* of the paths of the maze could only have been based on the side of a hidden stellated 13-sided polygon at its centre (picked out in red below) - allowing the inner hexagon open up to allow a path for the traveler to enter the maze and follow all its convolutions.

Ill. 2- 107: Chartres Maze, centred on a stellated 13-fold star – Critchlow, RILKO Occasional Paper 1, 1975

We are reminded that every year there is a slippage between the Lunar and Solar calendars of 11 days and 12 nights (hence our celebration of Twelfth Night). Muslims who fast for the lunar month of Ramadan notice how as the years go by, that month gives them 33 different experiences of the fast as it slips back through summer and winter, long days and short days – some difficult, some easy. All the tiny little half circles all the way round the fringe of the Maze add up to 4 x 28 = 112 cusps, corresponding to four months of 28 lunar days (two more cusps are lost at the entry point).

If you follow the route of the labyrinth with the point of your pencil, entering at the bottom, it can be surprising to see how the journey takes you almost to the centre straight away, but then follows the twists and turns of the journey (there are 13 semicircular sections to the journey picking out its own particular spiral). Although the

traveller is taken in and out from the centre, after a convoluted journey through the spheres finally the centre is reached, and if he or she then turns round to look back at the original entry point, above them they will see the rose window raining its colours down on them in a double epiphany.

I would not spend time struggling to construct the thirteen-sided polygon: you would do better to execute the ritual of walking the maze at Chartres Cathedral (strictly a labyrinth, since there is only one path to the centre) whose construction, as we have seen, Critchlow saw was seeded in the invisible stellated 13-sided polygon at its heart, pushing the hexagon into a heptagon and breaking apart the symmetry of what would have been a dodecagon, to allow a vaginal path to the centre – the ultimate goal of the maze-walker. Walking the maze was considered as meritorious - and as enlightening - as making the pilgrimage to Jerusalem. None of this geometry is surprising when we consider the known fact that Chartres cultivated a school of Pythagorean Geometry, picking up on Neoplatonic works preserved in the Classical manuscripts held in their library (Macrobius considered Cicero to be a Neo-Platonist).

PAUSE

We have had a surfeit of geometry over the last a few pages, so pause for a moment, and leave this book for a few days - or weeks even. After all this analysis drop it from you mind and do one of the following:

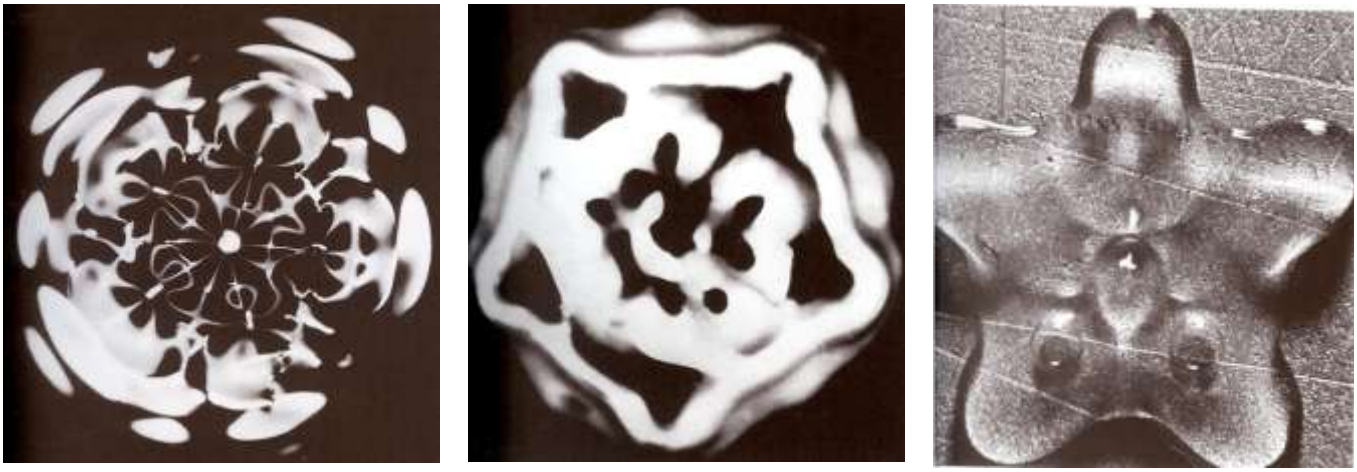
- ✪ Walk out into the garden and see if you look at things differently;
- ✪ Sit silent in a darkened room and listen to the Silence;
- ✪ Sit comfortably in a quiet place and really listen to a Bach or Mozart sonata;
- ✪ Walk round your house with bunch of grass or shaman rattle in your hand and clear it of bad vibrations.

END OF PAUSE

We have reached a watershed where we have by now covered all the numbers and their geometric forms - except 5 and 10. We now deal with these – and their involvement in the Golden Section, and Spirals.

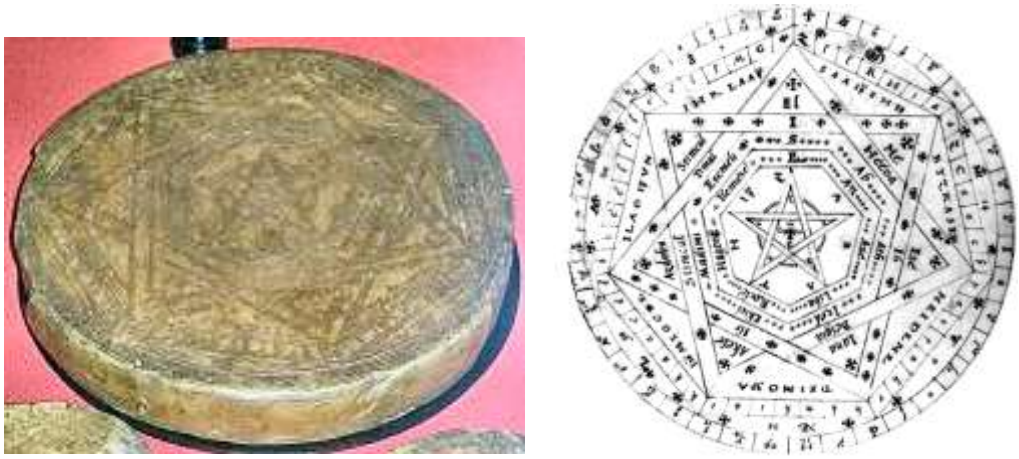
THE PENTAGON AND THE GOLDEN SECTION

The proportions of five-fold structures have a special harmonic quality. As with triangle and square, Jenny took photos of pentagonal shapes emerging as the result of the action of sound on matter, and how in one case (with glycerine) the way the substance fluctuated mimicked the process of flower formation (notice the smaller florets running off the main pentagon, below left). Its effects on mercury and water are more architectural:



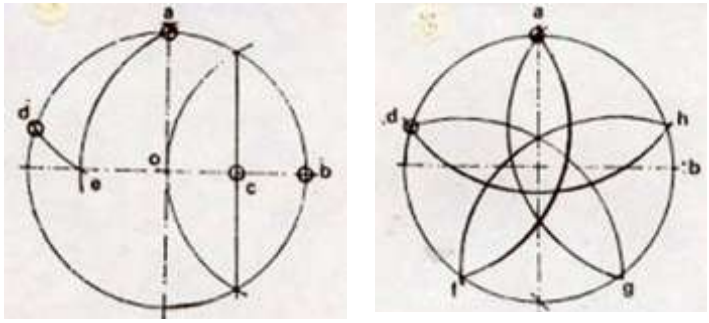
Ill. 2- 108: Pentagonal effects of sound on glycerine, mercury and water on a leaf (Jenny ills. 44, 119 and 77)

In former ages as much mystery used to shroud the construction of the pentagon as of the Vesica and was - and is - beloved of the magician as offering special protection – even when ignorant of how actually to construct it! The British Museum now displays John Dee's gold amulet with star pentagon inside a much larger star heptagon, called by him 'The Seal of God's Truth' – and it is a mark of the average occultist's knowledge that although the stronger shape is the heptagon, they always call this design a 'pentacle'. It was in fact well-known amongst practitioners of the occult as allegedly allowing them access to all levels of the divine as far as the Archangels, and Dee said it was first revealed through his medium, Edward Kelly:



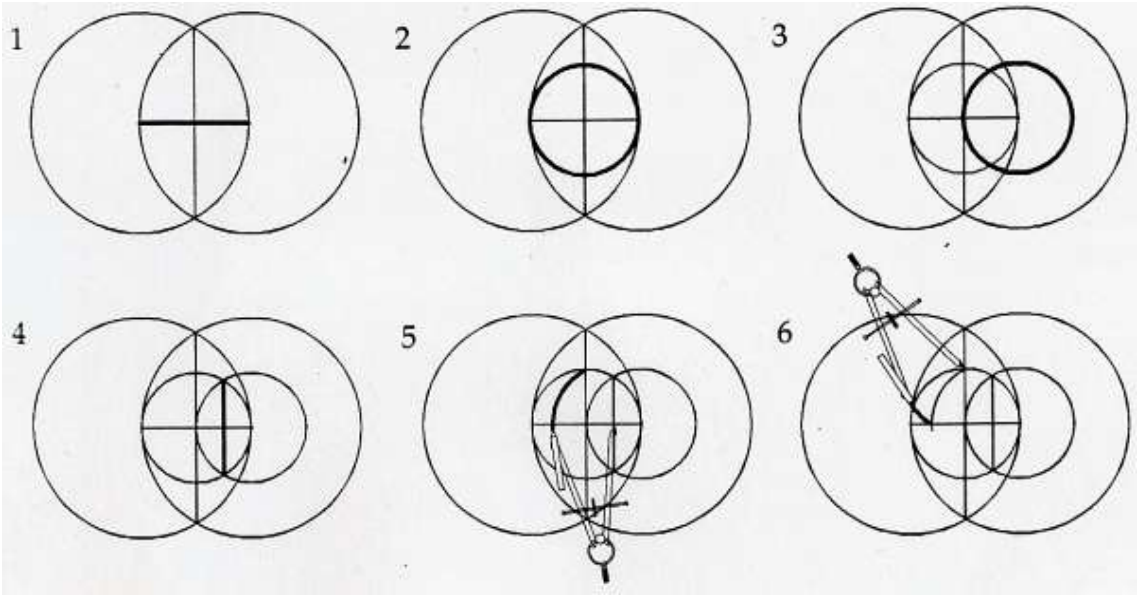
Ill. 2- 109: John Dee's Seal of God's Truth, with clearer drawing of the design, involving letters, numbers, the names of angels and made-up magical words – British Museum

For the ancient Egyptians the hieroglyph for the *Duat*, or Afterlife was ✳. Ghyka (another cult author of the Sixties/Seventies in the Classics Book List) writes, 'Hippocrates of Chios is reported to have been expelled from the Fraternity for having divulged the construction of the pentagon'. We now know, as ordinary mortals, that it is easy to construct and, although special, that there is no reason to make a big deal about it. Deriving a pentagon without measurement from a Vesica Piscis (in fact, it is the ratio of the half-size, smaller vesica against the original one that is the key) requires a few more moves than for making triangles or squares, and each step must be done accurately - there is nothing worse than a lop-sided pentagon! The rough diagram below gives the main essentials, the key move (with the compass point at **c,** the half vesica point) being to swing the pencil end from **a** down to **e**, and then with a new radius **a-e**, to swing it up to **d** to get the length of one side.



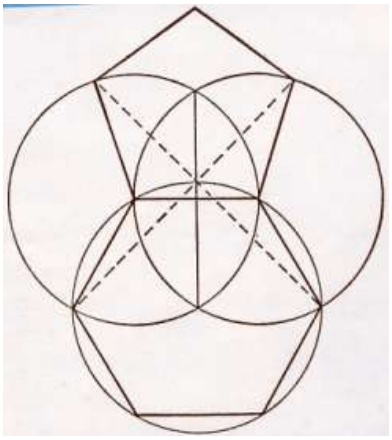
Ill. 2- 110: Overall view of the pentagon constructed from the Vesica Piscis

To clarify we give below Schneider's step-by-step version to guide you if you would like to have a go yourself. You will need to adjust your compass radius at each stage, and it is that final small arc in step 6 (**e-d**) in the previous diagram) that marks off the first side of the pentagon, from which you then can go round the circle with your compass plotting the corners of the other sides, in the same way as we do for a hexagon.



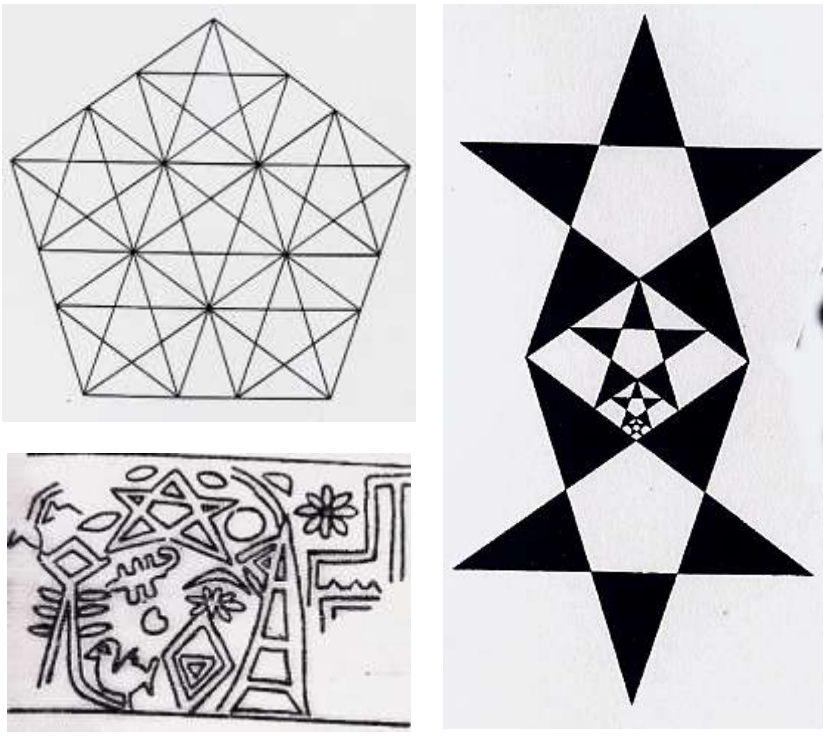
Ill. 2- 111: Separate stages for constructing a pentagon from the Vesica Piscis – from Schneider

It is also possible to arrive at a more or less accurate pentagon via the side of a hexagon, as below:



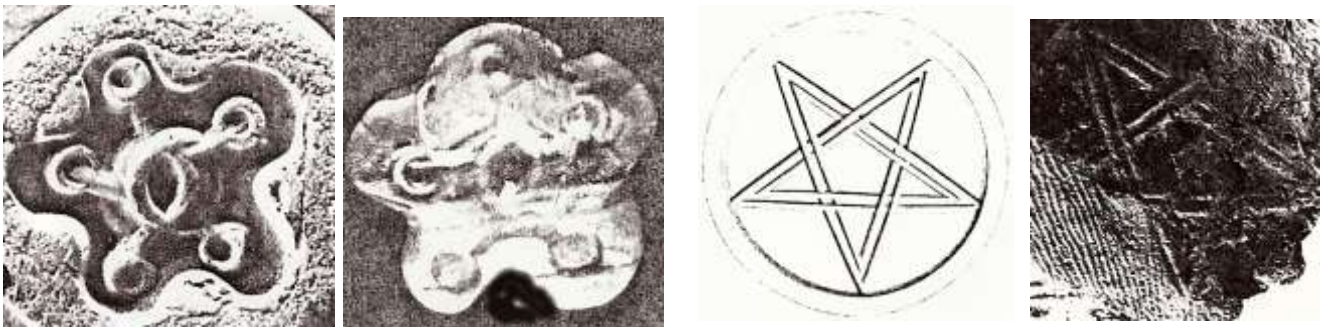
Ill. 2- 112: The pentagon generated from the side of a hexagon – from Lawlor

Extending the sides of the pentagon gives a stellated version of itself which goes on repeating in a pentagonal net if lines are extended to the edge of the page. Drawing the inner diagonals within the main pentagon creates smaller duplicates of itself which go on *ad infinitum* in a fractal process (we look at fractals with spirals



Ill. 2- 113: Nesting stars emerging from the pentagon - from Schneider - and protohistoric stamp seal design

anon). Note also how pentagons can be fitted into the octagonal net in the mihrab of the Sultan Hasan mosque in Cairo (***Ill. 2- 81***) – perhaps a reference to the Five Prayers of the day! I find it intriguing that as early as the 5M BC someone in southern Iraq roughly drew out a five-pointed star on a seal, as above, and that in the 2M the Minoans had no trouble in producing a geometrically precise pentagon or five-star on their tiny stamp seals:

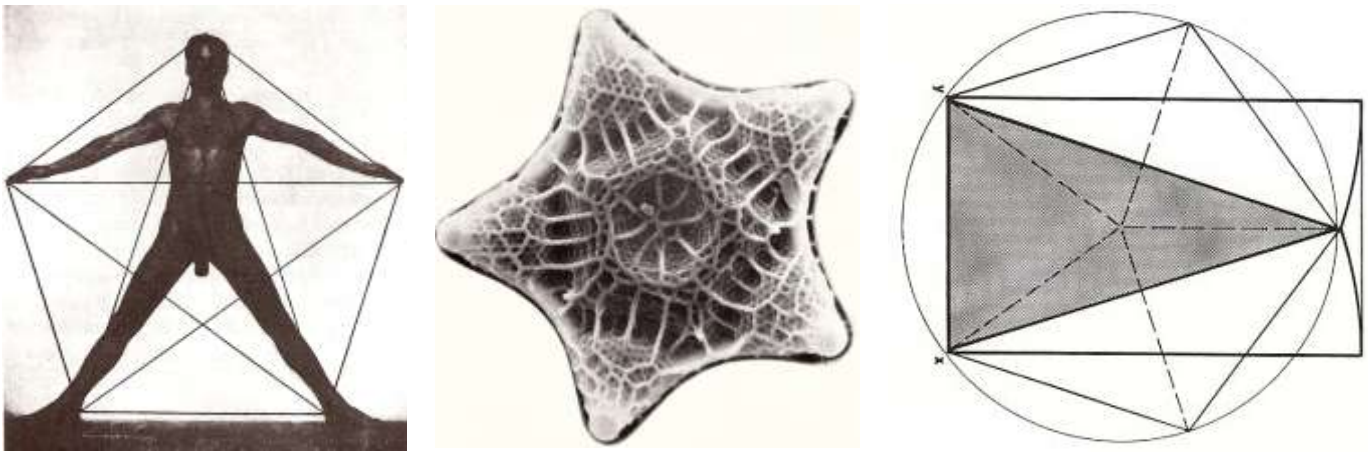


CMS *Cabinet des Medailles Paris no.30 (sealing and seal, sardonyx)*

CMS II,5 *no. 151 from Phaestos (drawing of sealing on clay)*

Ill. 2- 114: Pentagonal designs on 3-2M Minoan seals

Due to its association with the planetary cycle of Venus, Goddess of Harmony, we will come to understand from later books how the five-pointed star finds its way onto many national flags (from Muslim to Communist, and beyond) whilst the pentagon gives the structure for such symbols such as the Tudor Rose. The pentad is so crucial to plant and animal structures that we give them two separate books (***4*** and ***6***). The reason for this is



Ill. 2- 115: The human form fits the pentagon (Lawlor) and a diatom (magnified) – from IMAGES FROM LIFE

that within the triangle of any inner or outer pentagonal star (above right), the proportions between long and short sides are in Golden Section ratios. In other words, the shorter length line to the longer section is in exactly the same ratio as the longer part to both parts taken together as the full line length. This is the Golden Section ratio, found in play throughout the natural world - seen in the human examples illustrated above and below.

THE GOLDEN SECTION

We have looked at Pi already (the Greek letter π, as opposed to the one used for the Golden Section, Ø Phi!). We have also looked at the irrational ratios connected to triangles and squares. In metaphysical terms, π and Ø operate from a higher order of structure than that of the whole-integer and root number string length proportions governed by the sides and diagonals of regular polygons. Ø in particular has beautiful interlocking

properties, since, to repeat, it is a ratio whereby a line is cut at a point along its length such that the shorter to the longer is as the longer to the whole - a proportion considered by the Greeks to be Divine.

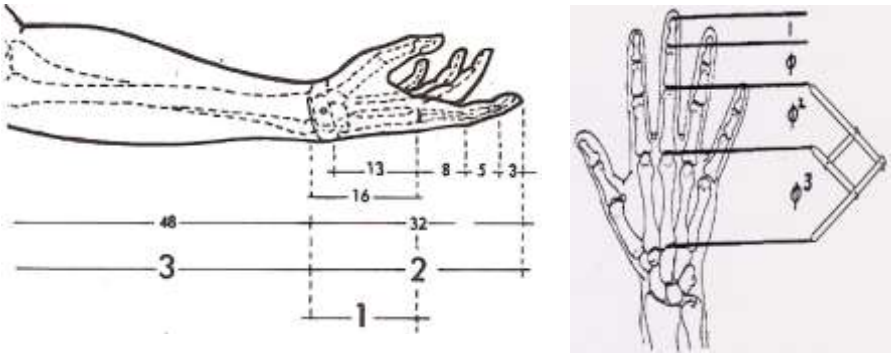
A = 0.618 B = 1 C = 1.618

----------A----x----------B----------

----------C----------

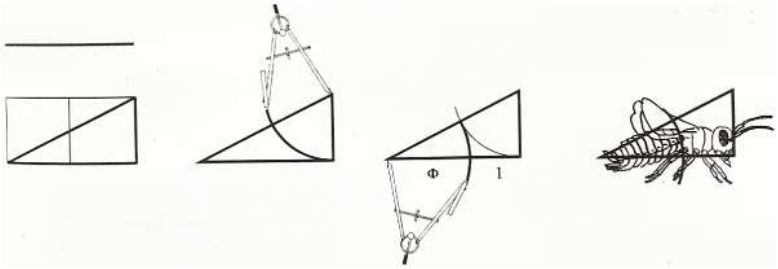
A:B = B:C = Ø (Phi, the Golden Section), or 1:1.618

Just one human limb such as the arm, manifests it at major and minor levels – so the hand on its own has several Ø ratios in its own right. It shows up everywhere in insect proportions, as in the diagram following.



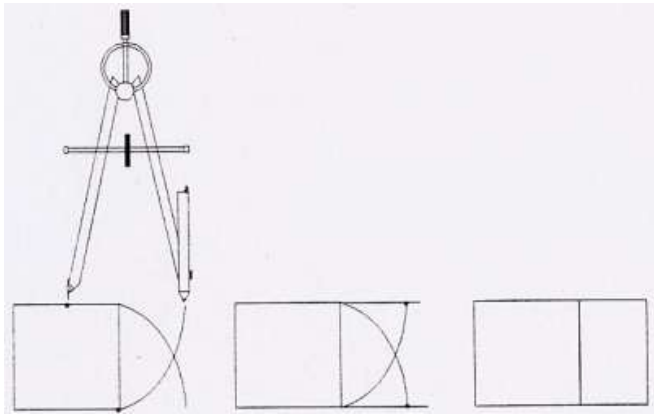
Ill. 2- 116: The Golden Section divisions of the arm, hand and fingers in relation to each other

If we need to divide any line at its Golden Section point, Schneider usefully summarises the three critical steps, whereby a double square is first constructed on that line (in passing, this neatly demonstrates the relationship between √5 and the Golden Section):



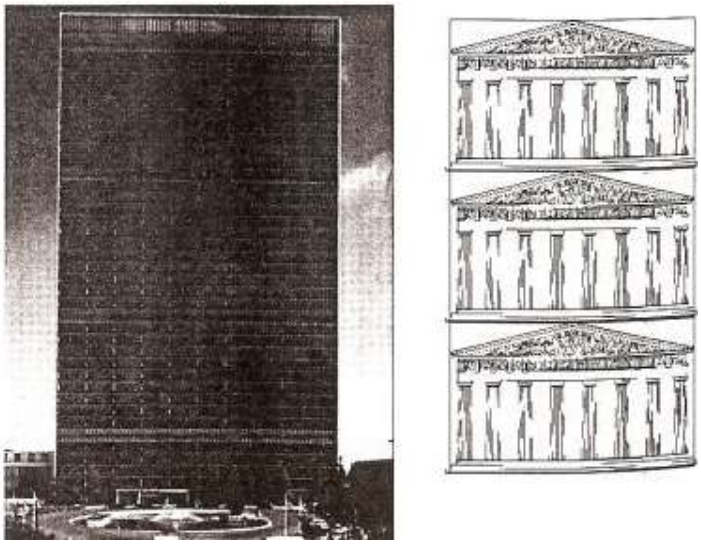
Ill. 2- 117: Dividing a line at the Ø point – just as the thorax for insects is divided from abdomen at that point

We spend much of our lives staring at screens, reading books or writing on sheets of paper – all are rectangles, some more pleasing to the eye than others (see ***Book 1, Ill. 1-13***). Having already looked at the main irrational ratio rectangles (***Ill. 2- 40*** and ***Ill. 2- 78***), what if we wanted to draw a rectangle with sides at the Golden Section proportion, rather than using a whole number contrast such as 8:5 or 3:2, or one of the root rectangles? We could construct a pentagon and take it from there, or simply follow the steps given by Schneider in ***Ill. 2- 117*** above from a given line. But a common way is to proceed from the midpoint of a square, as below:



Ill. 2- 118: The conventional construction of a Golden Rectangle – from Schneider

A beautiful example of a deliberately chosen Golden Rectangle as the underlay for a design is the United Nations building in New York, visualized as three Parthenon fronts (also Golden Rectangles) piled on top of each other!



Ill. 2- 119: The United Nations Building in New York made up of three Parthenon fronts (all ϕ Rectangles)

The value of Ø as 1:1.618 was discussed by the Rev. John Graham in a lecture given in Edinburgh in 1876 called 'Rediscovering the Golden Mean', the word 'gold' being an age-old allusion to Phi's miraculous synthesizing power. He called it a rediscovery because over the previous century or longer, it was in danger of being completely forgotten. In whole number terms the series of jumps from one golden interval to another is approximately expressed by what is known as the Fibonacci Series - after the Italian in Pisa who drew attention to it at the onset of the Renaissance:

1, 1, 2, 3, 5, 8, 13, 21, 34

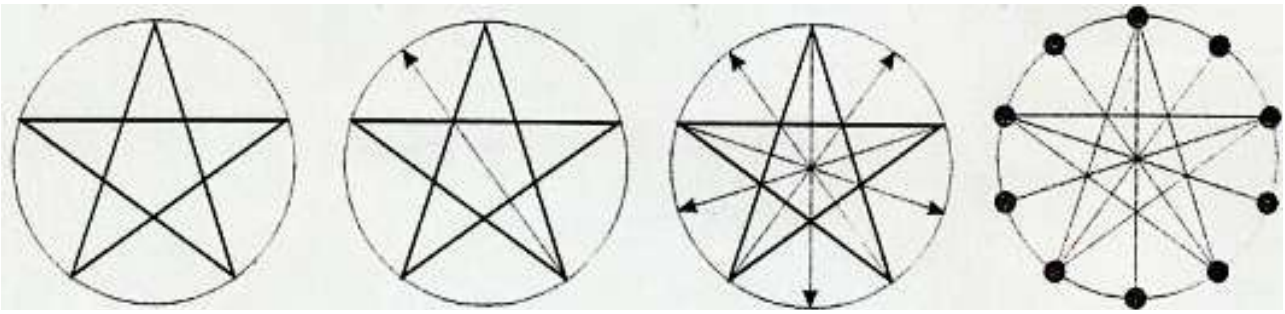
and so on, where 1 and itself makes 2, 2 and 1 make 3, 3 and 2 make 5 – the next figure always emerging from the addition together of the previous two numbers in an overlapping progression. Write out the Fibonacci

progression for yourself up to 144, which is the twelfth term in this series and a significant figure cited in the Bible, in Gematria and architectural theory. The progression nicely reveals the nature of the Golden Section as a series of interleaved intervals doubling back on themselves in a process of one step back, two steps forward. Even in the rule-of-thumb Fibonacci progression the ratio of each number to its neighbouring number approximates 1:1.618. Suffice it to say at this point that it is this property of measure that makes organic life possible, for it is rarely found in the atomic or crystal structures of the 'inert' and static building blocks of Earth's minerals. Le Corbusier thought it would be more useful for guaranteed beautiful architectural design (see ***Book 11***) to make a tape measure marking off the Fibonacci intervals rather than the feet and inches, or centimeter/metres of the usual measuring rods - though modern architecture overall has shown itself to be horribly ignorant of harmonic proportion, with consequent deadening effects on society.

We leave the Pentagon and the Golden Section at this point, since it will pop up in a wealth of specialized examples in the detailed scrutinies of later books. However, we should look at what happens when the pentagon is doubled on itself as the oft-appearing dodecagon, a figure also full of promising Golden Sections!

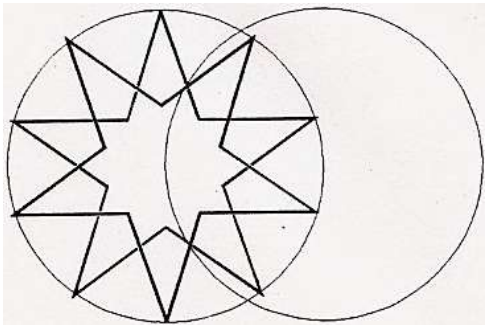
THE DECAGON GOLDEN HARMONIES OF FIVE AND TEN

The decagon, or ten-starred/petalled vortex is produced by drawing a second pentagon half-way round the first using the same centre, in the same way an octagon is based on a square.



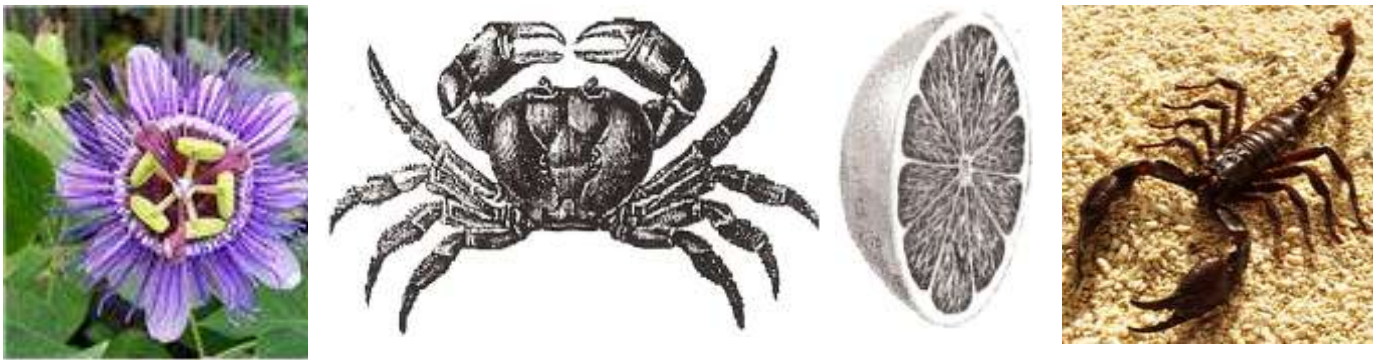
Ill. 2- 120: Construction of the Pentagon – from Schneider

Its relation to the Vesica Piscis is not straightforward, which cannot be used as a starting point without first making all the preceding moves needed to construct the initial pentagon:



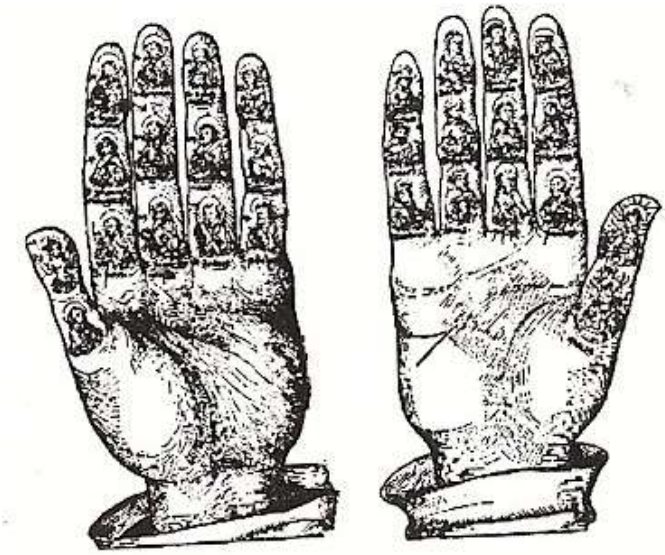
Ill. 2- 121: The Dodecagon in relation to the Vesica Piscis

Its occurrence in nature is rare, but always obvious, the commonest examples being in the passion flower, the grapefruit and 10-legged crustaceans/scorpions where the front pair are specialized as pincers:



Ill. 2- 122: Tenfoldness in plant and animal life

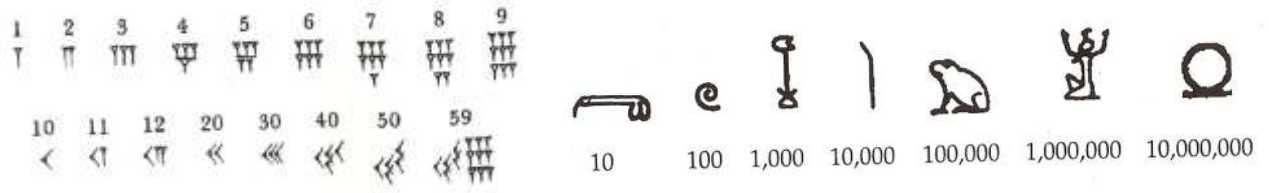
Looking at the nature of the number ten, there is no doubt that throughout man's history, fingers and thumbs have been used for counting, and that there is some natural basis for a decimal system apart from its artificial nature as introduced by Napoleon - possibly inspired by the use of decans in ancient Egyptian astronomy. We are reminded by Schneider that deca derives from the Indo-European *dekm* meaning 'two hands':



Ill. 2- 123: Engraving showing 28 Catholic saints remembered on each joint of both hands

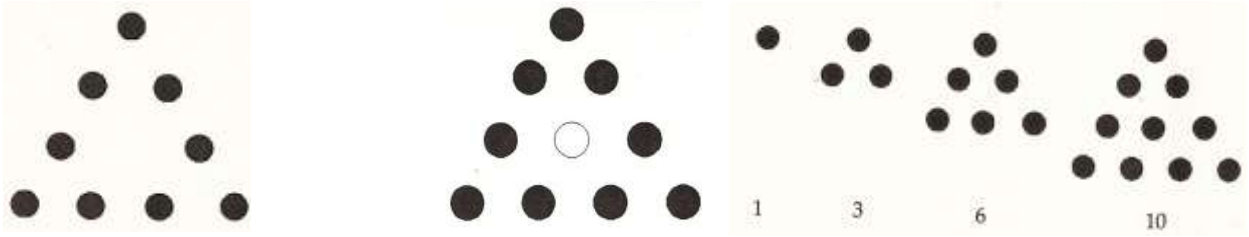
(Less often realised is that the joints of each digit have also been used in counting, giving twelve on the four fingers and two on the thumb, adding up to 28, again a lunar number: we devote an entire book to natural measures in ***Book 12***.).

Even in language we talk in terms of decades, centuries and millennia – or of situations being 'ten times worse', or 'ten times better'. When we look at ancient numbering systems, it is interesting to see how at every increase of a power of 10, a new symbol is assigned, as in the Mesopotamian and Egyptian systems below:



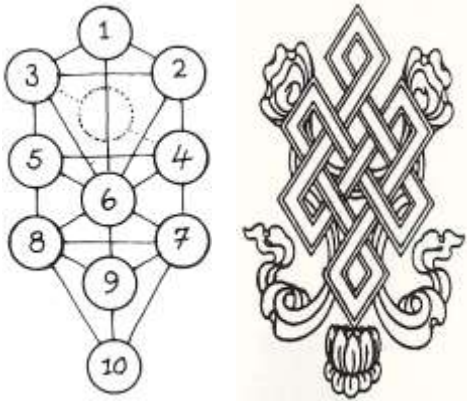
Ill. 2- 124: In the Mesopotamian system, the wedges for 1-9 change to small arrows for the tens, whilst for the Egyptians a new hieroglyph is accorded to each rise in the power of ten

Bringing in geometry reveals how Ten, or its higher powers, represents a return to the Centre after the outer limits of 9 have been reached. Schneider gives interesting examples in myth which confirm this: Demeter searches nine days for Persephone, finding her on the tenth day; Odysseus wanders nine years and returns to Ithaca on the tenth; and Dante, having traversed the nine spheres of hell and another nine of heaven, enters the Empyrean at the tenth sphere. We know how important the Tetraktys - the triangle successively made up of



Ill. 2- 125: Development of the Tetraktys as a return to the Centre from Nine

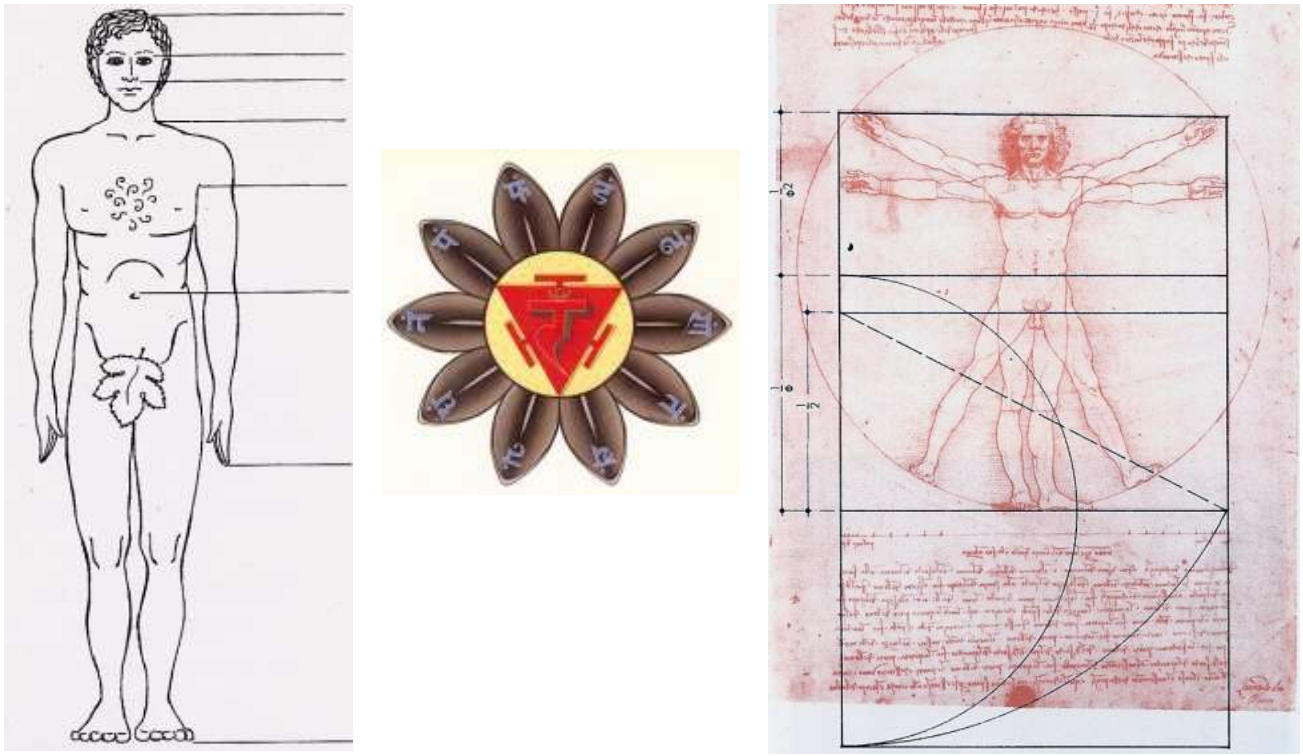
1,2,3 and 4 dots - as above right - was to the Pythagoreans, not only for the simple numbers expressed in its properties, but also for the very reason that it represented that return to the Centre from within manifestation.



Ill. 2- 126: The Sephirothic Tree (see also Book 0, Ill. 0-23), and the Eternal Knot

The Tetraktys is represented in less obvious mode in the Eternal Knot of the Buddhists and the Ten Sephiroth of Kabbalistic tradition that traces the path of the Creation of the World from *Kether* (1) down to the full physical manifestations of *Malakūt* (10) - from which point the only possible route is to make the Return Journey (note also the hidden Eleventh point, the Black Hole of *De'ath*). Both these, we could say, are alternative formulations of Life's Journey as evoked by the walk through the Chartres Maze.

Interestingly, the navel chakra is the only chakra whose number of petals relate it to the Golden Section, which makes sense, because it is placed at that point on the body where the upper and lower portions of the human

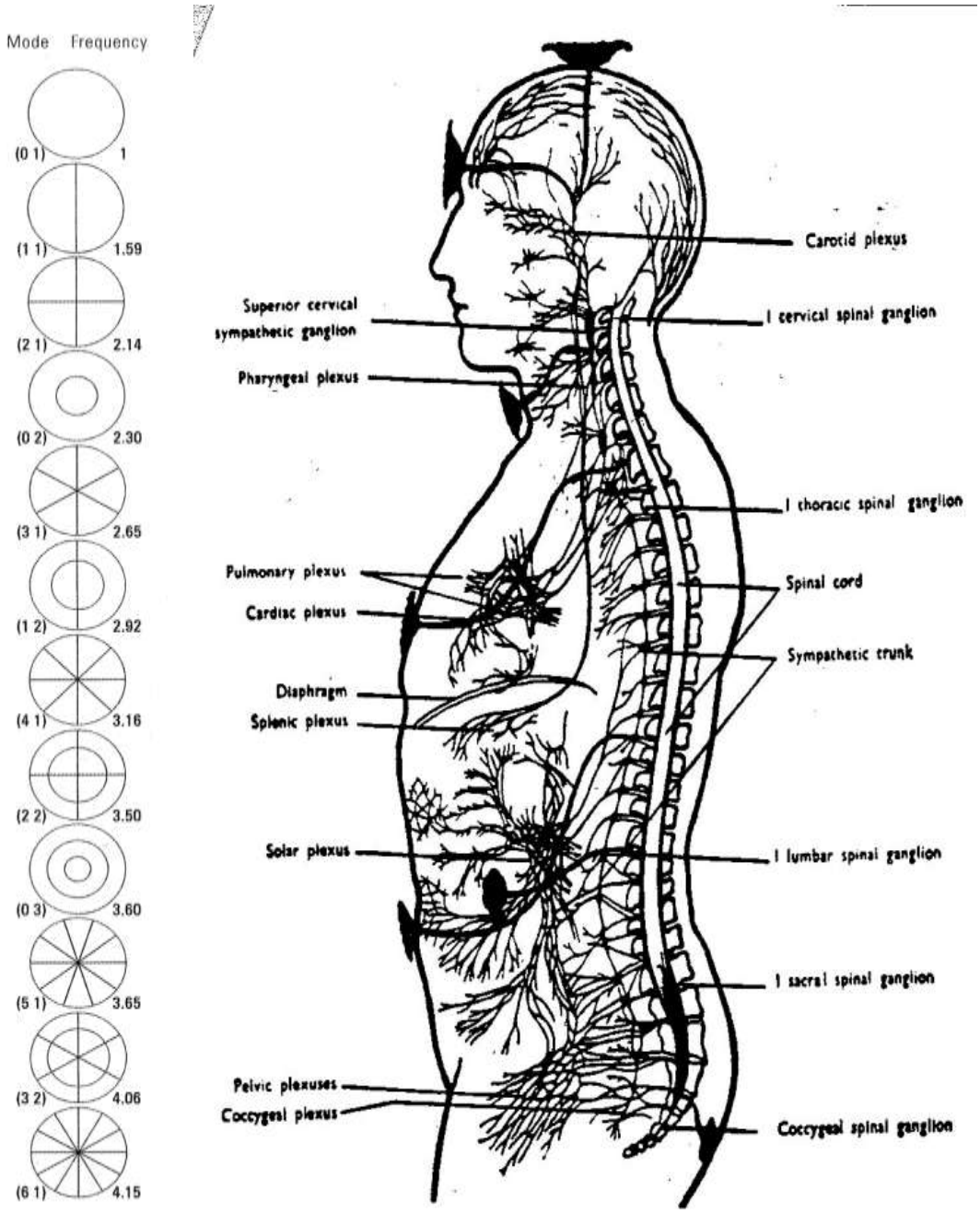


Ill. 2- 127: The ten-fold navel chakra (maṇipura) (middle) and its position at the ϕ (navel) point of the body (left), with some other key Golden Section division points in the human frame – from Schneider; Leonardo da Vinci remarked in his notebooks how in contrast the sex chakra is halfway down the body, at the 1:2 division

frame meet at the Golden Section point as marked above (in ***Book 6*** on animal biology we delve into the major and minor structures of the body, inside and out, in much fuller detail). Given the navel chakra is just beneath the Solar Plexus, like the Sun at the centre of the Solar System it matches up to centre- points at hormonal and nervous system levels, the umbilical cord itself being the outer mark of the core of the human body, the stump of its growth line after fertilisation. Jenny 's photograph of a jet of water meeting an energy stream shows how linear direction is thrown into a rope-like spiral much like the umbilical cord itself:

Ill. 2- 128: In a tornado twisting currents of energy are made visible (left), and twisting water jet - Jenny 137

In the same way we take the Sun for granted it is often overlooked, but working consciously with the navel chakra means living a centred life, breathing deeply from that point to link harmoniously with the Inward and Outward Breath of the entire biosphere. Through its invisible vortex in the subtle body (a small-scale version of the twisting tornado above) it synchronises with the other chakras of human body, all attached to it from higher worlds like flowers in a vase.

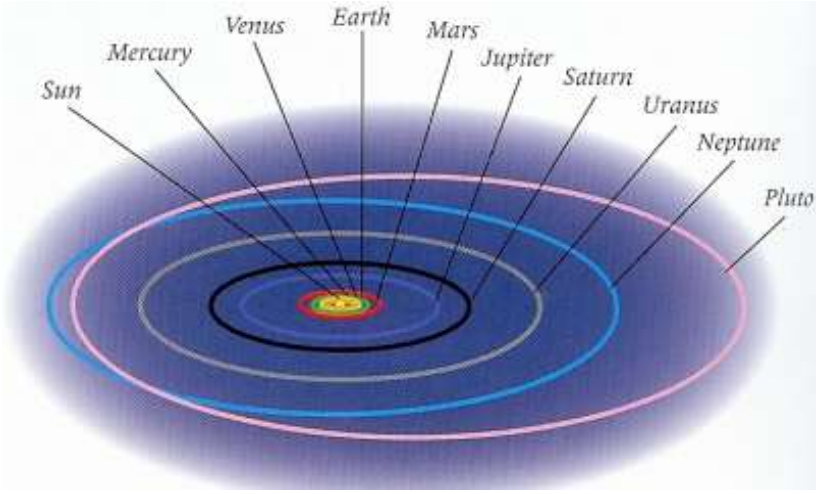


Ill. 2- 129: Summary of petal numbers of the 7 major (and five minor) chakras – from Lauterwasser (left): and their biological positioning – from Leadbeater (right)

These vortices have already taken us into the realm of the spiral.

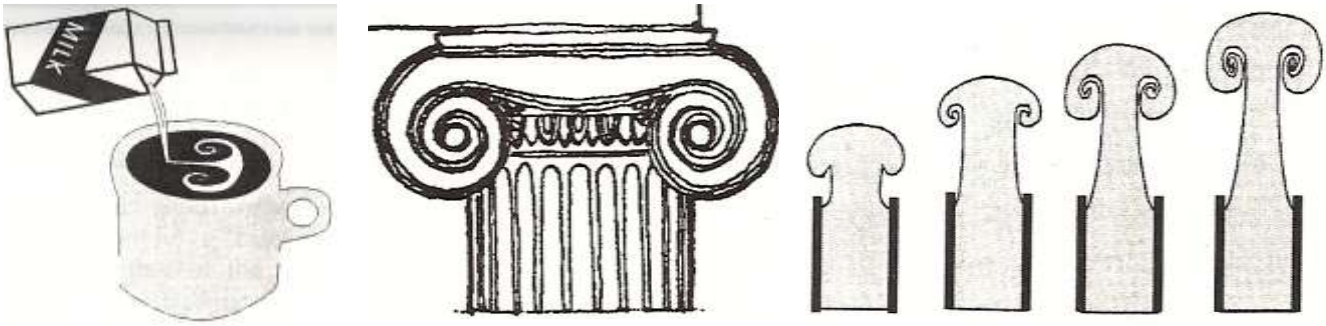
SPIRALS

We sometimes forget that all of us at this moment are spinning through the universe (if we stopped spinning we would all fall off Earth!). Planet Earth spins round once a day, itself spinning in orbit round the sun, the



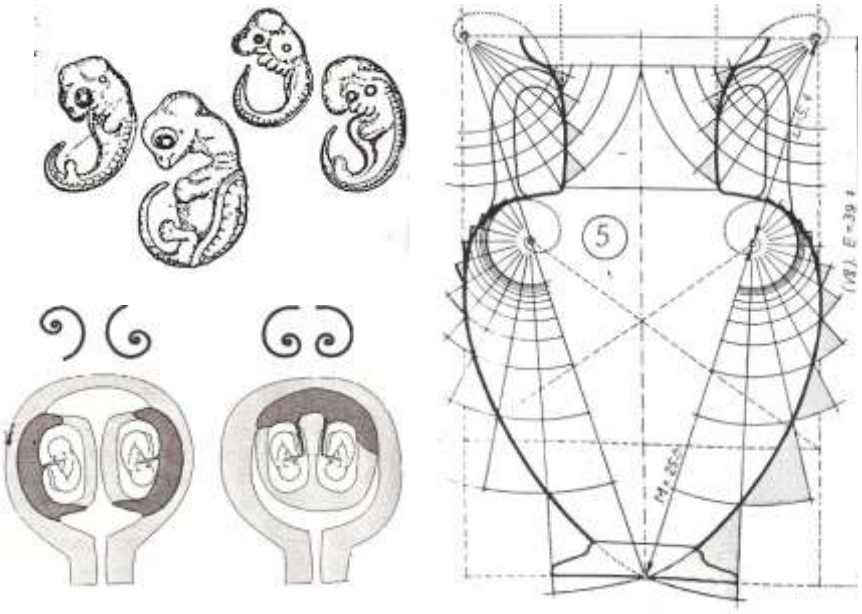
Ill. 2- 130: All planets spin round the Sun like water circling a plughole (from Skinner) - their harmonic spacing is explored in Book 9

solar system in turn spinning round the centre of the galaxy (roughly marked by Sirius). The galaxy, along with other galaxies, is itself spinning round the invisible centre of the entire physical universe at its gravitational heart. This is a consequence on the macro level of those primary atomic structures that came into being at the beginning of physical manifestation, where every particle of matter showed a tendency to right- or left-hand spin, just as humans are left- or right-handed. In modern space probes to Jupiter and Saturn, a few of the satellites of these planetary bodies were found to rotate in a contrary direction to the majority, the process of right- or left-handed rotation indicating that a stabilizing principle is at work to avoid a continuous one-way motion which would otherwise end in the self-annihilation that occurs at Black Hole points of the Universe (note the meaning of this last word as 'turning together as One'!). The spacing of the planets forms an octave in itself, as they rise and fall in a shallow whirlpool round the Sun. In fact, day-to-day phenomena bring up spirals for us everywhere, as the growing tip of a line curls round in a mushroom, often an inspiration for Rococo or Art Nouveau artists going off in several directions, or in more sober form with the Classical architects.



Ill. 2- 131: Common examples of natural and man-made spiral phenomena – from Schneider

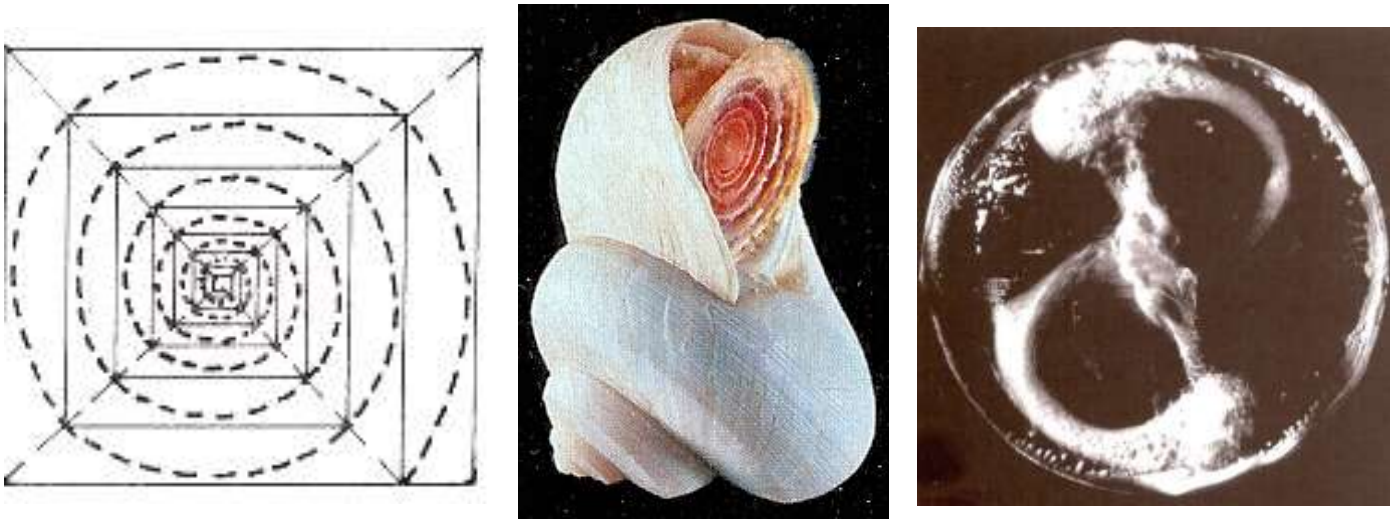
It is not surprising that even the human foetus growing off the umbilical cord should in the early stages look like a mushroom head, the similarity being even closer in the case of the alternate positioning of twins in the womb:



Ill. 2- 132: Foetal growth as a complex form of mushroom-head development: in humans, note the difference within the womb between spiral directions in fraternal (below left) and identical (below right) twins – from Schneider. The womb has often been compared with a vase – Ghyka analysed the volutes on a Greek vase

ARCHIMEDIAN AND PROPORTIONAL SPIRALS

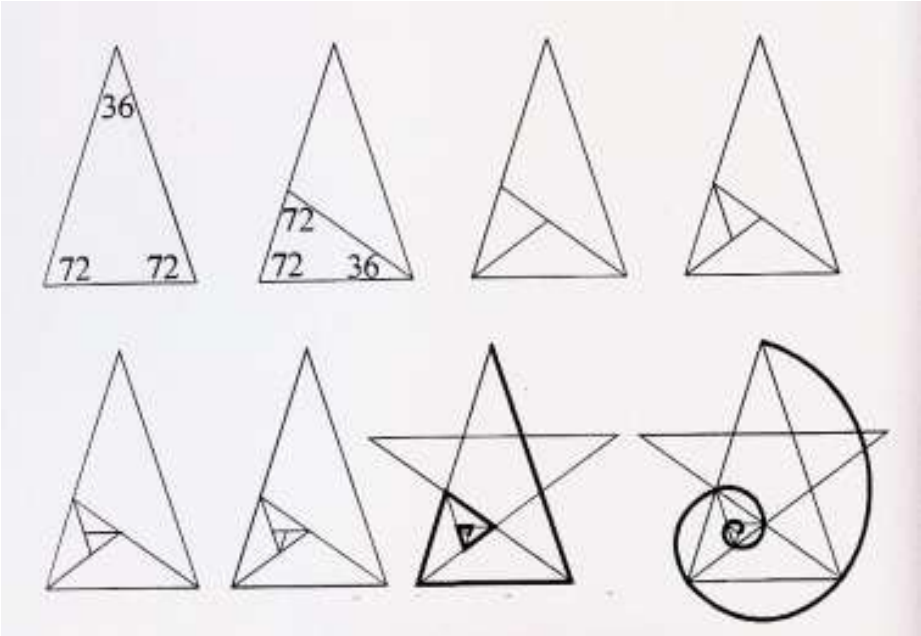
Initially the process of radiation from a central point is circular, clockwise or anticlockwise: in other words the initial polarity of the universe gets built into left or right circularity. But if during the motion the circle's radius moves outwards at a regular rate, as it comes round again it forms what we call an Archimedian Spiral, here demonstrated by joining up the corners of nested squares:



Ill. 2- 133: The Archimedian Spiral progressed from nested squares; in three dimensions as an ordinary gastropod shell, and two-way sound-activated spiral in lycopodium powder– Jenny 86

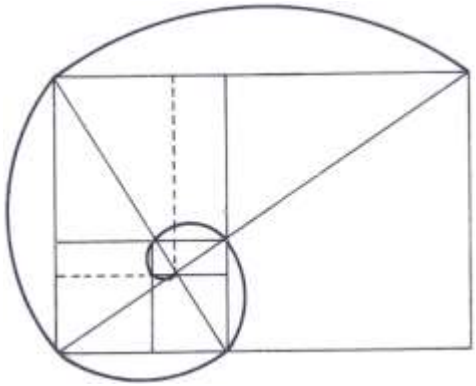
In the ***Timaeus*,** Plato describes how the entire Universe is created by counter-movements of the Same and the Different as they revolve round each other, to the right and to the left, not necessarily regularly, but unfolding according to *all* the ratios of the Lambda out of the original Diapason. Thus the ways in which radiation pulses outwards can progress by triangular, square or pentagonal progressions inclusive of their inner ratios of √2, √3 and √5: I refer you here to the detail given by Lawlor in his Workbook exercises (Workbooks 1, 2 and 3 dealing with √2, √3 and √5 rectangles and their outward progressions as spirals).

The most beautiful of the spirals moves out by Golden Section intervals generated from any one of a pentagon's inner or outer triangles whose base to sides are similarly in a Golden Section ratio: note how the crucial degrees for these scalene triangles (i.e. not equilateral and not right-angled, but having two sides the same) are a 36° apex to 72° on either side at its base. If that base is used as the long side of a replica triangle, the process of reduction continues by Fibonacci progression in the same way as for the square above. The apices of succeeding triangles are joined up to form the spiral, as below.



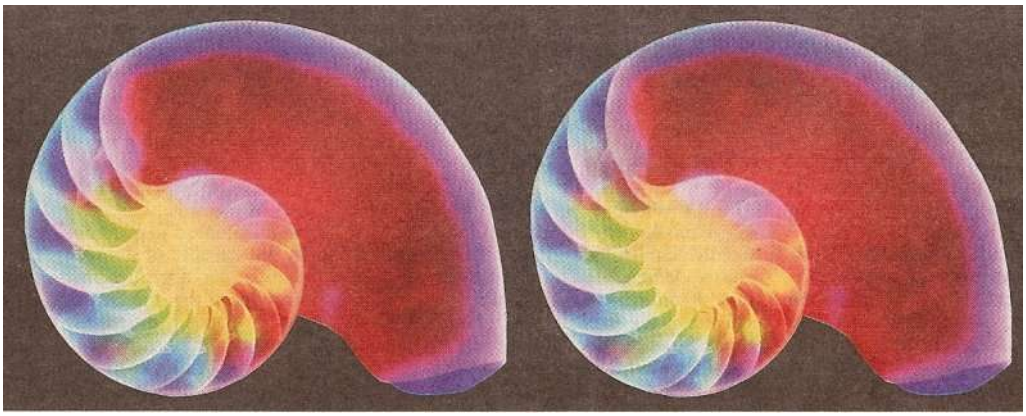
Ill. 2- 134: Constructing a Golden Section Spiral from a pentagonal star point – from Schneider

The Golden Section spiral can also be mapped from squares carved out of fractally receding golden rectangles. In other words, a large golden rectangle is divided into a square at one end, and the rectangle remaining again sectored in the same way, the resulting square becoming smaller and smaller. At every subdivision always a little golden rectangle is left over. A line drawn through the outer corners of successive squares results in the spiral that also unfolds at Golden Section intervals, sometimes called the Fibonacci spiral development. In reverse, it can also be generated from a succession of nested Golden Rectangles by starting off with an initial Golden Rectangle seed, building successive Golden Rectangles from it and then creating the spiral with a line connecting their corners.



Ill. 2- 135: Spiral generated from nesting Golden Rectangles – redrawn by Josephine Munthali

The most common manifestation of the Golden Spiral in nature is seen in the Nautilis shell:



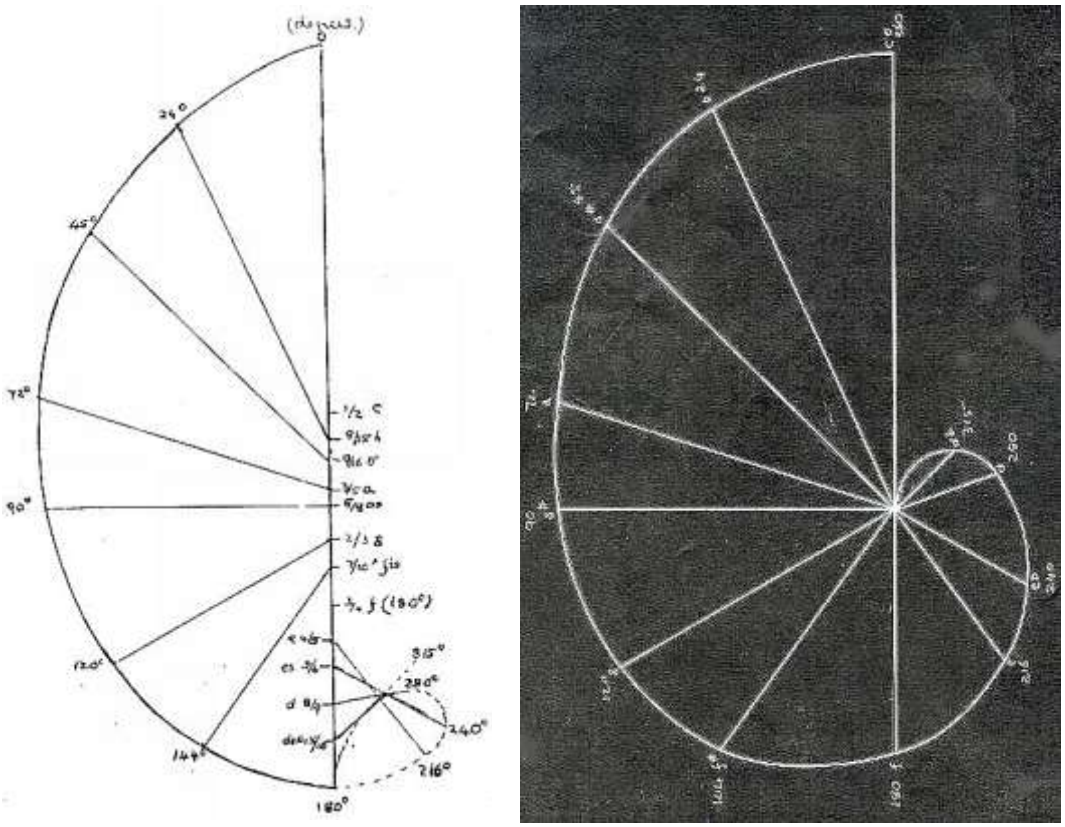
Ill. 2- 136: The nautilis shell image flattened and rainbow colourised - Sunday Times feature line

The way the triangle or square naturally proportionally repeats itself in the next size up or down is a fractal progression - first analysed by Mandelbrot as present in many natural phenomena. We look closely at fractals

Ill. 2- 137: Two versions of the fractal generation of the Golden Spiral – from Peitgen and Richter

in a later book, but a typical spiral fractal progression[13] is given above, showing on closer inspection how even the smallest tendril of the design is an exact replica of the master swirl on an ever-receding scale.

As the line of the Golden Spiral moves outward, we could judge distances from the centre in terms of string-lengths, and by joining up the ends of each string as it increases in length we arrive at the same Fibonacci



Ill. 2- 138: Sketch of Kayser's 'Teiltonkurve' from his Der Form der Geige (left), and systematized by Josephine Munthali

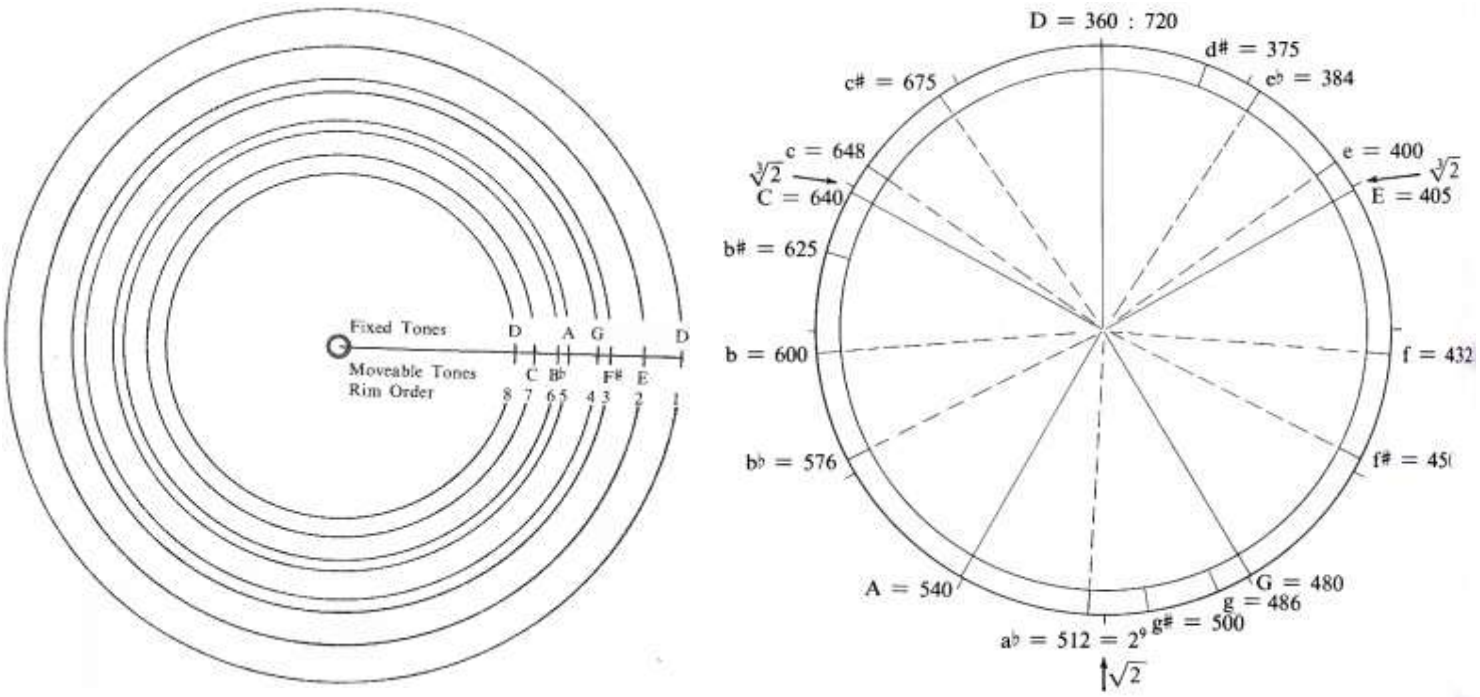
spiral, demonstrated by Kayser in his earliest book (Plato himself thought the revelations of sight so effective that he urged in ***Timaeus*** that number and tone should be translated into geometric imagery wherever possible – see, for instance, the next pair of diagrams). We showed earlier from Kayser's other diagrams how laying out string-lengths in order of succeeding notes from the centre of a full circle throuogh 360° means each note can be expressed as both line length *and* angle. In his Tone Spiral for the violin (see also ***Book 1, Ills.1-47/48***) he gives the angles and degrees as an Archimedean, or ammonitic spiral, this time not taking string length into account - but the principle is the same.

When we laid out side by side on a graph (see ***Book 1***) the strings of the piano that resound to the 16 harmonics, we obtained a curve which would in fact follow the same Fibonacci spiral if it were not for the fact that the low-note piano strings would be too long to be easily accommodated within the instrument's casing - a piano in the shape of a full Fibonacci spiral would be a complicated and impractical instrument, and it would be

[13] Taken from H-O Peitgen and P H Richter **The Beauty of Fractals** 1986

hard to know where the place the keyboard!. As we pointed out, in real life these strings are thickened and shortened to keep to the proper frequency so they can fit into a reasonably truncated piano case.

Music expresses activity as time and interval through sound vibrations, while geometry expresses the form of that activity in space, shape and volume, and because of their potent effect on events they even express philosophical thought. The only difference is that music is audible and substance is visible, but energy impulses themselves are not. Therefore we need definitions in the visible dimension to understand the activity of the unseen. This is what Kayser meant by the expression of 'value' in the string *length* itself, which is where matter and spirit meet. Geometry cannot therefore avoid being musical, and conversely, spirals, circles and the regular angular figures contained by circles emerge from unheard music, as Jenny's photographs so beautifully reveal. These photographs are sufficient to prove that the unseen forms the seen, and I simply mention in passing their extremely subtle relevance to Platonic thought as addressed in McClain's ***Pythagorean Plato*** - as pointers to the deep implications of music and geometry for human development and society, if you wish to study further.



Ill. 2- 139: Concentric cycles of the Spindle of Necessity applied to the Octave and referring to the outer circle of the Fixed Stars enclosing the circles of the Planets - as described in Plato's 'Myth of Er' in TIMAEUS (left) and (right) a tonal rendition of how the 18 Guardians in the marriage allegory in THE REPUBLIC played their part in the doomed kingdom of Atlantis – McClain Figs 16 and 34 respectively

Two of his diagrams above render in musical geometry Plato's apothegmatic descriptions, and can be taken as specific applications of the basics given in Kayser's Tone Circle and Tone Spiral: they help to give at least a taste of how deeply McClain and his followers have been able to unlock Plato's secrets and demonstrate in terms of musical scales the philosopher's analysis of the nature of society, political situations and their leaders – to me astonishing in its specificity. Plato himself wrote in ***The Republic***, *Never are the ways of music changed without the greatest political laws being changed.*

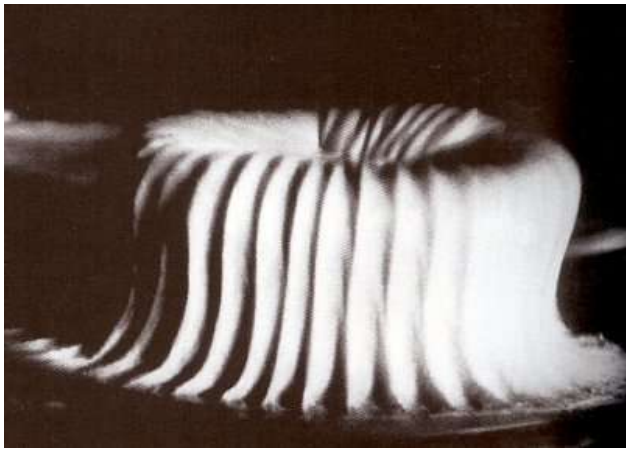
SPIRALS AND PERSONAL DEVELOPMENT

The progress of our own lives can sometimes feel as if we are in a maze, when in fact it could well be a labyrinth, with only one path to the Centre if we can only keep our heads: we can never expect events or relationships to unfold smoothly onward in one direction. We should build into our philosophy the expectation of reversals, for these are part of the progress of our plans. Instead of being downcast by what seems to be a major setback in our plans we could stop and consider that this is a left-hand spiral entering our lives which must be needed for the purposes of stabilization (as on a sunflower seedhead) even if at the time we cannot see the inner workings of such a rationale due to our involved position. If you have any experiences you would like to share about any section of the geometry in this book, e-mail me on asia@cosmokrator.com.

THE THOUSAND-PETALLED CHAKRA

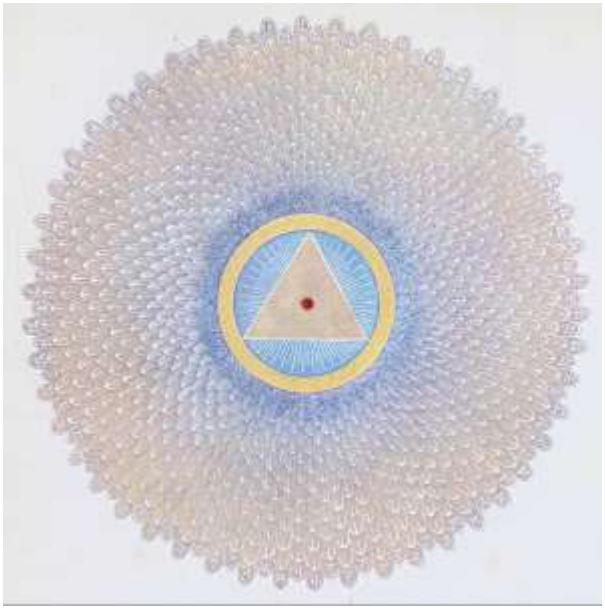
When on that life journey we are fortunate in life's maze to accomplish the journey to the Centre, there can be a massive flowering of our chakra tree at the top of the head in the thousand-petalled lotus (hence many religions protect it by various forms of headcovering – or on the contrary shave the top of the head as a tonsure, as communities of mediaeval monks did). On the Sephiroth Tree, it means final union after the return journey back to *Keter* (at 1 on the Tree – see ***Ill. 2- 126***), the word itself meaning 'Crown'. There are instances of great men like Titian or Ramesses II who lived to be old enough to experience the Neptune return of 84 years which often brings a final explosion of great work, as in Titian's last paintings (see ***Book 10***) or Ramesses' unparalleled temple-building projects at the end of the Second Millennium down the length of Egypt's Nile and into Nubia.

The Hindu seers describe the top chakra (*sahasrāra*) as having 7 or 9 layers with (as seen from the top) thousands of filaments radiating from the centre:



Ill. 2- 140: The raised thousand-petalled crown chakra (Sahasrāra) from the side showing seven or nine layers in the colours of the rainbow – from Layayoga (left) and Kaolin paste raised by sound - Jenny 137

On some sculptures of the Buddha, the raised bump of the thousand-petalled lotus at the top of the head, called the *ushnisha,* is strongly emphasized, and reminiscent of one or two of Jenny's sound experiments on kaolin paste which produce a similar upward and centralised surge of energy:



Ill. 2- 141: The thousand-petalled lotus chakra of the head crown from above – from Layayoga

It represents the full flowering of the entire chakra tree which, as in ***Book 4*** on ***Plants*** showing how growth spirals spin both to the right and to the left, as in the centre of a sunflower (***Ill. 2- 1***, middle left), I like to think of as a massive two-way spiral at the top of the head, in section akin to a rainbowed palm tree spurting out of the head and creating a 3-D spiral of endless golden proportions. Perhaps this explains the high hats so often used in the history of Man, and why crowns are royal because they make the crown chakra manifest in jewels.

PERSONAL TRANSFORMATION

In musical terms the Golden Section ratio of 1:1.618 governing the spirals of life is as close as can be got to the minor sixth of 8:5. This interval is often confused with that of the fifth (3:2), also present in the Fibonacci progression of 1,2,3,5,8, but a dominating 3:2 gives rise to the *Archimedian* spiral of the ammonite, which progresses out at a regular rate in contrast to the Fibonacci 'jumps' seen in the nautilis shell. It is common for Western minds to disregard small differences in degree, as has been done in the tempering of the octave, but from geometry we see how important such differences are, and we know what would happen were such discrepancies allowed to creep into, say, specifications for machinery in a factory. Roughly speaking, 8:5 has the value of 1:1.6, whereas 3:2 is approximately 1:1.5. The effects would be quite disastrous if we allowed what Daniélou calls with pregnant meaning 'small differences' to create an entirely unintended outcome in the development of the soul, as demonstrated in the difference between the nautilis and ammonite forms.

What this means is that small discrepancies of behavior can betray a whole field of spiritual error, and for those in spiral/spiritual authority this means attention has to be given to those tiny slippages which denote important qualitative shifts – especially to criteria for making decisions affecting entire populations or monitoring an individual's spiritual progress. It involves understanding spiritual and spiral progression, since it is the spiral which links the hierarchy of worlds with each other.

Robert Lawlor in *'Geometry in the service of Prayer'* in ***RILKO Newsletter*** no. 16 for 1980, well illustrates how theory of music and geometry through hearing and seeing becomes personal experience. During his visit to the Cistercian Abbey[14] of Le Thoronet in France, he was struck by the clear geometry of its vaulted interior, uncluttered by statue, painting or ornament, while listending to the organ music. Standing at one particular pier,

> *'one's hearing seems suddenly turned inside-out; the heartbeat and internal workings of the organs are magnified; even external sounds seem to originate from within. After experiencing this I recalled reading of experiments made on the effects of sound inside a perfect sphere large enough to contain a person. This Scientific American report said that sound reflected by the walls of a sphere caused strong resonations in the whole body – the skull, thorax, abdomen and bones all vibrated together – and produced the sensation that all sounds came from within the body…. Perhaps this is… the effect of the round vaulted arch'…. Whether or not this particular acoustical effect is simply coincidence, it is certain that from the darkest times sacred geometry has been able to express the mystic relationships between ϕ (phi) the function of division, and π (pi) the function of circle and unity... (it is commonly known that the proportions of the Cheops pyramid are essentially a ϕ:π relationship).*

The essay is well worth reading in full: elsewhere he describes the typical monks' routine as sleep between 7 p.m. and 3 a.m. (with an interval at 11 p.m. for a chanting session in the abbey) with the waking day consisting of four hours' study and five hours' physical labour interspersed by further sessions of chanting which would have doubly energized the community with potent, high-octane 'spiritual food' through architecture and music. He perceives the austerities of Cistercian architecture as deliberate, to maximize the full spiritual effect of their geometry and thence sound resonance (hence the title of his essay) and takes from Hans Jenny's work 'the implication that because the tissues and cells of our bodies are almost entirely made up of plasma (that is, liquid particle suspensions), living tissue is particularly responsive to the organizing power of sound'. So it is far from fanciful to visualise the vegetarian monks of Le Thoronet living on a permanent 'harmonics high' most of every day – and take seriously the effects the music we listen to on our state of being! Maybe we could even experiment with their timetable. McClain in The Pythagorean Plato quotes an earlier scholar[15] as follows:

> *Moral order in the soul, and justice in the state were both thought of in Platonic circles as analogous modes of attunement through the introduction of the required ratios and proportions.*

Life is a continuum ruled by waves and frequencies iin musical ratios and geometric proportions, both modes of experiencing them providing oases to the traveller lost in the jungle of passing shape. Modern science tends to ignore the very simple tools Pythagoras and his ancestors have provided us with to use as our compass, and more emphatically than ever before owe it to our children to provide them with it, so they can find their own way through the labyrinth of *nine dimensions of reality* –not a flat material one in which the universe is reduced to a 'Singularity'!

---

[14] The nature of its three-dimensional geometry is fully analysed in ***Book 11*** on ***Architecture***

[15] Glenn R Morrow ***Plato's Cretan City: A Historical Interpretation of the Laws*** 1960