


ARCHITECTURE 3000, GEOMETRY AND CONSCIOUSNESS FOR LEARNING SPACES



DESIGN YOUR SCHOOL OF THE FUTURE, NOW

EDUCATION  **3000**

Tomorrow's Education, Today

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ISBN: 978-99974-0-296-7
Legal Deposit: 4-1-2356-18
Digital version 2020
Editorial: P3000

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Architecture 3000 Research Network
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EDUCATION  3000
Tomorrow's Education, Today

Who are we?

We are an international multidisciplinary team which is co-creating a comprehensive, fun and more humane Education, promoting a sustainable Culture of Peace and Cooperation. We open a path for happy, pro-active, creative and responsible children, as well as loving, enthusiastic and stress free teachers and parents, introducing a new Society of Solidarity.

We invite everybody to generate changes in Education, with more consciousness at all levels and all over the world, beginning with ourselves. To date, we are linked to 53 countries.

Dedication

For Sitlali And through her, to the new generations and those to come.

For all the Schools of the World, present and future.

For a Planet of Peace and Harmony.



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INTRODUCTION

It is early morning. The air is still a little fresh, but the sun is already shining and warming up the beautiful garden of the kindergarten. Mary and Heather, the two teachers who actually founded the establishment years ago, are arriving at school.

- *"Can you guess what the kids did yesterday? They built an icosahedron from scratch and then even started building a "geodesic dome" to play in!" Mary exclaimed enthusiastically.*

- *"What?? Yes, Mary, they are amazing, aren't they?" answers Heather admiring the entrance of the kindergarten decorated with a colourful Flower of Life. "In my own class I saw them working with a table of 70 geometrical figures. How come they are so interested in Geometry?"*

- *"It's like they resonate with it."*

- *"You know, I'm thinking of doing a mobile phone with the platonic solids. I'm sure they will love it" replied Heather*

- *"Wonderful. Next week I will try the "Matrix Star" with the older ones. Anku's little brother asked for it. Do you remember Anku? I am sure he gave the idea to his brother. He is so bright. I heard he wants to start his own school, 7 something, 7 Petal if I recall well..."*

Heather and Mary smiled... They did remember Anku, yes, he could do anything he set his mind to (to be continued).

The word Geometry, of Greek origin, means Earth Measure. Universal Geometry contains the archetypes of Earth's original design, a matrix of life, like a blueprint of creation itself. It is an ancient science that unveils how energetic patterns create, organize and unify all things. It is the genesis of all life forms of all scale, every natural pattern of growth and movement. The science of Universal Geometry allows direct, practical access to the tangible and intangible forces of creation. The ancients believed that the experience of Universal Geometry was essential to the Education of the students. Geometric patterns and codes resonate with our own inner realm, *spacious awareness* and consciousness (Kenyon 2018). For its relation with the mystery of consciousness, Universal Geometry was also called Sacred, Symbolic and Harmonic Geometry.

Our proposal is to introduce Universal Geometry wisdom and practice in Education, in the experience of self-awareness, and in schools' architectural design. So in the next chapters, we will explore *Geometry, Consciousness and Architecture 3000 for the Schools of the Third Millennium* from a practical approach: hands on geometry activities, practical tips for school's design, bright ideas that can be implemented easily, and ways to facilitate and stimulate well-being, fun and learning.

Chapter 1, *Educational changes, Architecture and Consciousness*, is an overview of the characteristics of today's children's, and of the reasons why we believe that Education and Architecture should go hand in hand.

In Chapter 2 we explore why Universal Geometry is a wonderful tool to practice in schools with playful activities, and how its benefits may be implemented in the integral development of the human being since childhood. All of these benefits are further amplified if the activities are experienced in architectural spaces designed with Universal Geometry.

Chapter 3, *Geometry in School's Architecture*, addresses how to incorporate Universal Geometry principles in the architectural design of schools.

Chapter 4 focuses on the co-creation of learning spaces and architectural solutions that cooperate with the ecosystems and are beneficial for the well-being.

Chapter 5 illustrates places around the world where architectural bright ideas have been creatively implemented, opening up our imagination for endless possibilities.

Chapter 6 presents the project of the 7 Petal School, which comprises 7 pedagogical areas that ensure the complete development of the human being, leading to a Peace Culture around the World.

Chapter 7 presents a summary on how to start a school for the third millennium.

With this first book, our purpose is to incentivise everybody to design and build our schools of the future, now; and to invite you to co-create this reality together, all over the world.





**EDUCATIONAL
CHANGES,
ARCHITECTURE AND
CONSCIOUSNESS**

Changes in today's

The children of today present new characteristics that inexorably lead to changes at home, in schools and in society:

- Other forms of learning, fast and multifaceted.
- Hypersensitivity.
- Faster metabolism (not to be confused with hyperactivity or Attention Deficit Disorder).
- Highly developed Emotional Intelligence.
- Simultaneous management of Multiple Intelligences (adding up 26 in 2014)
- Extensive use of the right brain hemisphere.
- For some, innate activation of certain brainwaves such as alpha, theta, and delta.
- Many others aspects, still under investigation please refer also to the two volumes of *Pedagogogia 3000*, and the book titled *Physiological, emotional, and neurological changes in today's children and the Education that they need*.

These changes are physical, physiological, emotional, cognitive, behavioural, ethical, intuitive, and transcendental, and are further amplified by the developments in technology, Internet, communications and standards of living. Therefore, the Educational system needs to change its paradigms all over the planet based on the understanding of Education as a process of human evolution.

Educative environments are key tools for the development of students as integral human beings, to fully expand their abilities and potential. Consequently, the architectural design of schools should be in consonance with this understanding and create spaces that allow for this expansion.

Architecture is a determinant factor that shapes our activities every day. Architecture produces archetypes, which define behaviours and patterns of subconscious evolution.

Jung understood *archetypes* as universal, archaic patterns and images that derive from the collective unconsciousness and are the psychic counterpart of instinct.

The words “architect” and “archetype” come from the same root, *arkhi*, which means “first” or “master”. So the ways in which “master builders” work is linked to the “master forms” that underlie us all, and that contribute to a planetary consciousness.

We do believe that school’s architecture should be in consonance with the children needs and produce master forms to foster the necessary educational changes with consciousness, and not the other way around. We are co-creators of our reality. This is why, in the last 10 years, some pioneer schools around the world have begun to experience notable changes in the ways of understanding architectural design as a determining factor to foster learning, with consciousness of the new characteristics that today’s children present. Many fascinating educational centres around the world serve as evidence (see appendix 3).

We wish to promote a new pedagogical culture that prioritises the children of today and tomorrow, keeping in mind their changes, their specific needs and new ways of learning. In the next chapters, we will share creative tools to design spaces based on Universal Geometry. Our purpose is to contribute to an integral Education from a practical approach, connected to the matrix of life, generating a more humane Education and society.

Schools as focal centres for consciousness expansion

Consciousness is the quality of the Human Being that allows him/her to recognize himself or herself. We realize that the exterior world is nothing but a reflection of the interior world. Existence itself transforms in a source of eternal “learning and growing”, and vice-versa, knowing our inside we create our outside. Through vibrational resonance, we attract what we think, what we wish, what we look like. The Insight, or looking inside, is the key for consciousness and self-awareness, bringing with it an understanding of our interior dynamics and the consequences of our personal actions. This is an important process in becoming aware of ourselves as active beings, full protagonists of the re-co-construction of our societies and environment.

On an Educational level, consciousness expansion is achieved through triggering mechanisms. This term is used in psychology to describe an activity or circumstance that can unleash subliminal mechanisms that awaken or expand perceptive and knowledge processes. A trigger is like a starter in a car or the boot up of a computer. It is of vibrational nature and it creates movement. There are many types of triggers: people, places, games, sounds, light, colours, shapes, movements, universal geometry, ancestral symbols, and any of these can trigger a remembering process that unveils innate wisdom.

Astonishment and decoding reality

Astonishment is a fantastic way to awaken and expand consciousness. Children have an innate capacity to be amazed. This capacity of understanding life from astonishment is in itself a way of understanding the world from a higher level of Consciousness. When one marvels at the perfection of creation, that emotion triggers a process of de-codification or revelation of that reality, which allows one to integrate the "sacred" of creation and understand multidimensional reality. As explained by architect Oscar Senmache, de-codification is an essential process for the Education of today and tomorrow:

"There are three modes of perception that should be incorporated for an integral Education (as it used to be in ancient Education):

- to be marvelled;
- to relate and understand the law of Creation;
- which unveils the power of de-codification of the elements of the whole Universe to act according to it.

Observing Nature closely, for instance, allows this process of de-codification and permits to understand the strategies of Evolution itself:

- Discovering the strategies of Evolution in Nature i.e. observing the strategies of the intelligent development of an animal is astonishing for children and adults alike.

- Understanding transformation processes i.e. the children are in awe at processes such as the metamorphosis of a chrysalis, photosynthesis, or germination. Nature does it continuously, it cannot be static, and so schools should be in constant transformation as well.
- Studying and understanding symbiosis as non-competitive interchanges. For instance, the hummingbird and the flower, the shark and a fish cleaner of its teeth. Understanding these relationships teaches the student non-competitiveness, cooperation and solidarity.
- Understanding natural Cosmic Laws. i.e. the Law of Attraction, using magnets; the Fibonacci sequence with flowers; the Law of Balance with chemistry; the Law of Causality with physics and so on.” (Oscar Senmache, in Noemi Paymal, 2010, 33)

To allow a child to develop their power of de-codification through astonishment and discovery is sacred, as it favours a natural understanding through experience, which in turn furthers the understanding of energetic structures, or energetic geometry, that lies beneath all shapes and events. Its effects then are:

- it activates all brain areas, amplifying the capacity of thinking and loving;
- it contributes to harmonic and non-competitive relations, as a symbiotic process of life in which we all cooperate.

This converts Nature and Universal or Sacred Geometry as powerful allies in today’s Education. Universal Geometry offers children the experience that everything has a geometric shape in which energy accumulates and circulates. This is why all schools should be built and run with these principles in mind.



2

GEOMETRY IN EDUCATION, A WONDERFUL TOOL

The growth in understanding of spatial order seems to follow closely man's own evolution as a conscious being.
(Critchlow 1969, 3)

Universal Geometry practice can be fostered since childhood with playful model-making activities. Traditionally, Geometry is taught starting from two dimensions, reducing the world to abstract flatness. We believe that starting by observing nature into three dimensional model-making has more advantages for the integral development of children, as it provides a way to experience the sensorial interplay and spherical thinking towards the integration of an unified conception of reality. Students may play as they explore geometry, combining pleasure with learning subjects such as mathematics, physics, history, music, biology, philosophy, astronomy, art and architecture. Many teachers are discovering children's innate relationship of children with geometry, especially three dimensional geometries, and their pedagogical benefits:

- Spatial intelligence
- Creativity
- Intuition
- Balance between the two hemispheres of the brain
- Focusing attention, as it facilitates to reach alpha or theta brain waves
- Fine motor skills
- Teamwork
- The sense of harmony, proportion and beauty
- The comprehension of scale, from our own bodies, to nature and the Universe
- The integration of Earth's matrix
- The understanding of universal codes of life, from molecules to galaxies
- The multidimensional being and the ability to "decode" symbols.

Through Geometry, reason translates the language of the heart. (M. Talhaoui)

Integrating Universal Geometry in human development since childhood helps us stay in contact with our own *spacious awareness* (Kenyon 2018) and our mind aligned with the expansion of our heart's energetic field. Therefore, it greatly contributes to living in harmony with ourselves, the others and our environment. Universal Geometry is a powerful tool that helps us to stay in tune with our energetic essence, our planet's life system and the universe. Practicing Universal Geometry unleashes the human connection to creation, and to self as co-creator of reality. As such, Universal Geometry is a tool for Consciousness and Awareness, bringing us knowledge of our true nature as well as that of our environment.

The expression of Geometry is the image of the architecture of consciousness, in which each intersection is the reflexion of an infinite mirror. (M. Talhaoui)

Universal Geometry is the metalanguage, seal and pattern of creation itself, containing the structural patterns or archetypal forms of everything that exists. It is the matrix that creates life, as we may observe in the patterns of nature and cosmos. Geometric patterns and proportions are found in everything of what we know in the universe: from DNA molecules and our bodies, to crystals, snowflakes, flowers, the branching of trees, pine cones, the nautilus shell, the turtle shell, stars, galaxies - all life forms emerge out of geometric patterns.

Universal Geometry is Earth's original design code, a matrix of life. This matrix may be understood as a metalinguage of vibrational patterns, and translated into shapes, light and sound. So Universal Geometry applied in Education allows students to understand and incorporate the archetypal structuring and organization of energy into shape, light and sound.

Therefore, Light, Sound and Form (Shape) form the fundamental Creative Triad for Education in the Third Millennium. Furthermore, for Architect Oscar Senmache, the geometric alchemy contains three important potentials that allow its manifestation in time and space: fractality, symmetry and harmonic proportions. By understanding the dynamic process of these potentials, we have the possibility to recreate our environment in coherence and wisdom. Viewing, contemplating, building, living within these geometric patterns' alchemy allows us to develop our innate wisdom and stay tuned to the forces of creation of our planet and the Universe.

Using our hands to understand and practice Universal Geometry is "re-membering" our true essence as vibrational beings. Here follow some ideas of perfect geometric figures and practical activities (see Appendix 2) to implement in schools, and to discover why this is such a wonderful tool:

Geometry is the poetry of Creation.

(M. Talhaoui)

- The Sphere
- The 5 Platonic Solids
- The Kepler Polyhedron or Stellated Polyhedron (A polyhedron is stellated by extending the edges or face planes of a polyhedron until they meet again to form a new polyhedron or compound).
- The Star Matrix
- The 13 Archimedean Solids
- The Golden Proportion
- The Fibonacci Spiral
- The Flower of Life, Fruit of Life, Seed of Life, Tree of Life
- The Metatron Cube
- The Merkaba
- The Vesica Piscis
- The DNA helix

The Sphere

The sphere is a symbol of Unity, the Cosmos and Universal Creation. It is the universal matrix. Each point of its surface has the same distance to its centre. It is an expression of unity and integrity. Atoms, cells, planets, suns all resonate to this form of unity and potentiality. A single nuclear sphere associated with spheres of the same dimension generates different shapes. (in Critchlow 1969: 8-9)

Therefore from the sphere derive the most fundamental three-dimensional forms. The sphere contains the five models of regular polyhedrons.

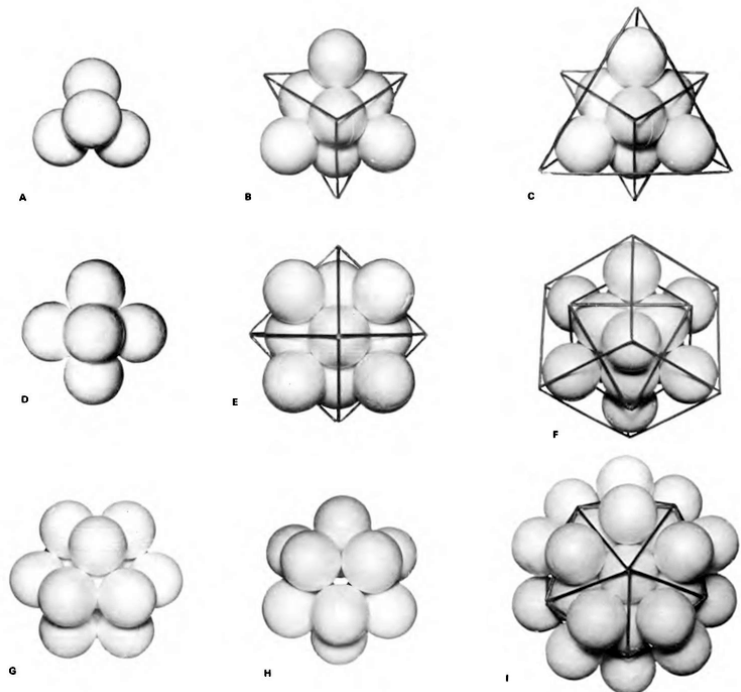


Fig. 2.1 - Evolution of the basic spherepoint configurations

The 5 Platonic Solids

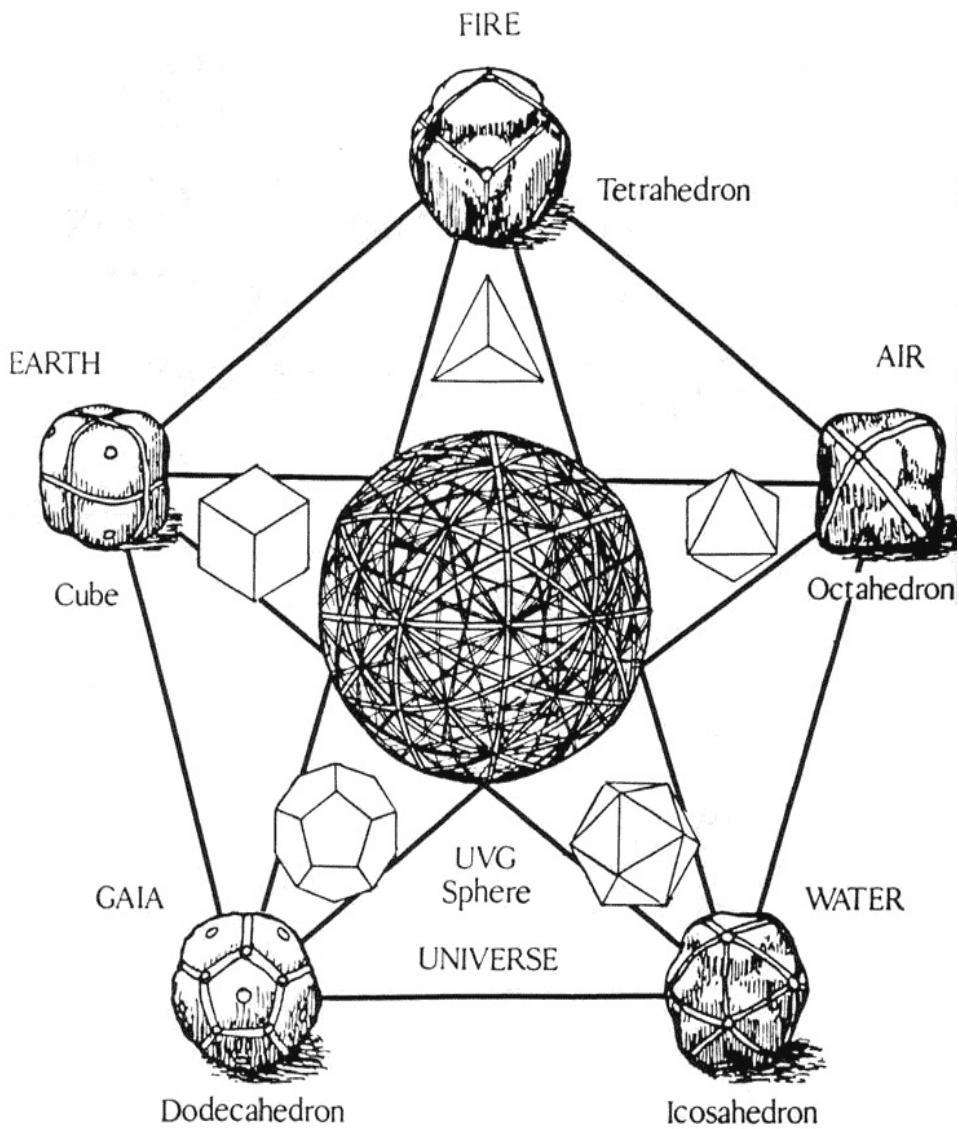
The 5 Platonic Solids are convex *Polyhedron* (in Greek, “many bases”) or three dimensional forms that fit perfectly within a sphere, with the following properties:

- equal regular polygon faces;
- equal edges;
- equal angles;
- identical vertices;
- same number of faces and edges are joined to their vertices;
- every vertex point is at the same distance from the centre.

The earliest written description was found on Plato’s (427-347 BC) *Timaeus*, and for this reason they are called Platonic Solids. But several Neolithic leather-tonged stone models have been found in Aberdeenshire, Scotland, dating at least 1000 years before Plato (ca. 1400 BC), crafted with these same patterns (Critchlow 1969).

These 5 solids are: the *tetrahedron*, the *cube* or *hexahedron*, the *octahedron*, the *dodecahedron* and the *icosahedron*. Plato associated each of these solids with the elements.

- The *tetrahedron* is made from 4 equilateral triangles, representing the element of Fire.
- The *cube* or *hexahedron* is made from 6 square faces, representing the element Earth.
- The *octahedron* is made from 8 equilateral triangles, representing the element Air.
- The *dodecahedron* is made from 12 regular pentagonal faces, representing the mysterious fifth element of Aether.
- The *icosahedron* is made from 20 equilateral triangles, representing the element Water.

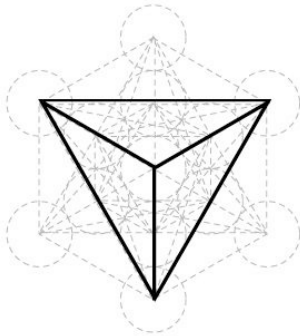


Pythagorean Cosmic Morphology

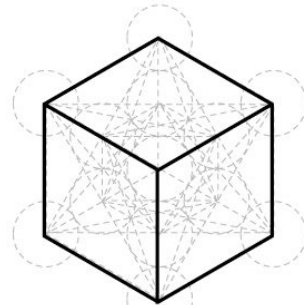
Illustration #5

©Becker-Hagens 1984

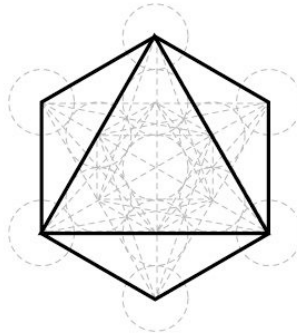
Fig. 2.2 - Five Platonic Solids and Five Elements



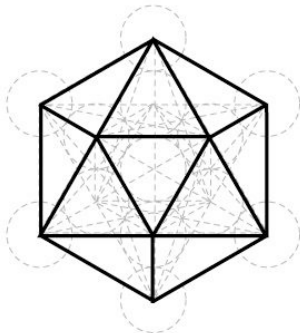
TETRAHEDRON.



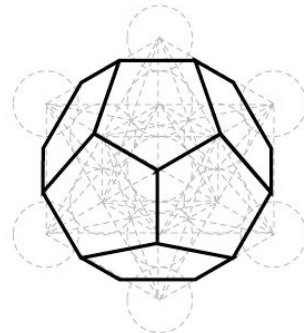
CUBE.



OCTAHEDRON.



ICOSAHEDRON.



DODECAHEDRON.

FIVE PLATONIC SOLIDS AS PROJECTIONS OF METATRON'S CUBE

Fig. 2.3 - Five Platonic Solids

The Kepler Polyhedra or Stellated Polyhedra

Johannes Kepler (1571-1630) proposed the stellation of polyhedron, meaning the extension of polyhedron edges until meeting in one single point, forming a star shape. The resulted polyhedron are known as stellated dodecahedron and stellated icosahedron.

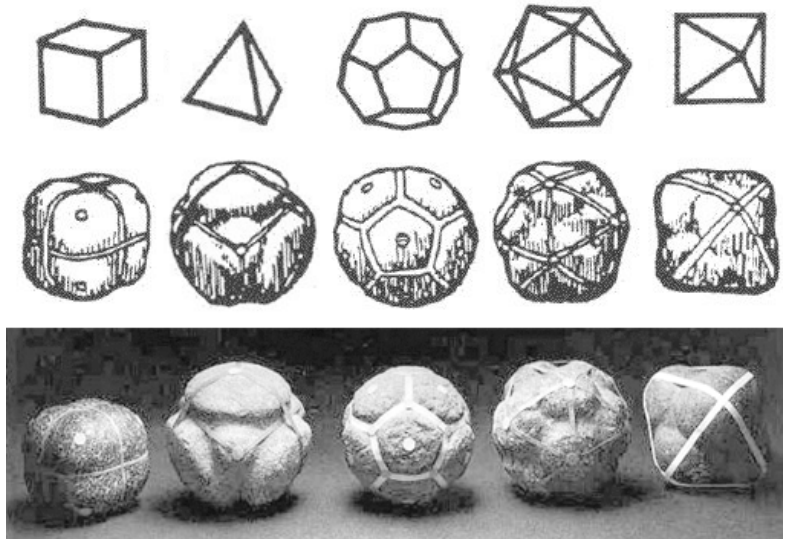


Fig. 2.4 - Neolithic stones, Ashmolean Museum in Oxford, England

The Matrix Star or Metatron's

The Platonic Solids and the Kepler Polyhedron fit together in fascinating ways, and building one outside the other gives rise to the Matrix Star, also called the Metatron's Star, as it is based in the Metatron's Cube. Building the Matrix Star is a wonderful and fun tool to get our hands on geometry with children and adults (see appendix 2). When we consciously experience these universal (or sacred) geometric proportions through our bodily experience, we resonate and tune into the elemental energetic patterns of the Universe.

Universal Geometry principles are integrated on both physical and spiritual levels. This means that geometric light patterns are activated in each point of our body where energy is received and transmitted. This resonance and attunement is what produces a gradual awakening to the universal metalanguage that we are all made of, opening up multiple levels of understanding and furthering the evolution of consciousness.

In other words, it is also explained that the activation of Universal Geometry through our cells allows our heart's energetic field to expand and connect to the unified field of universal energy, which allow us to be part of the global conscious network.

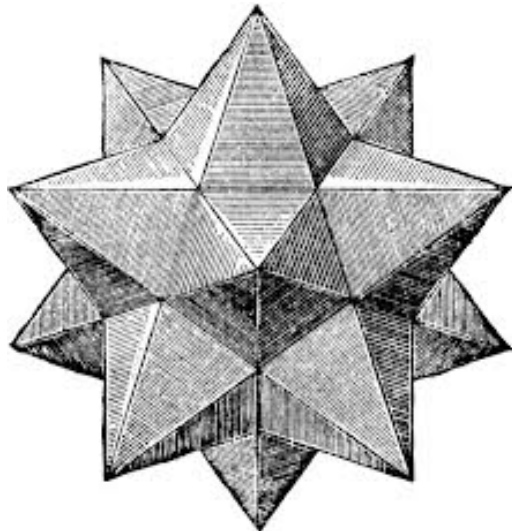
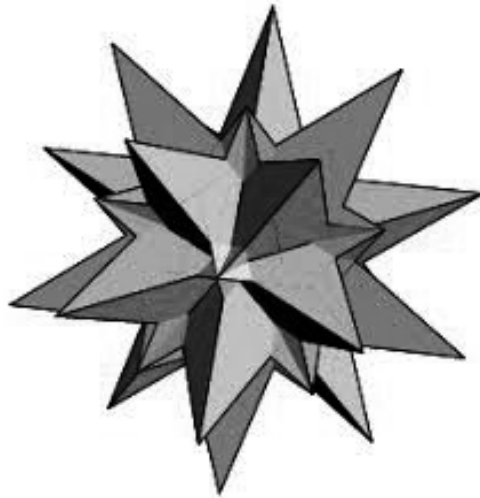


Fig. 2.5 - The Kepler Polyhedra

The 13 Archimedean Solids

The 13 Archimedean Solids are also known as semi-regular polyhedron that fit perfectly within a sphere, with the following properties:

- regular faces of more than one type;
- identical vertices.

The earliest attribution of these solids is to Archimedes (287-212 BC).

If the 5 Platonic Solids are truncated, 5 Archimedean polyhedron are produced:

- The truncated tetrahedron,
- The truncated cube or hexahedron,
- The truncated octahedron,
- The truncated dodecahedron,
- The truncated icosahedron which is the geometry of a soccer ball.

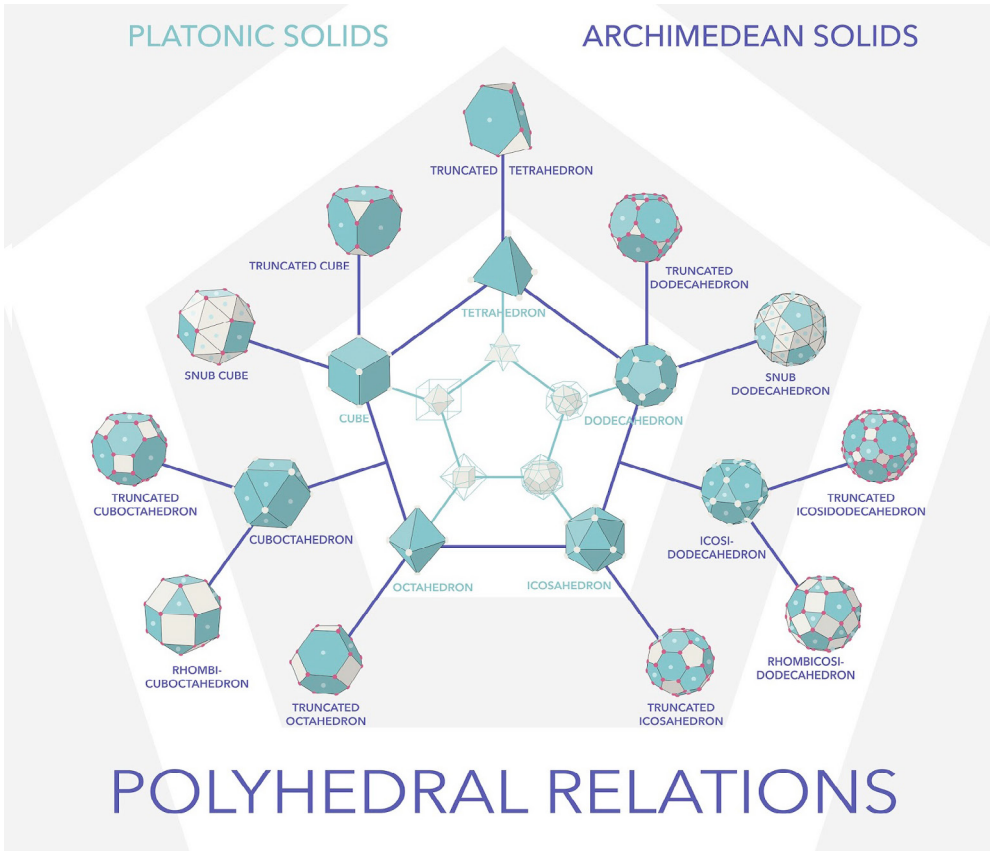


Fig. 2.6 - Polyhedral relations by Allison Y Chen 1

1 <http://chenallison.blogspot.pt/2013/03/the-art-of-charts.html>

2 Numeric value of 1.618033988749894848204586834365638117720309180...

If two Platonic Solids are combined, two Archimedean polyhedra are produced:

- The *cuboctahedron* is the product of the intersection between the *hexahedron* with the *octahedron*,
- The *icosidodecahedron* is the product of the intersection between the *dodecahedron* and the *icosahedron*.

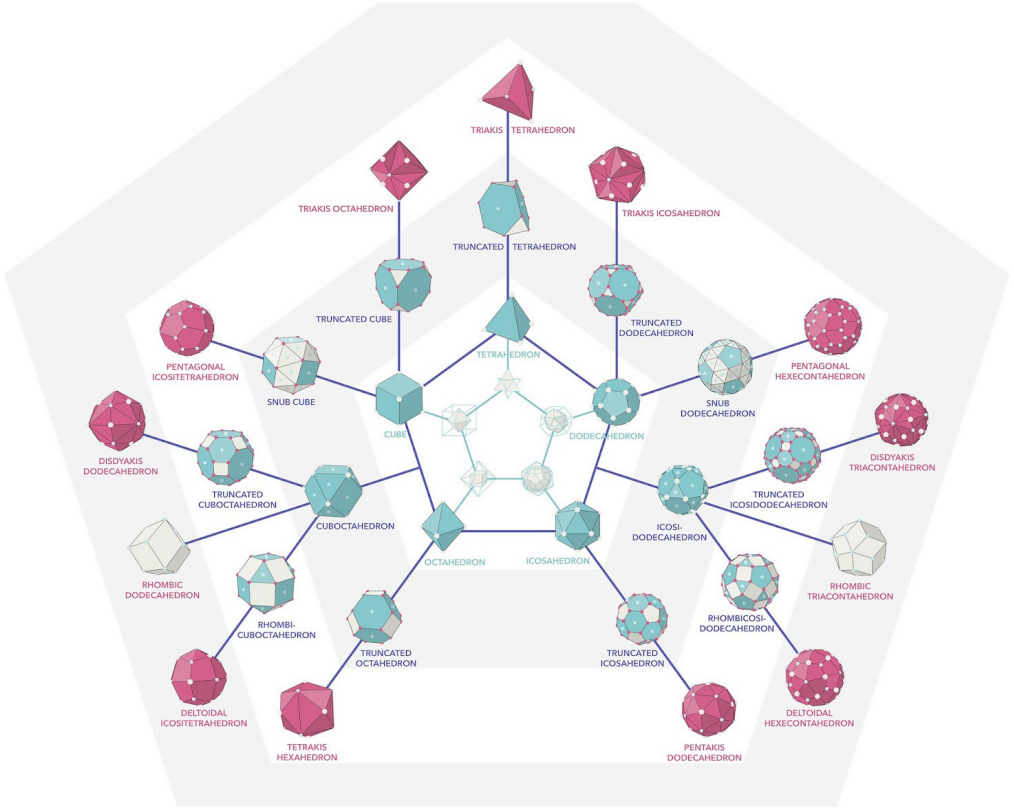
The explosion of faces of polyhedra results in rhombic polyhedra:

- The *rhombicuboctahedron* results from the explosion of the faces of the *hexahedron* (or cube) and the *octahedron*.
- The *rhombicosidodecahedron* results from the explosion of the faces of the *dodecahedron* (or cube) and the *icosahedron*.
- The *great rhombicuboctahedron* results from the explosion of the faces of the *truncated hexahedron* (or cube) and the *truncated octahedron*.
- The *great rhombicosidodecahedron* results from the explosion of the faces of the *truncated dodecahedron* and the *truncated icosahedron*.

The twist of faces of polyhedra results in snub-polyhedra.

- The *Snub Cube* has octahedral symmetry and results from the twist of the *rhombicuboctahedron*.
- The *Snub Dodecahedron* has icosahedral symmetry and results from the twist of the *rhombicosidodecahedron*.

PLATONIC SOLIDS ARCHIMEDEAN SOLIDS CATALAN SOLIDS



POLYHEDRAL RELATIONS

Fig. 2.7 - Polyhedral relations by Allison Y Chen 1

The Golden Ratio, the Golden Spiral

The golden ratio is a fundamental measure of the Universe apparent almost everywhere. It appears in some patterns in nature, such as the spiral arrangement of leaves and other plant parts. With a numeric value of approximately 1.618 2, it is represented by the Greek letter ϕ (phi), and is also known as phi ratio, sacred cut, golden mean, or divine proportion.

The golden ratio is the unique ratio such that the ratio of the whole to the larger portion is the same as the ratio of the larger portion to the smaller portion. As such, it symbolically links each new generation to its ancestors, preserving the continuity of relationship as the means for retracing its lineage.

A golden rectangle is a geometric shape in which the ratio of the longer side to the shorter is the golden ratio.

The golden spiral is an endless cosmic spiral based in the ratio of 1,618... This ratio repeats itself in nature and seems to be a creative ordering pattern of the Universe. We find it from the mollusc shell to galaxies.

The golden ratio has been widely used in Art and Architecture since Antiquity (in the Great Pyramid, the Parthenon, Leonardo Da Vinci's painting The Last Supper, Beethoven's Fifth Symphony, among many others). The ratio of segments in a 5-pointed star or pentagram was considered sacred to Plato and Pythagoras in their mystery schools.

Some twentieth-century artists and architects, including Le Corbusier and Dalí, have proportioned their works to approximate the golden ratio, especially in the form of the golden rectangle, believing this proportion to be aesthetically pleasing. The intentional use of this natural proportion expands our sense of beauty, balance and harmony.

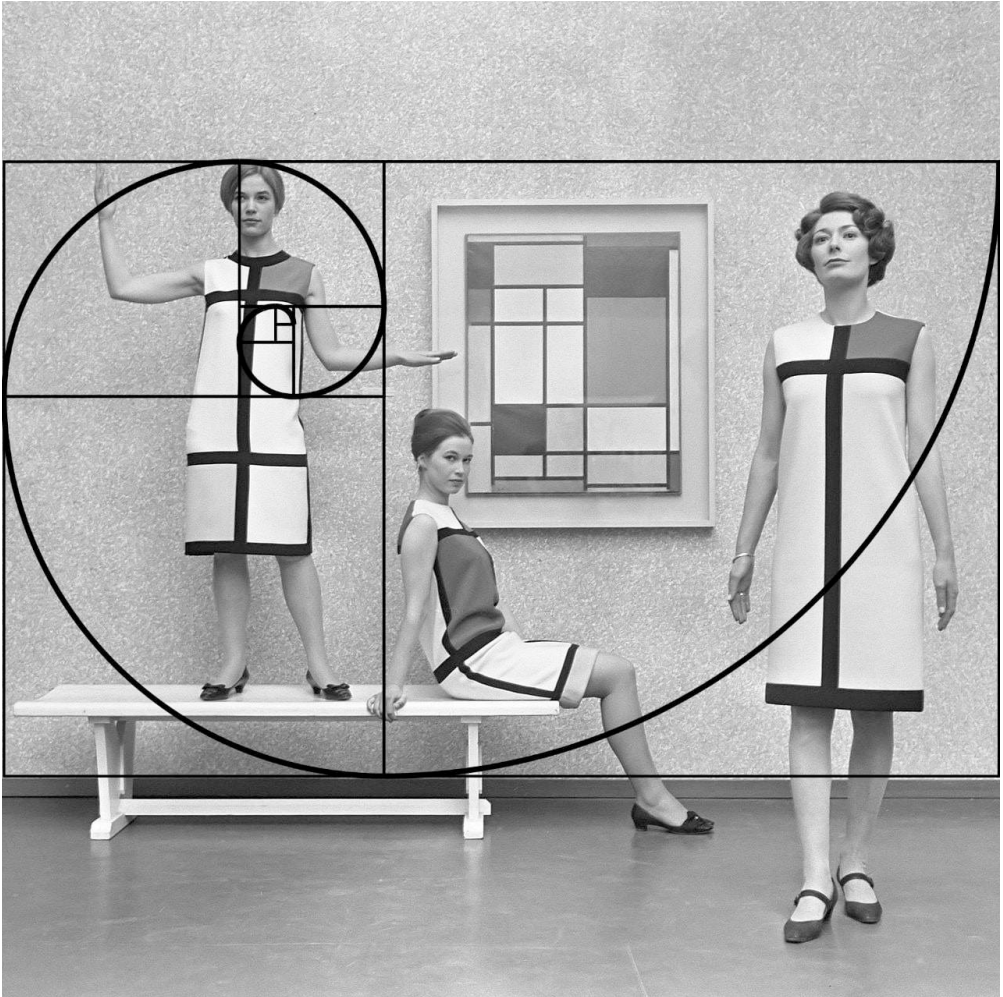
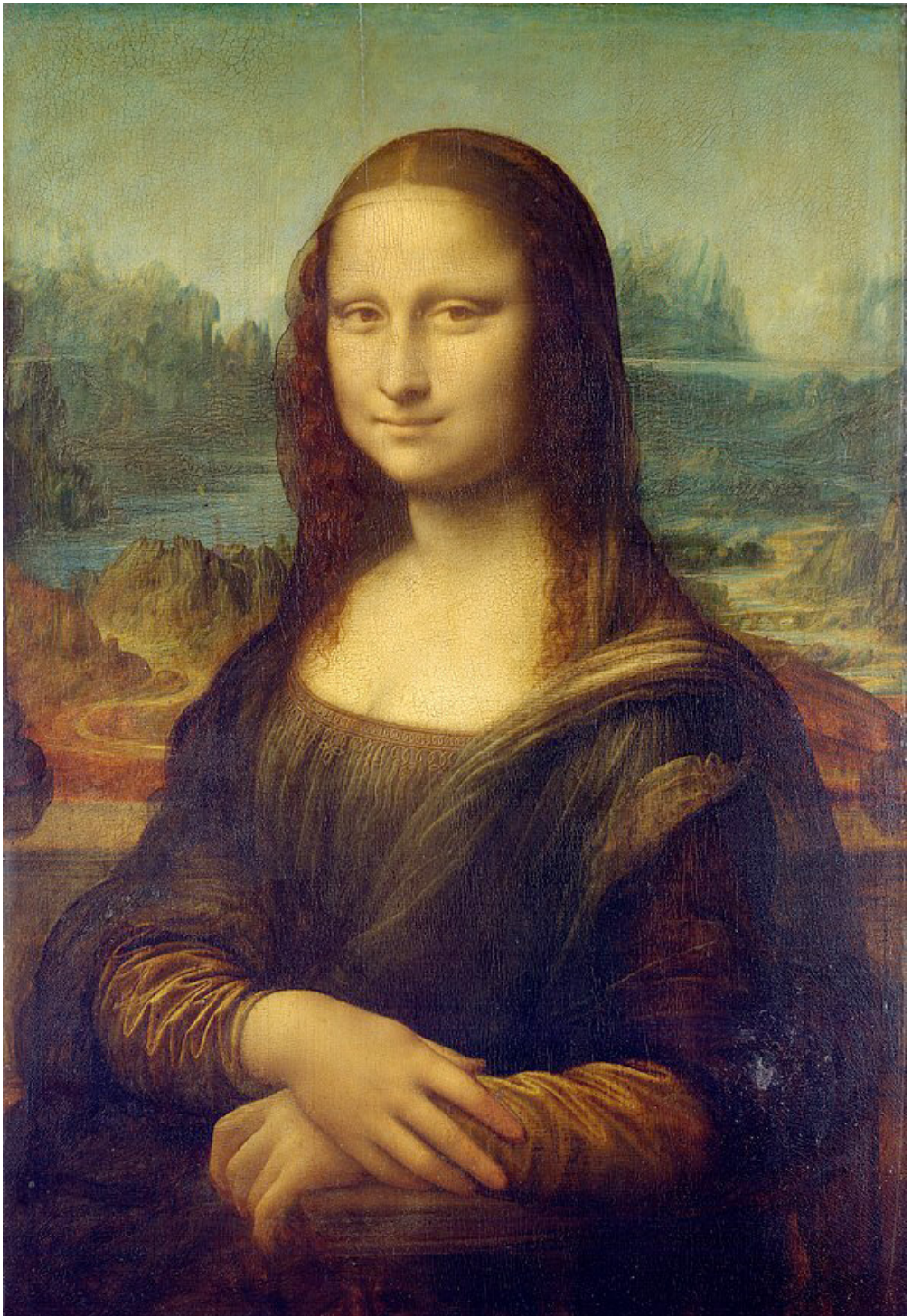
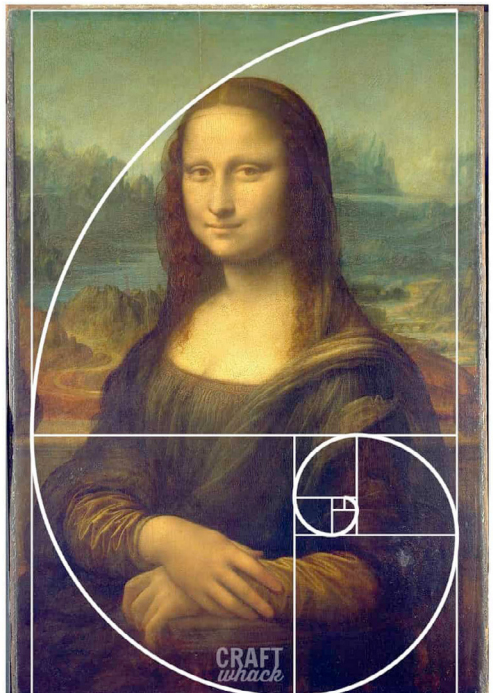
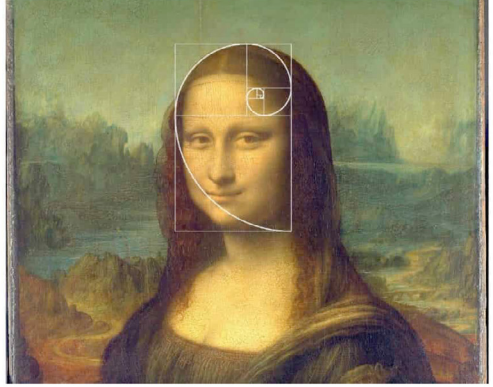
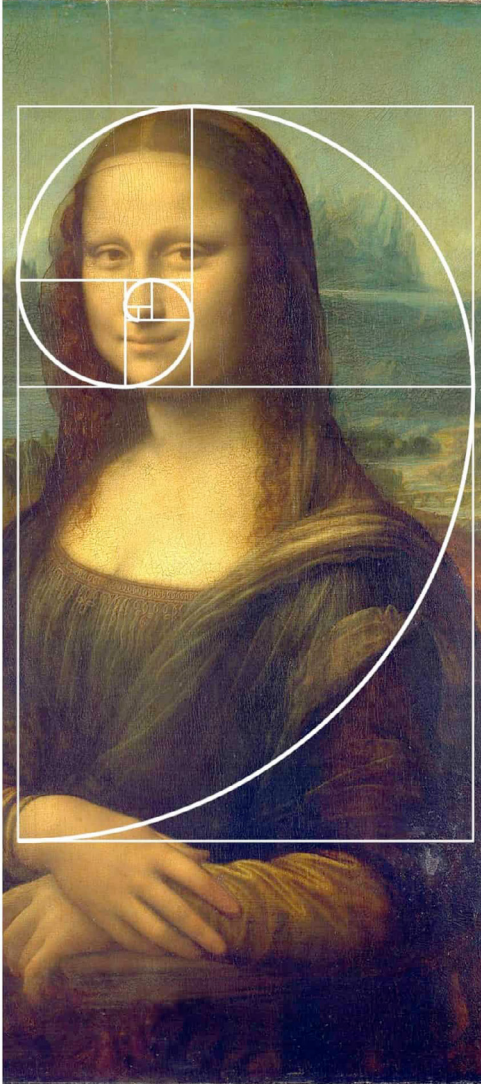
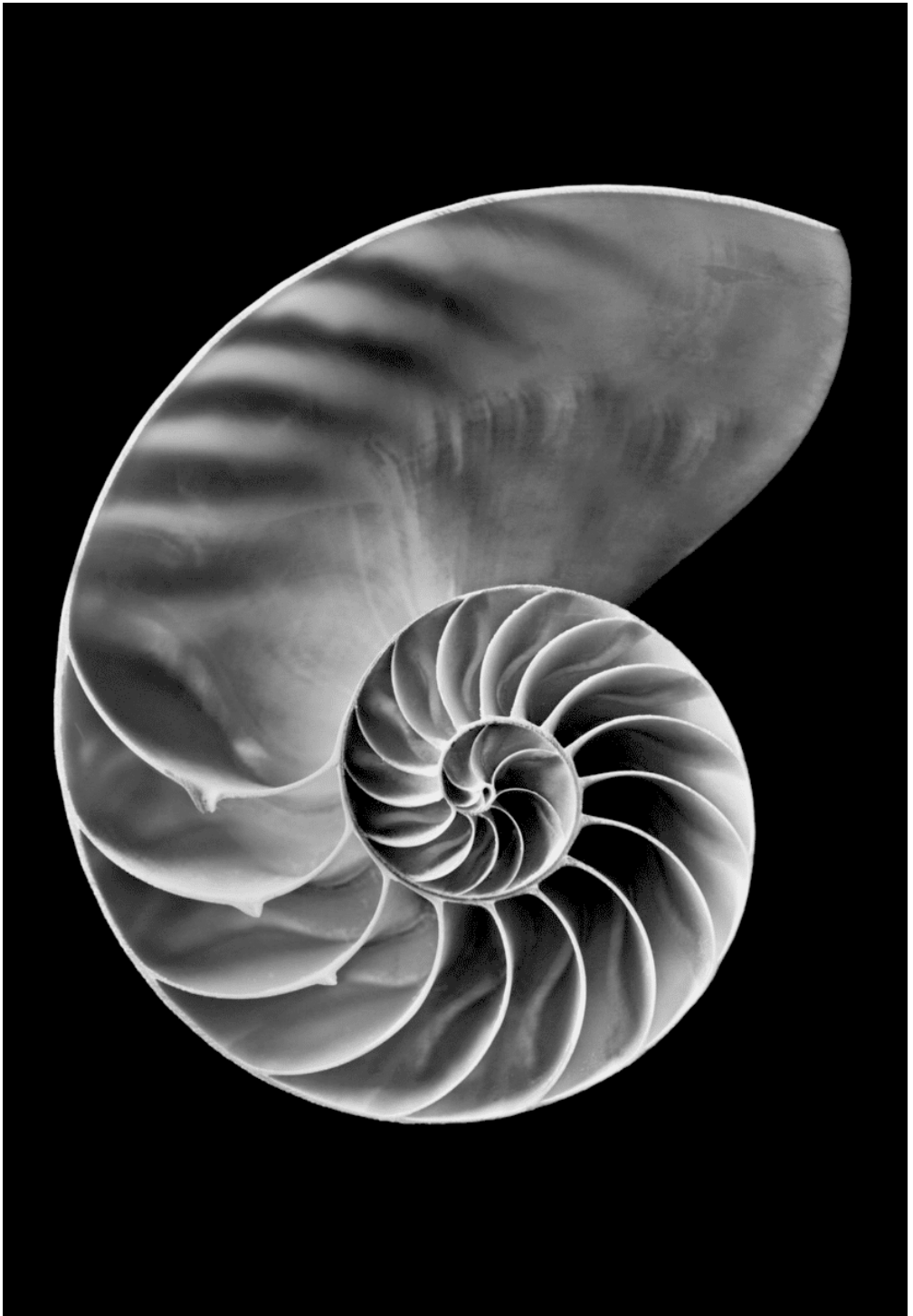
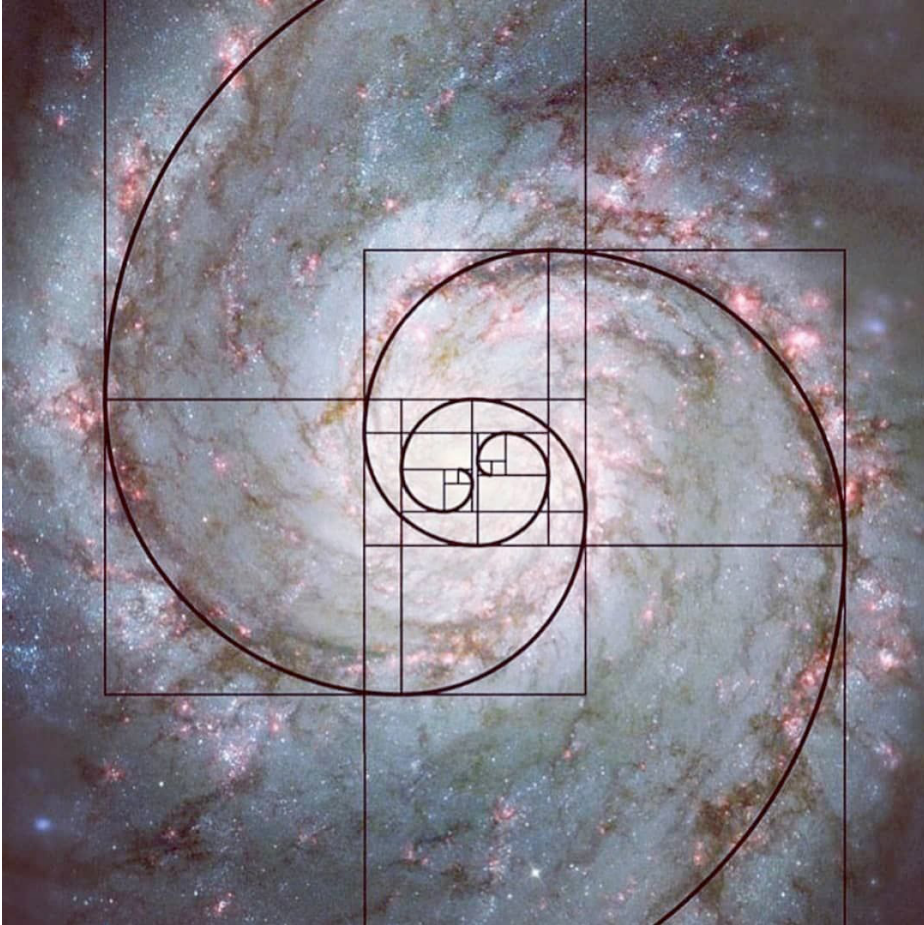


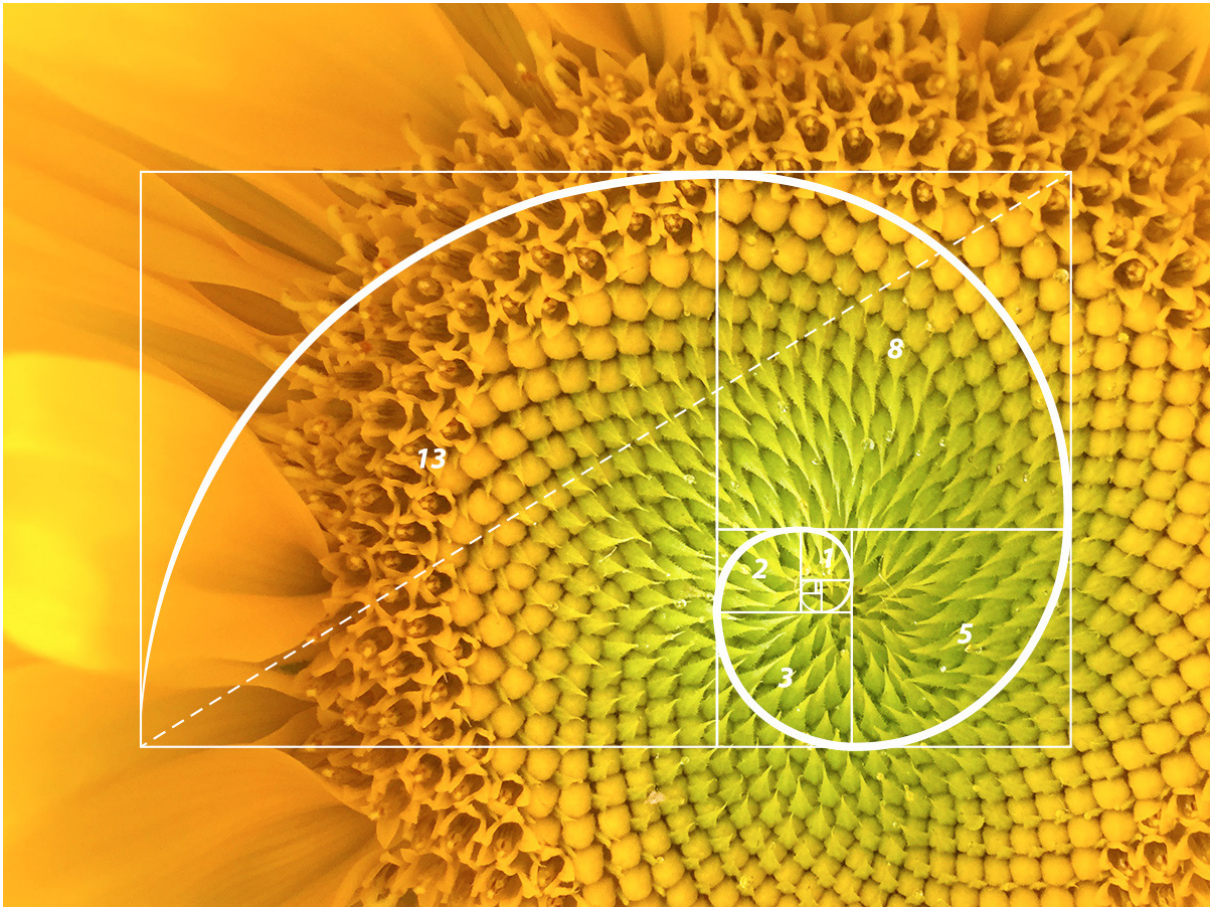
Fig. 2.8, 2.9, 2.10, 2.11, 2.12, 2.13 - The golden ratio and the golden spiral











The Fibonacci Sequence

The Fibonacci sequence is an arithmetic projection discovered in 1202 by Mathematician Leonardo de Pisa, also known as Fibonacci. It is an infinite sequence of numbers in which each number results from the sum of the two previous numbers:

1, 1, 2, 3, 5, 8, 13, 21, 34, 55,...

$$1+1=2$$

$$2+1=3$$

$$3+2=5$$

$$5+3=8$$

$$8+5=13$$

$$13+8=21$$

and so on.

The Fibonacci Sequence appears in biological settings, such as branching in trees, the arrangement of leaves on a stem, the fruitlets of a pineapple, the sunflower, the flowering of artichoke, an uncurling fern, the arrangement of a pine cone, and the family tree of honeybees.

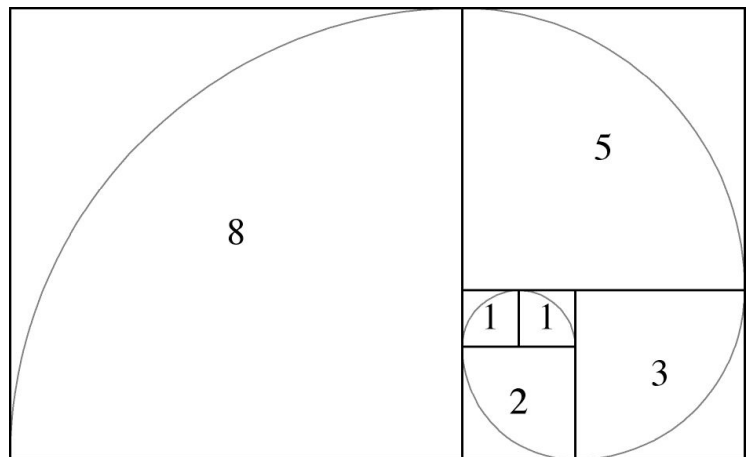


Fig. 2.14 - Fibonacci sequence

The Flower of Life

The Flower of Life is a modern name given to an ancient sacred geometry pattern found in several ancient places around the world. The oldest known example of the Flower of Life has been discovered at the Temple of Osirion at Abydos, Egypt, inscribed on top of rectangular monolithic columns. In the Forbidden City, in Beijing, China, the Flower of Life can be seen underneath the paw of the "Fu-Dog", the "Guardian Lion". It can also be found in Lebanon, Turkey, Japan, Italy, Spain and many other places. The Flower of Life pattern is made up of 19 overlapping spheres (or circles) of the same size, as Vesica Piscis.

The Flower of Life is the geometric matrix from which all creation is generated and has long been regarded as the blueprint of the Universe. It is believed to depict the fundamental forms of space and time. It contains a vast system of information about life itself, including templates for the five Platonic Solids, which in turn, contain the Pi, square root of 2, square root of 3, Phi proportions and much more. The Flower of Life is the basis for the design of every atom, molecular structure and life form. Therefore it is said that the Flower of Life reveals the matrix of creation and contains the geometric archetypes of everything that exists. It is undoubtedly one of the most powerful ancient symbols.

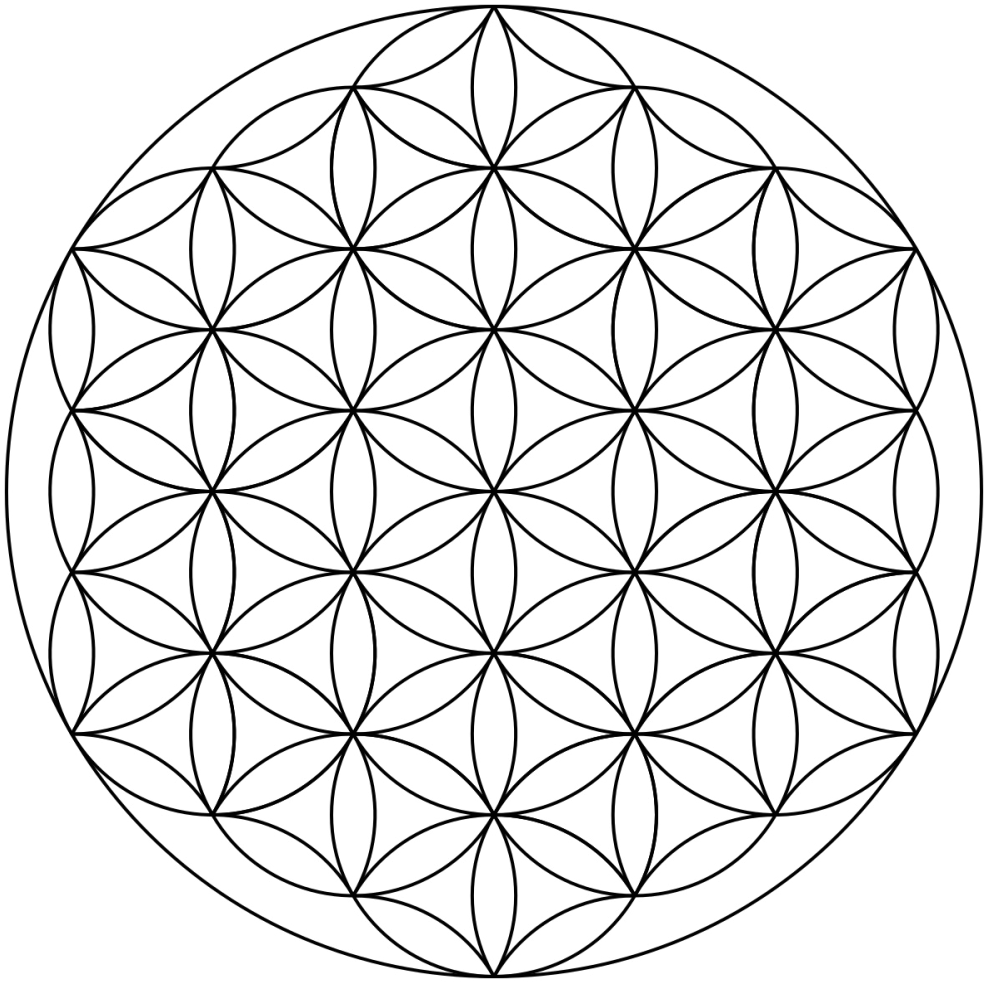


Fig. 2.15 - The Flower of Life

The Fruit of Life

As in a life cycle, from the flower grows the fruit, inside the fruit grows the seed, from the seed grows the tree, from the tree grows the flower, and so the cycle continues. The Fruit of Life is made of thirteen spheres (or circles).

It is the matrix of the Metatron's Cube and contains the five Platonic Solids.

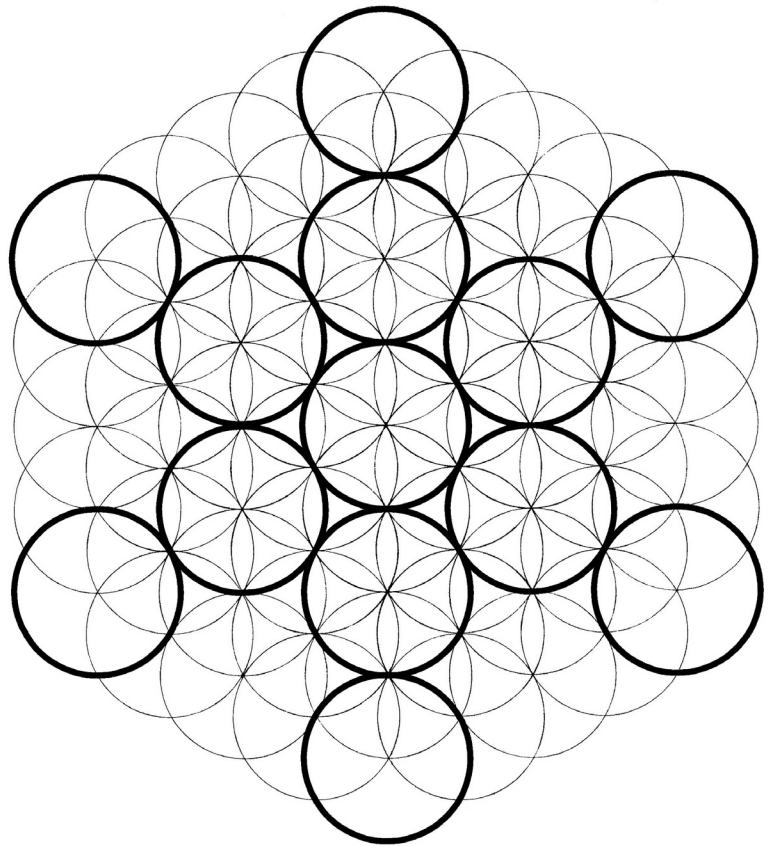


Fig. 2.16 - The Fruit of Life

The Seed of Life

In the centre of the Flower of Life, there are seven interconnected spheres (or circles).

This pattern, surrounded by another circle, is the image of the Seed of Life. It symbolizes the genesis principle, the ovule fecundation, or the cells mitosis. It is said that these first eight cells do not renew each seven years as the others do, but remain with us until we leave the body. In them is our physical body program. This geometry generates the Flower of Life as an advanced expression of all creation.

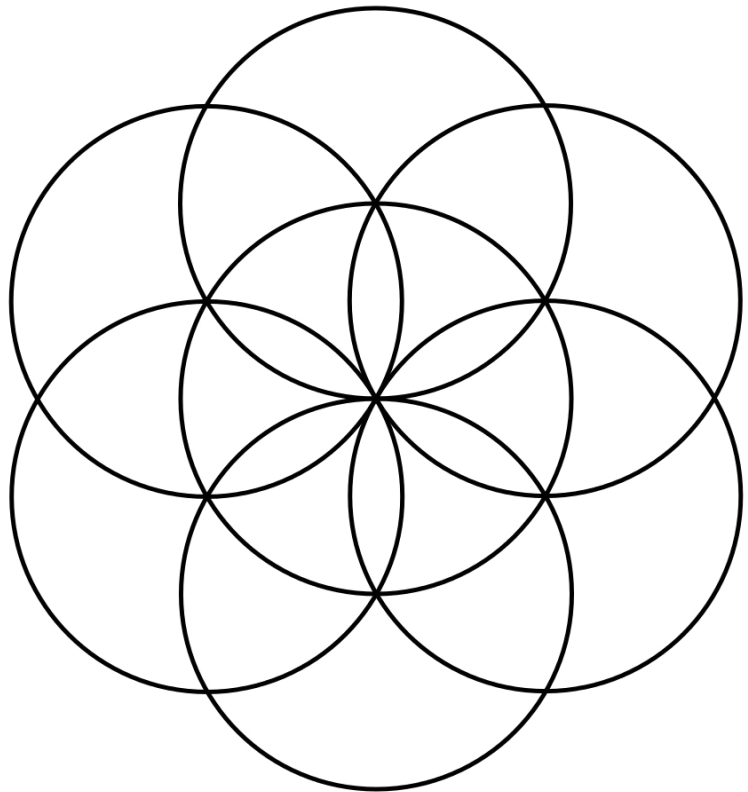


Fig. 2.17 - The Seed of Life

The Tree of Life

The Tree of Life is another image inside the Flower of Life pattern. We have a tree, then a flower, then a seed. If these geometries parallel the five cycles of a fruit tree, then the source of the tree, must be perfectly contained in the seed. If we take the image of the Seed of Life and superimpose the figure of the Tree of Life, we can find this relation.

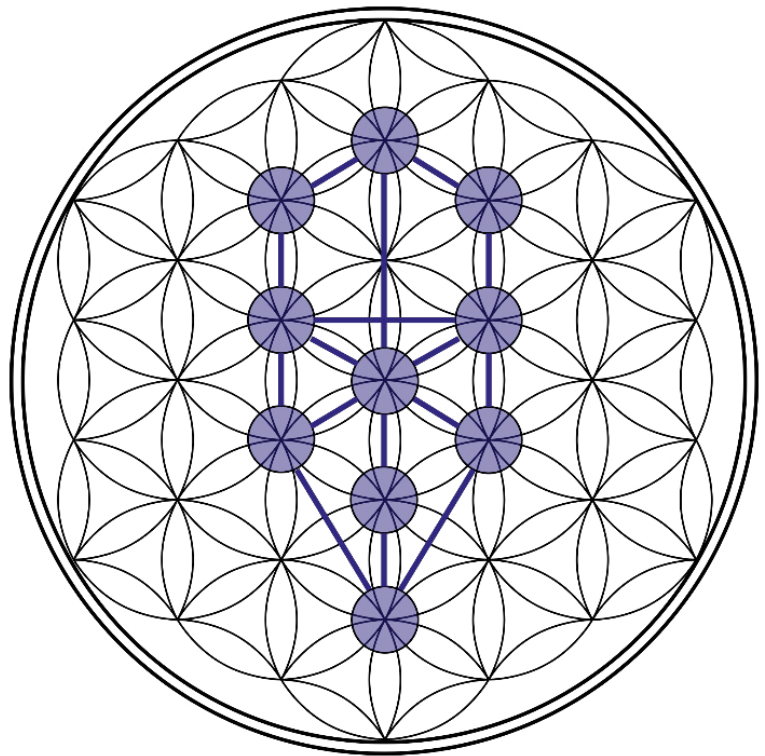


Fig. 2.18 - The Tree of Life

The Metatron's Cube

The Metatron's Cube is a geometric pattern based in the 13 spheres of the Fruit of Life. We obtain the Metatron's Cube by connecting the centres of each sphere of the Fruit of Life. It is a powerful experience of simultaneous codification of the five basic functions of consciousness. It is also called Matrix Star (see practical activity on appendix 2).

The Metatron's Cube contains the five Platonic Solids, the tetrahedral star and many other primal forms, and is said to contain the information of the whole Universe. In it we may find the infinite possibilities that exist in our tangible reality. It is a quantic accelerator capable of transforming and co-creating our reality.

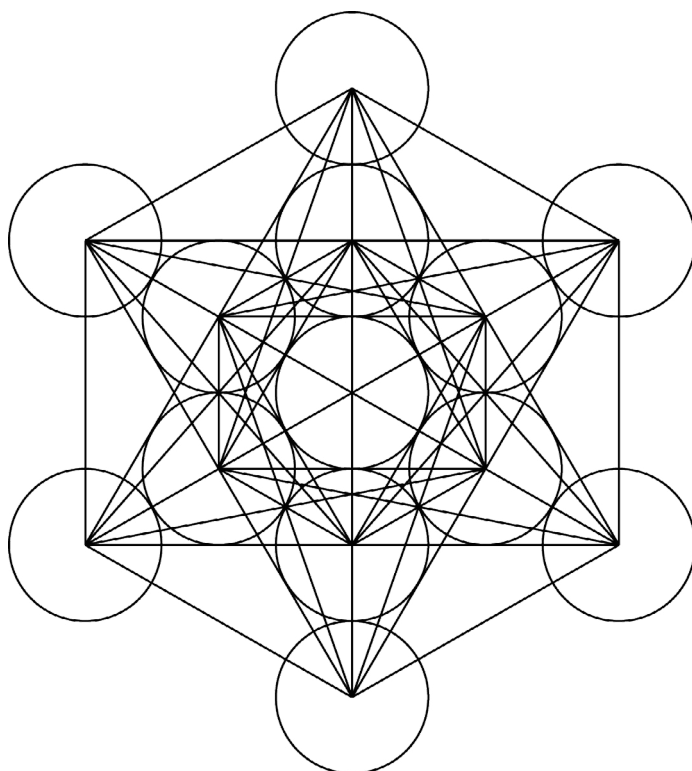


Fig. 2.19 - The Metatron's Cube

The Merkaba

The Merkaba (in a 18th dynasty Egyptian translation “Mer” means Light or Vehicle, “Ka” means Spirit, “Ba” means Body; and in Hebrew merkaba translates to “chariot”). The Merkaba has been known ever since Antiquity as an energy field which surrounds all life forms. Drunvalo Melchizedek has described the Merkaba geometrically as a rotating tetrahedral star (Melchizedek 1999). It is a combination of two tetrahedrons of opposite polarities that form a counter-rotatory field of light. The top tetrahedron points up and corresponds to the masculine part, the human mind, heaven. Its field is electric. If one is inside the Merkaba, it turns left, counterclockwise. It channels energy from the Universe down to the Earth plain. The bottom tetrahedron points downwards and corresponds to the feminine part, the emotional human, the earth. If one is inside the Merkaba, it turns right, clockwise. Its field is magnetic and draws energy from the earth beneath up to heaven. The Merkaba unites Heaven and Earth, creating a multidimensional vortex.

The Merkaba may be understood as the spirit-body surrounded by counter-rotatory fields of light, spirals of energy as in the ADN, that transport spirit/body from one dimension to another. These fields of energy normally spin around our bodies at the speed of light. But in most of us, it became slow or inactive, due to a lack of use and attention towards it. The Merkaba can be restored and reconfigured through experience. When activated, it allows to experiment an expansion of consciousness, to raise awareness of potentials, restore memory and access into the infinite possibilities of our being.

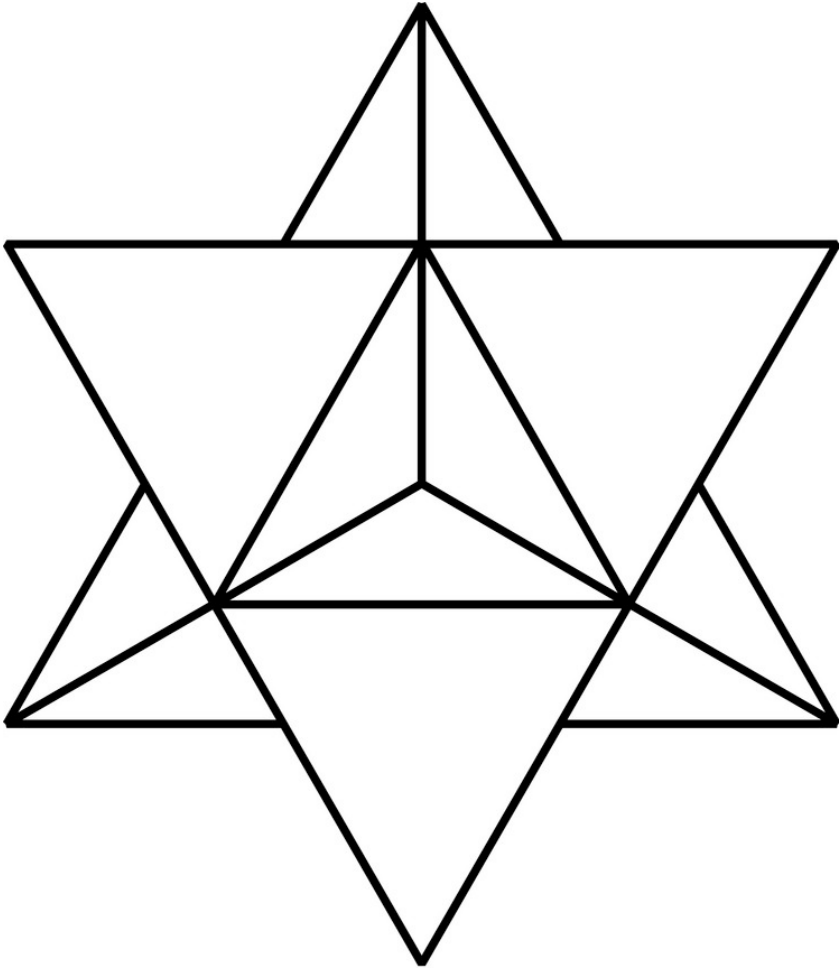


Fig. 2.20 - The Merkaba

The Vesica Piscis

The Vesica Piscis is a powerful geometry that occurs when two identical spheres (or circles) intersect in each other's centre. The intersection has the shape of the human eye or mouth. In 2 dimensions, the intersection is composed of two equilateral triangles, which together have the proportion of a golden rectangle. The Vesica Piscis has many symbolic meanings, representing the eye, the mother's womb, the vagina, the origin of life. It also symbolizes the divine verb. This proportion was used in Egyptian temples, such as in Osirion temple at Abydos. Vesica Piscis also symbolizes a shared space or a shared vision, mutual understanding between equal individuals on a common ground.

From the successive repetition, intersection and rotation of the Vesica Piscis, a new dimension and sound is created. After six spheres, the seventh surrounds the resulting pattern, completing the geometry of the Seed of Life.

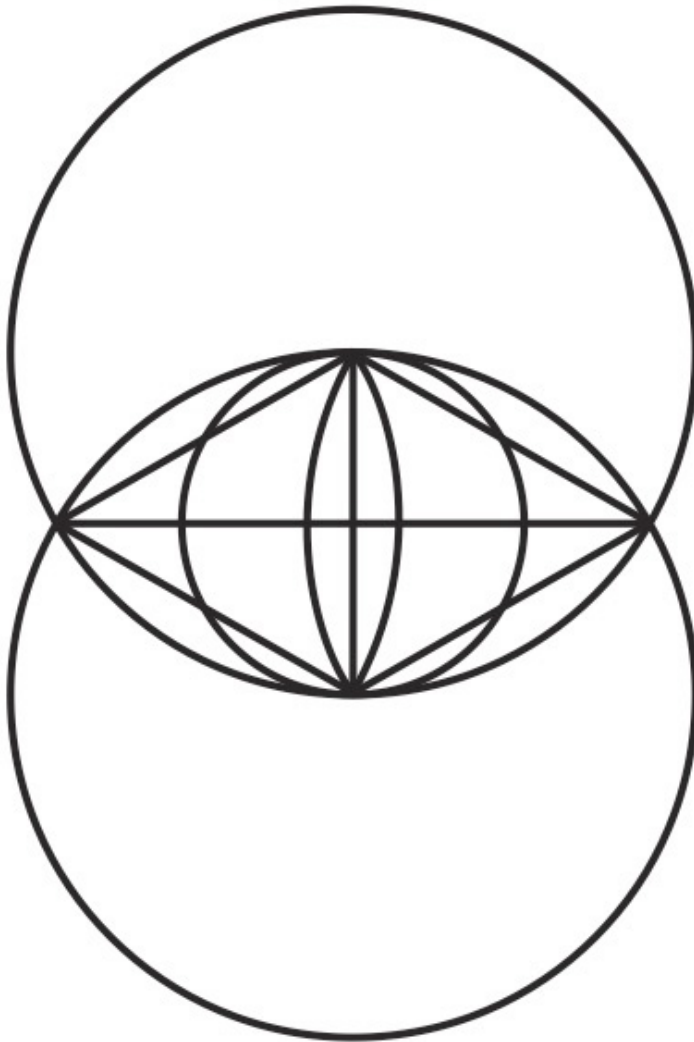


Fig. 2.21 - The Vesica Piscis

The DNA

The DNA, whose function is the preservation of life, has a helicoidal shape based on a spiral of unfolded dodecahedrons, and the spiral of the DNA molecule is based on the golden section. Physician and researcher Mark White proposed that the codon table of the genetic code follows the shape of a 12-faced pentagonal dodecahedron. Mark White's 'G-Ball' DNA model shows an icosidodecahedral spatial symmetry in which 20 standard amino acids are organized in space according to water affinity (Merrick 2011).

Hands on Universal Geometry

In appendix 2, you will find several geometric models to build up. Building these models of Universal Geometry has multiple benefits: we tune into specific patterns, we consciously put ourselves in resonance with its frequencies and allow the information to be incorporated, hence easily achieving wellbeing. As will be seen in the next chapter, if we inhabit spaces with specific qualities, proportions and forms based in Universal Geometry, our frequency fields get tuned to operate in accordance with the dominant harmonic geometry. This is why it is so important to integrate Universal Geometry in the design of spaces where we develop our everyday activities. Through the principle of resonance, these tuned spaces contribute to connect us to universal creation.

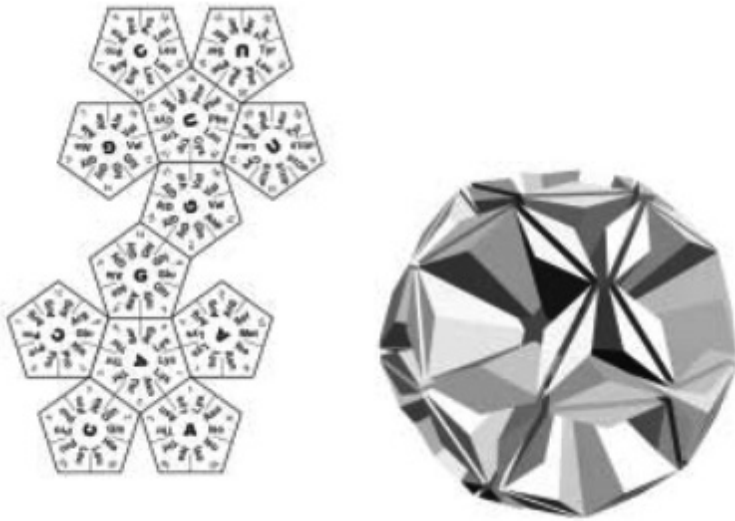


Fig. 2.22 - G-Ball model of DNA by Mark White



3

UNIVERSAL GEOMETRY IN SCHOOL'S ARCHITECTURE

The Universe is alive, everything is connected, space is filled with energy that can be tapped and utilised to transform our civilisation.

In <https://academy.resonance.is/>

Architecture shapes our everyday experiences. It sets the conditions for the way we interact with our surroundings. As we experience the world in a simultaneous and multi-sensory manner, the quality of a space in turn shapes our senses interplay, our kinetics and neural balancing, which are determinant factors for the integral development of human beings. Educational spaces designed for the total experience of the body, mind and spirit, while playing and learning, can greatly contribute to our educational and evolutionary process. Therefore the importance of implementing Universal Geometry in the architectural design of schools. As mentioned, Universal Geometry is a powerful tool as it contains Earth's design archetypes, all patterns of transformation that humans have observed in nature since ancient civilisations. Universal Geometry is a technology that our ancestors left for us, as it may be found in the architecture of many ancient places around the world. Since Antiquity, temple builders have relied on geometry linked to particular numbers and proportions to shape sacred spaces.

Schools were envisioned as such sacred spaces.

Universal Geometry applied in architecture confers rhythm, beauty and harmony to creation. It implies the knowledge and comprehension of energetic dynamics, towards a responsible use of cosmic energies by the human being in its evolutionary process. Quantum geometry and resonance science are nowadays exploring this connected universe and raising scientific proof of what the ancient already knew: everything is connected by fields of energy. Everything follows a geometric archetype: patterns, designs and structures that exist in nature, from the smallest particle to forms of life recognizable by the human eye, to Cosmos.

The architectural design of Schools should be engaged based in Geometry as a matrix of life. Geometry is not a limited set of static shapes or volumes that can be disposed from a visual perspective only, as it is commonly understood. Geometry creates energetic vibrating structures, what we could refer to as Resonant Architecture. Ancient civilisations built architecture based on an embodied knowledge of vibration, energetic geometry, cosmology, light and sound as creative design forces. It has been discussed that ancient architecture, besides providing shelter, was created based in the language of vibration and universal geometry, with the intention to facilitate the human experience of connection between Earth and Cosmos. Therefore it is important to recognise and remember the value of ancient knowledge. And it is fundamental to explore new forms of experience and connection, adapted to our culture, particularly to our children characteristics and needs.

Architectural space, resonance and attunement

Through the universal principle of resonance, every being resonates greatly to specific frequency patterns. The phenomena of resonance is explained in acoustic science as sympathetic vibration 3. When a body resonates in response to frequencies that are close to its own, there is an enhancement of the intensity of oscillation, or vibration. The experience of sympathetic resonance between space and body, as an interconnected field of vibration, is directly related to the relationship between the geometry, materials' density, spatial volume of the space of propagation, and the type of frequencies that are propagated.

As seen, we are in resonance with Universal Geometry because it translates the archetypes of Earth's matrix of life into spatial forms. Designing architecture based in Universal Geometry allows the

archetypal structuring of energy. These architectural spaces resonate greatly with our bodies; we get tuned in. Therefore, architecture is determinant to the human being attunement to certain fields of energy, as it draws the background for our physical, emotional, mental and spiritual tuning.

Experiencing spatial geometry engages the felt sense of being surrounded by a resonant space, which triggers neural pathways that allow the experience of our own spacious nature. It activates the deeper potentials of the right hemisphere and its spatial capabilities. Every space, being and object has frequency patterns. We are resonant bodies, so our senses attune in different ways according to different frequency fields. The quality of resonance is attuned to vitality, when it integrates Universal Geometry, the matrix of life. A space that resonates with universal vital qualities generates energetic conditions that may foster well-being. This phenomenon is also explained by neuroaesthetics.

Neuroaesthetics and Universal Geometry

Neuroaesthetics studies human response to aesthetic experience, and is trying to uncover universal neural basis for appreciating the qualities of beauty. Neuroscience findings regard direction, location and dimensions as determinant parameters. Certain universal qualities are found regardless of culture or experience backgrounds. The language implicit in these qualities is Universal Geometry. Neuroscience and neuroaesthetics are providing evidence that Universal Geometry has profound implications in architecture, and the way we respond and relate to our surrounding environments. In an interview 4, architect Michael Rice explains how architecture is a living bio field, and how geometry creates archetypes that anchor universal energy. He is interest in neuroaesthetics regarding how beauty and fractal

harmony of sacred geometry affects us at a sensory level, stimulates our brain electrically and chemically and invokes biological response.

Vibration and energetic geometry

Vibration expressed as geometry creates forms as energetic vibrating structures. The nature of forms as vibrating structures or periodic systems was vastly investigated in meticulous experiments carried by physician and natural scientist Hans Jenny, to which he called Cymatics 5, a study of wave phenomena to visualise examples of patterns' formations. He studied how vibrations generate and influence patterns, shapes and moving processes. Cymatics, along with other earlier experiments, such as the Chladni figures, the Lissajous figures or harmonograph studies, allowed the visualisation of vibration and frequency patterns, clearly revealing visually that form or geometry is a vibrating structure of energy.

It has been argued that these patterns are the expression of a dialogue between the vibration of the tone and the 'answering' matter, between the motion energy contained in the vibration, and the matter which is either resonating in co-movement or paused inertia (Lauterwasser 2006, 42- 46). The visualisation of these vibrational patterns also revealed similarities to patterns found in nature and universal geometry principles and symbols (Vesica Pisces, the Flower of Life, the Golden Ration, the Five Platonic Solids, the Matrix Star). Therefore, Geometry creates archetypes that anchor universal energy. These archetypes or patterns may be understood as life forms, creative forces, dynamic beings, vectors of movement, containers of energetic fields, among others.

The architectural shape of a space is an energetic container. Its geometry, materials and spatial volume determinate the propagation of energetic fields (electromagnetic and acoustic waves) perceived through our senses as light, colours, sound, temperature, movement. When waves meet the surfaces of a space, these can be reflected, diffused, refracted or absorbed. The space's vibrational fields result in specific energetic qualities that define an ambiance. An ambiance may be experienced as lighten or saturated, harmonious or unpleasant, etc.

These are some of the reasons why the principles of vibration and energetic geometry should be embodied in architectural design.

The architectural shapes and the site should be engaged in a relation of resonance. One should start the design process based on observation, experimentation, intuition, before going into conceptual drawing in paper or computer. The site reveals its energetic potentials. In architectural design, the geometry of shapes and patterns will work better along the site forces. It is obviously more beneficial to work along the forces of nature than against it. This is what the next chapter is about: how to design with the intention to pattern the site's ecosystems and build interconnections which allows for energy efficiency and harmony.

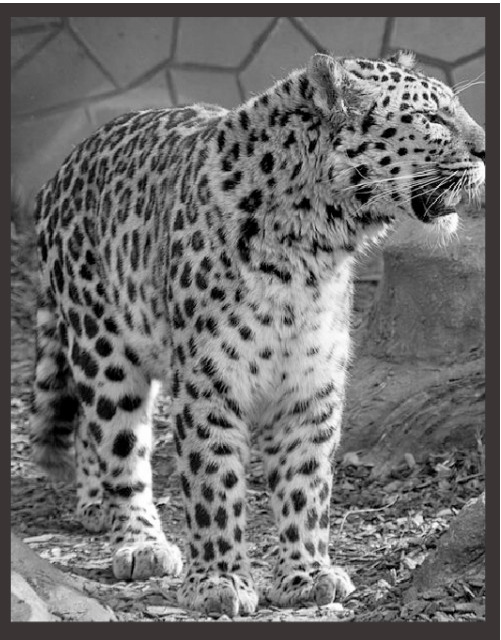
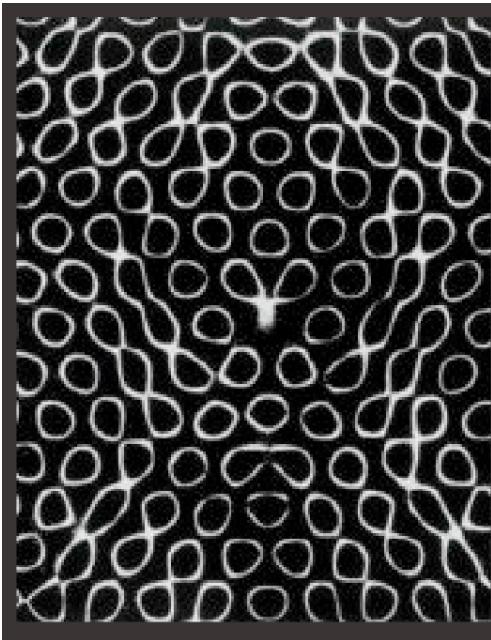
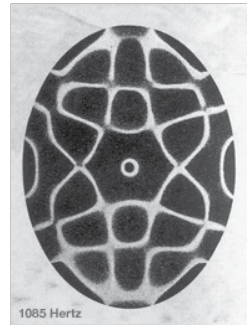
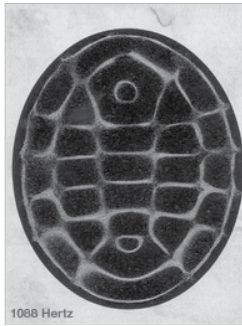
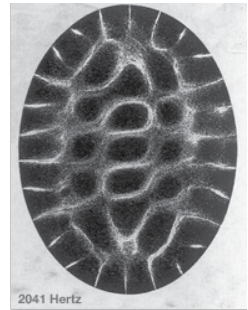
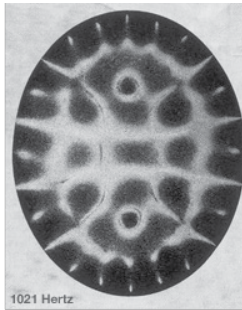
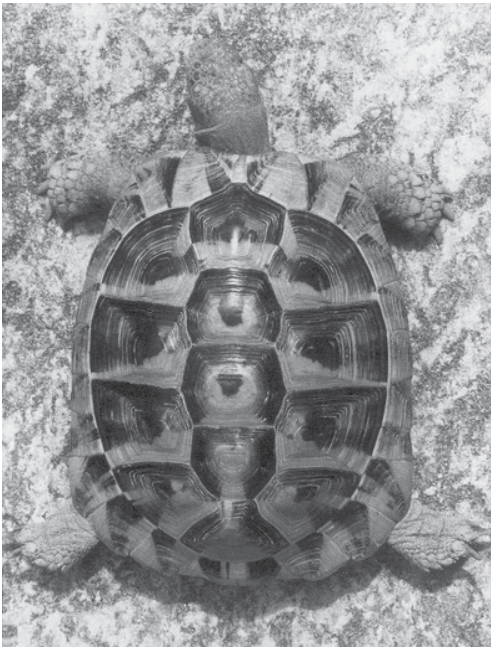
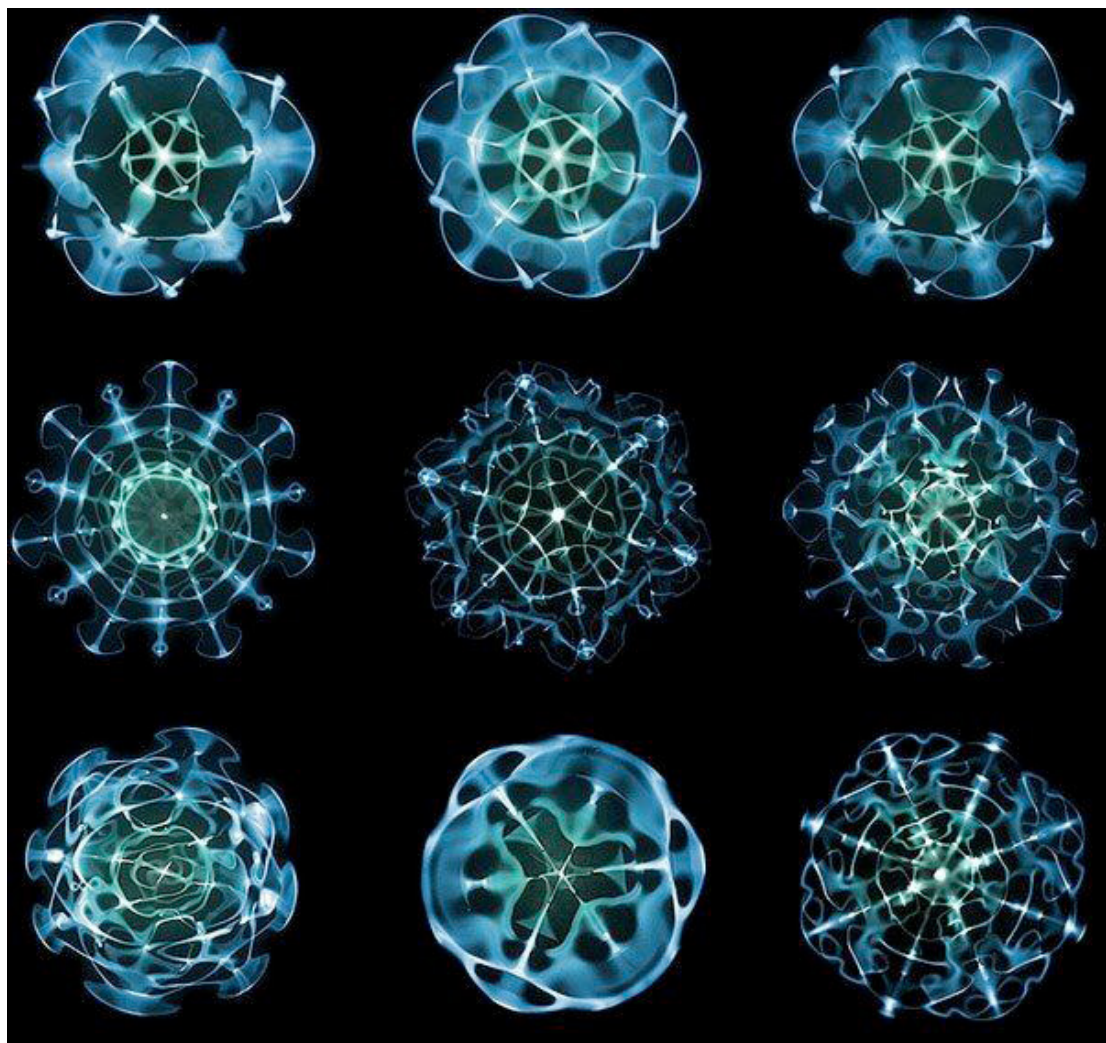
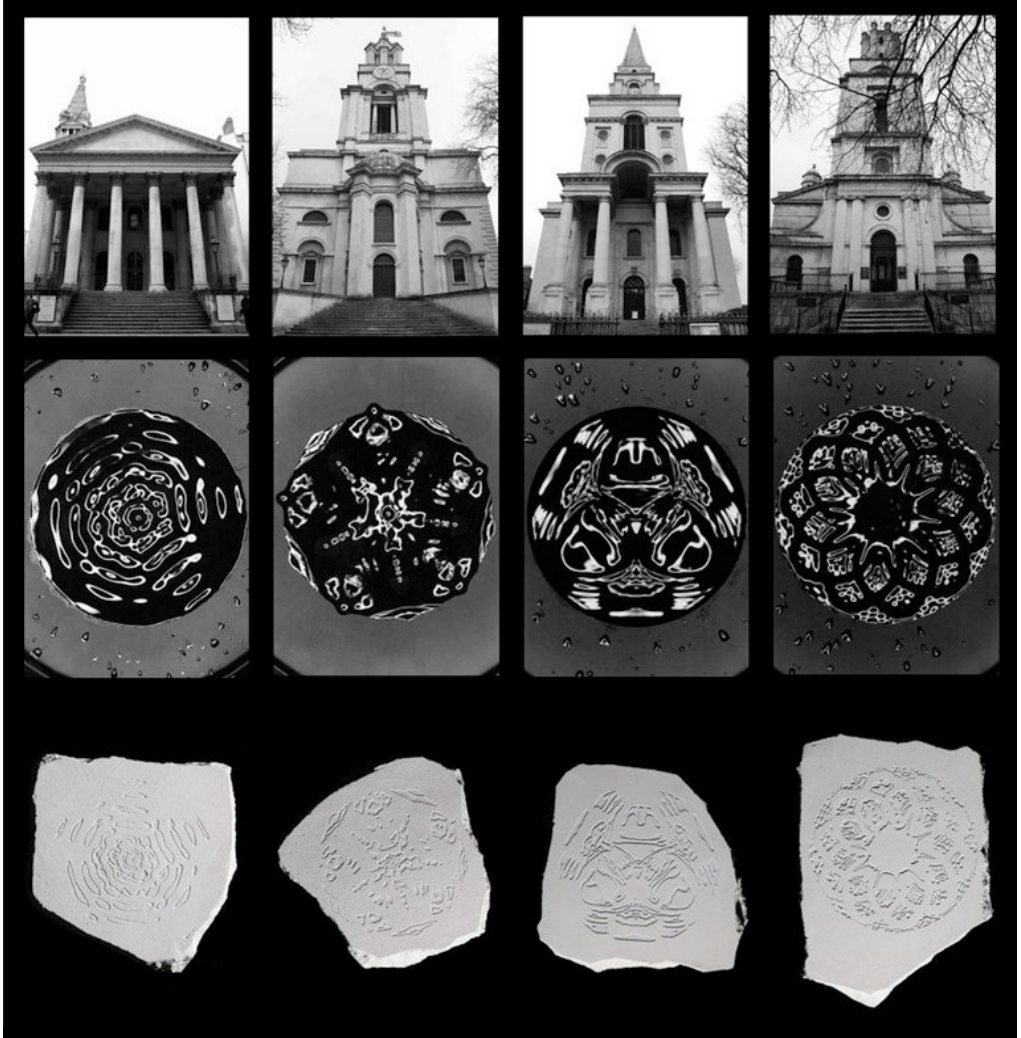
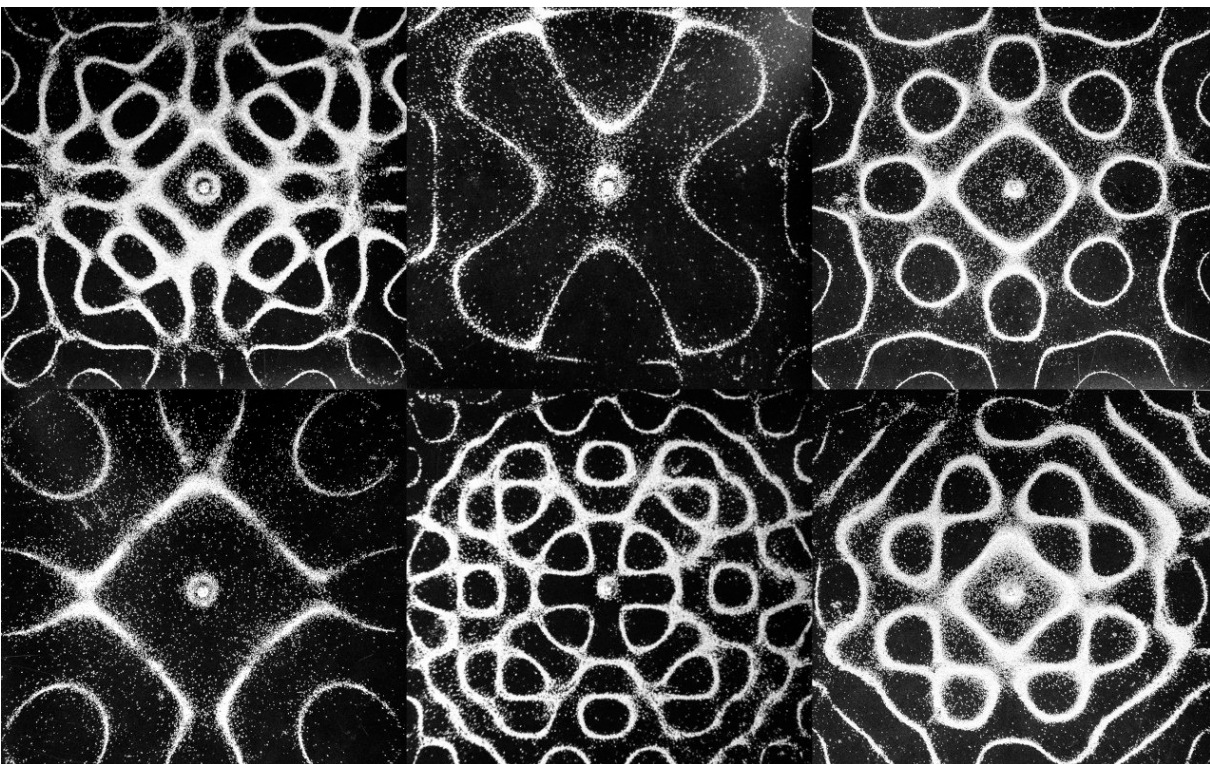


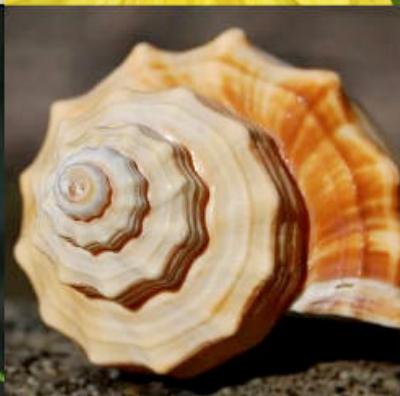
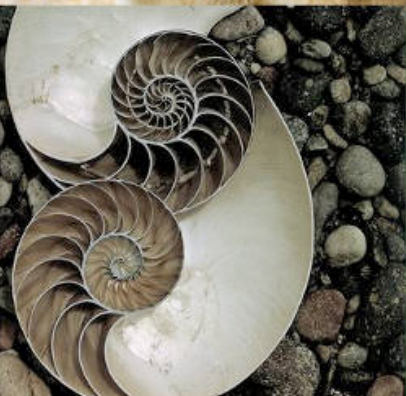
Fig. 3.1,2,3,4,5,6 - Vibrational patterns in Nature and architecture













4

**CO-CREATING
LEARNING
SPACES
WITH THE
ECOSYSTEMS**

Anthroposophist Rudolph Steiner introduced the term biodynamic in agriculture in the 1924, taken from the Greek words bios meaning life and dynamis meaning energy. Hence biodynamic refers to working with the energies which create and maintain life, using management practices that are intended to restore, maintain and enhance ecological harmony. This idea can be extended to an architectural practice that regards Geometry as an alive matrix. Architecture can be envisioned as a life form, an organism. It can adapt itself to local conditions, to work with the energies that create and maintain life, so to enhance ecological harmony. Any learning space's design and implementation should be in harmony with the site's natural environment and cooperative with the local biodiversity and climate. In this approach, there are determinant parameters that should be taken in consideration when designing a School:

- Co-creation
- Local Cosmvision
- Permaculture design
- Bioclimatic design
- Biodiversity
- Sustainability
- Natural raw materials
- Ambiance dynamics
- Light and colours
- Sound and acoustics
- Smell and touch
- Architecture, geometry and well-being

Co-creation

The first step to co-create our School is to envision the dream and project it with all the community: from parents, teachers, children, youths, neighbours, grandparents, stakeholders, and families in general. This step is further developed under chapter 7 (p.155). This step should be engaged in total respect with the local ecosystems.

Local cosmovision

Ancient architecture examples all around the world show evidence of very specific alignments between Earth and Cosmos (Teotihuacan in Mexico, Tikal in Guatemala, Tiwanaku in Bolivia, Cusco, Machu Picchu or Chavin de Huantar in Peru, Djoser or Giza pyramids in Egypt, Stonehenge in England, Maeshowe in Scotland, among many others). Ancient astronomers have used Geometry to calculate holy seasons in order to cooperate with particular energetic conditions, taking in account electromagnetic and gravitational forces at work in particular periods. Specific features are common to many places, such as portals, holes or stones aligned with the sun rise or the sun set at precise moments during the year (Solstices or Equinox). The alignments were sometimes with the rising of stars or constellations (such as Orion, Procyon, the Pleiades) which indicated annual cycles or even climate changes, such as the arriving of rains seasons. Architecture temples were conceived as observatories of the sky and its interaction with Earth's movement and cycles. It was the basis to establish time-space markers and calendars. This observation was very important to develop a harmonious interaction with nature and gain benefits. Furthermore, it is believed that the specific orientation of constructions creates particular resonant fields and amplify certain energies. This is one of the fundamentals of traditional Feng Shui flying stars method.

The integration of local cosmovision can be very beneficial for school's architecture (actually for architecture in general). It can be very simple to conceive a learning space for an observatory of the sky-earth interaction along the year. Students will be very enthusiastic with an observation place to learn many subjects through fun explorations of the sky (mathematics, physics, astronomy, geography, history, arts...). Furthermore, celebrations of special dates, such as Solstices, Equinox, the foundation of the school, will foster a sense of circular time, coherent with the planet's cycles.

Permaculture design

Permaculture design may be envisaged as a beneficial assembly of components in their proper relationship. According to Bill Mollison ⁶, there are four components of a complete permaculture design, which should be based in a harmonious integration of landscape and people:

- The Site: water, earth, landscape, climate, plants;
- Energy: technologies, connections, structures, sources;
- The Abstract factors: timing, data, ethics;
- The Social dynamics: legal aids, people, culture, finance.

Some essential principles may be helpful to start envisioning your school's site implementation:

- Conceive an ethical intention in mass planning and intervention;
- Be respectful of natural resources, cultural, social and economic contexts;
- Establish a direct relation to the site's reality and communities, before abstract drawing;
- Plan site-specific concepts in which the design intention will pattern ecosystems;
- Energy efficiency will come from interactions that are harmonious;

– Interconnections will be made more efficient as all life kingdoms existing in a site are integrated. Many other interesting design principles are widely available in permaculture literature.

Bioclimatic design

Solar orientation is a basic important aspect in architecture implementation. And natural light in educational environments is essential. So it is very useful to make use of eco bioclimatic design tools. The site's stereographic sun path diagram should be carefully analysed beforehand, in order to design the building's spaces orientation according to optimal solar exposition. The seasons' specificities of the site should also be taken into account, such as the annual variation of rain, humidity levels, temperatures. All of these factors are determinant to the choice of orientation, construction techniques and materials.

Biodiversity

Architecture should be integrated in a site regarding its biodiversity, water, greens areas. Biodiversity begins to flourish with a balance of management and planting based on integrated ecological design and permaculture philosophies like work with Nature, not against. There should be extensive greens areas, with plenty of "useful" plants and trees, such as autochthonous trees, fruit trees, aromatic and medicinal plants, vegetables, and as much biodiversity as possible.

It is wonderful to have an access to a natural body of water such as a river, a lake or the sea nearby the School's site. Water is life, it is a source of vitality. If not possible, landscape design should include water ponds, fountains, canals. As for the topography of exterior spaces there should be a wide variety, adapted to every children needs. In example, a child with lots of dynamism likes open spaces to run, parcours to jump around, challenging spaces to climb

and escalate, etc. And a child with a rich imagination likes to explore and discover multiple universes like gardens, water, earth, mud, different places to paint, trees, shelters, etc. If possible, having animals around is fabulous to integrate self as part of the ecosystem, to develop environmental care and emotional balance.

Sustainability

The architectural design of schools should make a conscious use of local resources and materials, as natural as possible. It should also plan the management of natural energy, and recycle as much as possible. The choice of materials and construction techniques should also take in consideration the site's specific needs for heat, cooling and ventilation. These criteria vary according to each location, and are essential to design passively sustainable buildings, in order to reduce energy consumption and environmental impact.

Natural raw materials

Place and climate are determining factors in the choice of each material and the most suitable building techniques. Bioconstruction prioritises local, healthy and sustainable materials. Be aware that certain synthetic materials may seem less expensive but at the end have a negative environmental impact and a high cost on well-being due to high radioactivity, toxicity, lack of transpiration, and interference in natural magnetic and electrical fields, among others. The massive use of unnatural materials has led to an environmentally unfriendly type of construction which is unhealthy and not at all comfortable (such as synthetic polymers, fibres, aluminium, plastics). In bioconstruction guides ⁷ some priorities are suggested for materials choice:

- watch out the firing temperature of ceramic materials, avoid temperatures of over 950oC;
- use lime or plaster mortars rather than synthetic cement;
- make mortars with the sand and gravel available on the terrain;
- study the impact of using synthetic materials, plastics derived from chlorine chemistry, and so on.

Raw materials existing in nature have been used since inmemorial times in buildings, such as clay, stone, lime and wood, among others. Raw materials biochemistry or molecular geometry quality is not damaged by high temperatures. They are alive, therefore with vital properties that are beneficial for the energetic wellbeing of the students and teachers.

Innovative materials such as natural geopolymers have been reintroduced by Professor Joseph Davidovits ⁸. He is a scientist, writer, specialized in ancient civilizations, and discoverer of the geopolymer chemistry in 1979. Davidovits discovered that the ancient Egyptians built the pyramids (Djoser, Giza, Khufu, Khafre, among others) using a geopolymer concrete technique, named Ari-Kat, to make the construction blocks in situ ⁹. This theory has been extensively proven ¹⁰. Geopolymers are natural materials made of compounded molecules at ambient temperatures, and combine excellent resistant and morphing qualities. For these reasons they are one of the most sustainable and healthy options in bio-construction and the building industry. I.e. the Global Change Institute (GCI) building structure, University of QLD's St Lucia Campus, Australia (Hassell Group architecture), was built with the most environmental concrete technology available in the world today, geopolymer concrete, known as Earth Friendly Concrete (EFC). This sustainable building construction is

a showcase of next generation environmental building technologies.

If you are looking for a low cost, easy to produce material solution for a small scale building, there are also very simple do-it-yourself geopolymers that anyone can do and use, such as the Low Temperature Geopolymer Systems (LTGS) Brick ¹¹.

Ambiance dynamics

Architecture meets the innate necessity of the human being for inner and outer beauty and peace when there is harmony between the geometry (the shape and volume of the space, the colours, the light, the sounds, the acoustics, the materials, the smells, the textures. The synergy and balance between these qualities generates an ambience dynamic that stimulates the senses interplay in specific ways. The ambience dynamics is a key factor for well-being.

An ambience draws upon sensory variations and influences a person's feeling of comfort and wellbeing. If we take into account that students and teachers spend a large number of hours in school, the design of educational healthy spaces becomes a priority. Then an educational space should be approached as an ambience, a form of energy, with different frequency fields. To improve an educational space (new or existing), architectural design should engage an ambience as a whole environment.

The fundamental principles to fulfil an ambience as a whole integrate light and colours, sound and acoustics, spatial volume and proportions, materials, movement, interconnectivity and surprise elements that harmonically configure spaces rich in dynamism.

As seen, the spatial experience is a fundamental process in the integral development of the human being, that is shaped by architecture. The direct experience of an ambience, and its consequences in

sensory variation should be carefully evaluated as a way to unify life sensations: visual, acoustic, tactile, kinetic.

Sensory variation varies in general in terms of frequency, patterns, rhythm and tone; it can be sensed as movement, temperature, light or sound. Sensory variation may draw attention to subtle forces at work in the place, usually gone unnoticed. In other words, techniques may engage the modulation of natural phenomena, to achieve a sensorial harmony, through sensory variations of sound, light, smell and temperature.

Light and colours

The whole nature changes with light variations. Human beings' metabolism and biochemistry varies according to the frequency received of light energy. It is essential to have spaces with abundant natural lighting and sunlight, as this is very beneficial for children's health, concentration and creativity.

Colour always played a role in the human evolutionary process. Studies confirm that light and colour influences humans psychologically and physiologically. Colours have specific frequencies spectres. Each colour vibratory energy influences our senses and moods in different ways. Chromotherapy is known since ancient civilisations, such as the Chinese or Egyptian. Bellow Egyptian pyramids, such as in Saqqara, we find chambers with specific dominant colours, and it is possible that these were used to research the effects of the colour spectre on wellbeing and healing. In these chambers, specific acoustic resonance frequencies were found as well ¹².

In 1921, Albert Einstein made significant contributions to the understanding of light as electromagnetic waves, in which energy is transported by photons. Photons release amounts of energy according

to the wavelength. Different colours have different wavelengths. I.e. blue light is produced by more powerful photons, and its wavelength is shorter; while red light is emitted by weak photons, and its wavelength is longer. The human being reacts to colours physically, as it has a preponderant role in all vital functions. Colours influence significantly in moods, emotions, mental and general wellbeing. I.e. blue color transmits a sense of peace, while orange stimulates creativity.

Each colour therefore has physical properties and particularities, which affect the human being, independently of cultural backgrounds. Next follows a short overview of each colour's main characteristics:

- **Red** is a primary colour. It releases warm vibrations and represents our inner fire. It is the colour of blood. It warms up the body, stimulates blood circulation and energizes heart. Red incites action, vitality, dynamism, enthusiasm, motivation, determination, effectiveness. It is a powerful stimulant to vital energy necessary to physical activities. It should be used moderately as there are persons who have already a hot blood temperament. A small detail in red is sometimes enough to qualify a whole ambiance.
- **Orange** is a secondary colour. It has red and yellow, therefore has characteristics of both colours. Orange favours creativity, enthusiasm, and assimilating new ideas. It raises joviality, optimism, vitality, dynamism, serenity, and happiness. It is a very positive colour stimulating joy, socialization, cooperation, and participation.
- **Yellow** is a primary colour, releasing mild vibrations. It represents wisdom, as it awakens intellectual inspiration, stimulates imagination, self-knowledge,

freedom of thought. Shining as the sun, this colour warms up gently, cheers the soul and lights the heart. Yellow highlights intellectual vivacity, activates concentration, and mental receptiveness to understand, study, research and memorize things with ease.

- **Green** is a secondary colour. It has blue and yellow. It relates to Nature, Earth and promotes balance and harmony. It soothes both mind and body.
- **Blue** is a primary colour. It releases cooling and soothing vibrations. Colour of the sky and the ocean, it symbolises freedom and intuition. Blue incites peace, tranquillity, exploration, inspiration, discovery, and facilitates concentration and creativity.
- **Violet** or purple is a secondary colour. It is the colour of spirituality. It evokes spiritual insight, psychic connection, wisdom. It contains the appeasement energy of blue and the impulsive strength of red, which confers an action of total transformation of being. In general, most children like violet or purple.
- **White** is pure light, awakened spirit. It is a synthesis of all colours of the spectre. It symbolizes perfection, clarity, empty space, balance and harmony. White is purification, inner peace, beauty and enlightenment. White lightens any colour into peaceful tonalities.
- **Pink** generates a warm nurturing ambiance, stimulating affect, love, harmonious emotions, softness, kindness and sharing.

When combining colours, remember that less is more, and do not overload the walls with too much colourful decoration. Take time to carefully study a harmonious choice of colours and decoration, as a small detail can have a very strong impact.

Sound and acoustics

Inner and outer balance, harmony and peace is not necessarily achieved in children through quiet and silent spaces. On the contrary, most children need multi-stimulation to concentrate. This does not mean noisy cacophonous ambiances either. Children like acoustically stimulative ambiances with a harmonious circulation of sound. The whole sensorial sphere needs to be engaged, but not overwhelmed. Acoustic variation is a key aspect to foster well-being. When exposed to the same stimulus for a long period of time, our senses get tired, we lose energy and willingness to perform activities. Certain acoustic spheres invite to different activities, in the same way as colours and light. Different acoustic qualities stimulate different moods and predisposition to perform particular activities. This kind of acoustic ecology can be achieved in spaces which shapes establish relationships between outside and inside.

Reflection and absorption

Sound waves traveling in space at one point encounter different materiality and geometries in the room, and produce what is called acoustic effects. The main effects associated with sound waves are reflection and absorption. The effect of reflection is how waves bounce off hard surfaces, producing reverberation or echo in a space. This affects the reverberation time of a room, and therefore defines a certain acoustic quality. Sound waves propagate for longer, so it generally augments the perceived

loudness, some times to the point of being aggressive for our ears. A high reverberation is important for certain kinds of music. But it is very unpleasant for voice clarity. This effect can easily be modulated with appropriate acoustic design.

Architectural design should always be aware on three interrelated aspects that are determinant for the quality of acoustic space:

- Geometric proportions;
- Material density;
- Spatial volume.

The main idea is to reach a combination of geometric proportions, material density and spatial volume that favours the acoustic quality we want to enhance in that space.

Geometric proportions

In acoustics, it is important to avoid parallelism between walls. If the materials are reflective, sound waves are trapped, reflected, amplified, and it may become very aggressive, thus saturating the ears of those standing in between.

Shapes similar to spheres, such as circular walls or ceilings, domes, zomes, dodecahedrond, have very particular geometries where sound propagates harmoniously thus generating specific resonant spaces with very pleasant and powerful acoustics. Also be aware that particular resonant frequencies in acoustic space trigger specific brainwaves.

Material density

The choice of materials is a determining factor for the acoustic quality of spaces, because every material has a specific absorption coefficient. This means

that a material can be reflective or absorbent. Hard materials such as concrete, brick, stone, metal or glass have low absorption coefficients, therefore greatly reflect sound waves, thus the perceived loudness is higher. On the opposite, soft materials such as cork, textiles, wool, have high absorption coefficients, therefore absorbing or dampening sound waves; the energy is absorbed, so the perceived loudness of the sound will be lower (this is generally used as a solution for noisy environments, or to work on a precise reverberation time for a concert hall or an auditorium). Wood is a very pleasant acoustic material, as it combines reflection with absorption. So the choice of the materials according to its absorption quality is not to neglect, as it is determinant for the space's acoustic quality.

Spatial volume

Different geometries, materials and spatial volumes may be composed in order to propagate a varied spectre of sounds with rich tones and different qualities. I.e. a performance space should have a generous volume for sound propagation. It should also resonate specific frequencies of musical instruments, therefore diffusers can be created with wood panels. A classroom should enhance voice clarity (not too loud, nor too low). It is also important to avoid too much reflective materials, as sounds get louder and might hurt sensitive hears. Soft textiles hanged and cushions are simple ways to improve the acoustic quality of such a room, and provides a sense of security and cosiness. A library or study area should have a smooth pleasant acoustics that combines soft natural light, inviting concentration and long stays. In this kind of spaces, it is important to use high absorption materials to dampen impact noises, such as cork panels. The smell of cork is also very pleasant.

Smell and touch

Other senses, such as smells and touch, also play an important role in the way we experience space, particularly in young children. These qualities may be achieved by using different bio-construction materials that have distinct scents (earth, wood, cork, straw, clay), by diversifying the textures of the walls, floors, furnitures, and also by including a large variety of vegetation and aromatic plants.

Architecture, Geometry and well-being

Learning spaces' design is determinant for the wellbeing of students and teachers. It has a powerful impact in the development of our children and future generations' creativity, capacities and potentials. As the end users are mostly children, architects have a responsibility to ensure that the built environment offers children the chance to play, explore, and learn in physical space. Therefore, we should question the kind of learning environments we have and what other solutions we actually need:

- Why a square space and not a circular one?
- Why a chair and a desk?
- Should students be always sitting?
- What would hapen with flexible furniture that allows standing or seating with tables of different heights?
- What colours stimulate particular activities?
- What different materials and shapes engage different acoustics?
- What is the impact of colours and acoustics in students and teachers wellbeing?
- Etc...

We should look for architectural environments that foster wellbeing at all levels. The quality and variety of our spatial experiences shapes our predisposition (physical, emotional, mental, spiritual) to develop our everyday activities. This in turn generates our sense of integral wellbeing. Every building is experienced differently according to its geometry, materials, light, colours, sound, acoustics, with characterising feelings of invitation or rejection, hospitality or hostility, intimacy or monumentality, dynamic or stillness, warm or cold, exciting or depressive, vitality or tiredness, concentration or dispersion, attraction or repulsion... Rethinking the design of learning spaces should be based in today's children and youth needs, to allow them to fully deploy their innate abilities and potential towards wellbeing at all levels. Innovation, quality and diversity in architectural design of spaces are crucial to maintain our sense of curiosity, creativity and wonder from childhood to adulthood. Grounding, peace and interior stability are also essential keys for a harmonious implementation that nurtures wellbeing. That means to ensure that the School, children, youths, teachers and parents, are "grounded", anchored, rooted, with their feet on the Earth, with a feeling of security, stability, but also with open space for flexibility, freedom, expansion and fulfilment.

Resuming, these primary needs foster wellbeing:

- Confidence, protection
- Socialisation, happiness
- Freedom, changeIn response, there are primordial spatial principles that generate well being:
 - Sphere, circle, embracing, inclusive, safe
 - Relation, gathering, connection
 - Spiral, fractal, transformation, movement

As practical examples of these spatial principles we may think of:

- Circular spaces, nests, cocoons
- Open spaces, networks, arena, piazza

In other words, the idea is to establish internal comfort and internal stability, which provides confidence, and at the same time, provide open tools to be able to accept and adapt the fast changes of today. This educational approach gives students security, inner peace and creativity to be able to handle any challenging situation personal relationships or professional with ease, contributing to an enduring Peace Culture.

We recommend to implement these aspects from the start of any architectural design. An educational environment provides confidence if it is friendly, inviting, welcoming, comfortable, relaxing, inclusive. A space allows freedom if it is open, interactive, flexible, easy to move around, adaptable to group working and collaboration. One way to meet this quality is to design environments that are aesthetically pleasing and are not aggressive for the senses. Architectural spaces should always meet the innate necessity of the human being for inner and outer beauty, harmony, peace and creativity.

⁶ See "Introduction to Permaculture" book

⁷ See Camilo Rodríguez Lledó, 1999. Guia de Bioconstruccion

⁸ See <https://www.davidovits.info/>

⁹ See <https://www.youtube.com/watch?v=Fe2c-xbXmi4>

¹⁰ See <https://www.geopolymer.org/faq/faq-for-artificial-stone-supporters/>

¹¹ See <https://www.geopolymer.org/applications/lts-brick-low-cost-construction-material/>

¹² See El Ojo de Horus <https://www.youtube.com/watch?v=d-5kiQaO5y30&index=5&list=PLA08F1DFFFE53CA3>



5

**CREATIVITY
AROUND
THE WORLD**

This chapter presents creativity around the world, architectural bright ideas implemented in learning spaces, opening up our imagination for endless possibilities.

Geodesic Domes

A Buckminster Fuller's structural discovery, geodesic domes are half-part of geodesic spheres. This visionary architect, engineer and geometrician developed for more than five decades pioneering solutions in innovative design that did "more with less", and were responsive to the way nature works. In 1985 (after Fuller's death), a new carbon molecule (C₆₀) was discovered with a similar structure to that of a geodesic dome. It is a form of carbon with molecules of 60 atoms arranged in a polyhedron resembling a geodesic sphere. This molecule was named "buckminsterfullerene", now commonly known in the scientific community as "buckyball". It confirmed that Buckminster Fuller's geometric creations definitively comprehended nature patterns.

Investigating deeply nature's geometric patterns, Buckminster Fuller promoted widely the architectural design based in geodesic spheres. He claimed for a building process based in structural tensegrity, for the economy or less effort between elements. He argued for the urgent need to change architecture's archetypes, for the human survival would depend on the willingness to live according to the way nature works. For Fuller, the essential nature of matter-energy lied not in abstract form-making but in processes based in energetic geometry and in the characteristics of vibrating systems such as interconnection, relation, polarity and multidimensionality. He investigated the principle of vibration, observing nature's

processes and forms. Buckminster Fuller uncovered frequencies and rhythmicity of structural motifs, and translated it into geometric patterns of formation, as architecture.

With his two volumes of work entitled: "Synergetics: Explorations in the Geometry of Thinking" (1975), Fuller contributed with major advancements in the building of space based in energetic geometry and molecular structures. His research was based in powerful thought tools: topology, geodesics, synergetics and general systems theory. Synergetics principles are embodied in nature. Buckminster Fuller claimed that this system described the coordination of physical and metaphysical phenomena alike, both energy and thought. Synergetics is a triangular and tetrahedral system, using 60 degree coordination instead of 90 degree coordination, which does not exist in nature, and is not energy efficient. He introduced the tetrahedral model to substitute the cube, to simplify the understanding of the physical universe, and to open up innovative practical applications. Fuller has explained the importance of the role of physical forces (gravity, magnetism, electrical and chemical attractions), and how space was not empty. For Fuller, space has specific properties or constraints, it has underlying invisible forces and multidimensional fields and shapes. In his introduction to "Space Structures", scientist and crystallographer Arthur Lee Loeb explained that "space is not a passive vacuum, but has properties that impose powerful constraints on any structure that inhabits it. These constraints are independent of specific interactive forces, hence geometrical in nature" (Loeb 1976, xvii; in Edmondson 1986, 10). In this sense, Buckminster Fuller investigated thoroughly nature's coordinate system,

to uncover the operative principles in the universe. However, his main purpose was to call our attention to an invisible design revolution taking place, and to inspire our active participation in guiding this progression in preferred ways (Edmondson 1986, 268) As Buckminster Fuller put it, all of humanity now has the option to 'make it' successfully and sustainably, by virtue of us having minds, discovering principles and being able to employ these principles to do more with less.

Domes in general harmonize energetic fields. The geodesic shape of the dome contains and protects a specific energetic field, which will vary according to the spatial volume and materials density.

Geodesic domes have the natural capacity of astonishment. Children get marvelled and stimulated by its geometry. A small scale geodesic dome structure can be used as a climbing playground. And a bigger scale geodesic dome can be used as an educative space. These structures have the advantage of transparency and bring the outside inside. Everyone may benefit from 360 degrees of natural light, with the impression of being outside, and all the benefits of being inside. Solar Domes (Great Britain) are applying widely the concept of "outdoor classrooms to educate, motivate and inspire" ¹³. They propose different ways of how domes may be used in education:

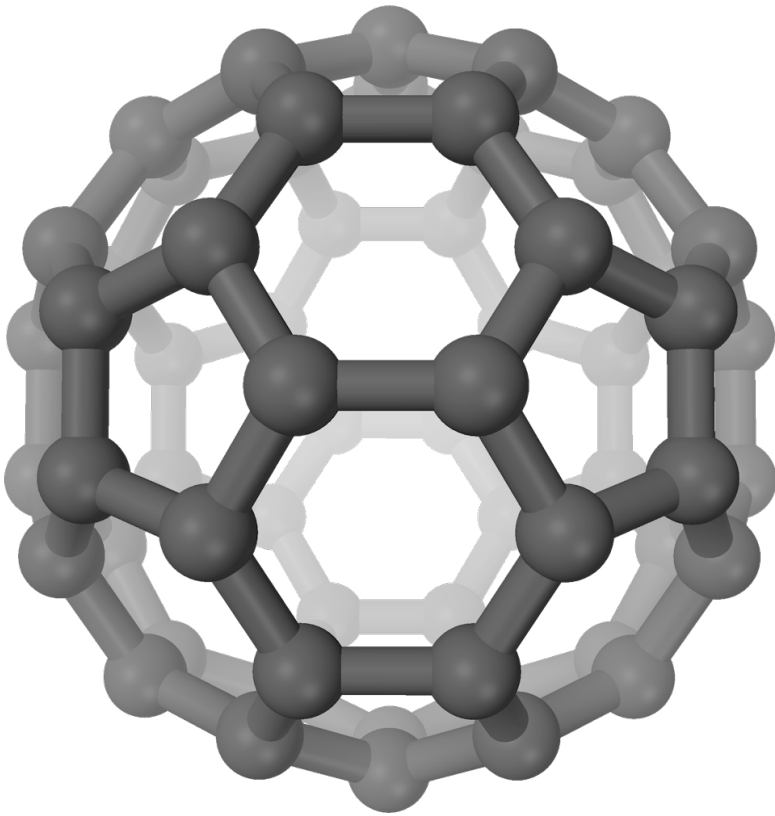


Fig. 5.1 - Molecule buckminsterfullerene C₆₀

- as a school garden, the dome can make an ideal eco-dome, rainforest dome or biodome. The benefit of the dome is that it goes further than a traditional greenhouse because students get excited and gardening is taken to another level;
- as an Arts' space, the geodesic shape is in itself an inspirational subject for art lessons, to draw, paint, act, sing, dance, as an exhibition gallery,...
- as a reading space, the dome may encourage group participation, improve attention spans and create lasting memories;
- as an outdoor studio for drama and story re-enactment, the dome geometry may enhance optimal acoustic conditions, thus creating lively dynamics, great to thrive communication and social skills;
- any speaking, singing, musical and listening activities are enhanced with domes' harmonious acoustics;
- for studying mathematics and geometry, the geodesic dome makes an ideal hands-on learning environment, about the geometry of the dome itself (which is made up of triangles, hexagons and pentagons), or studying the mathematics found in nature and the plants in the dome;

for all kinds of science classes and experiments, the dome space enables practical and theoretical lessons to be combined. Students may learn and experiment about growing and the environment, about composting and recycling. They may even get inspired to re-create several biozomes with different ecosystems;

for sustainable energies experiments, children may design and create a renewable energy watering system inside the dome, using wind turbines and solar power, to power a water pump and irrigation system.

There are many ways of building a dome, and an extensive literature on the internet. It can be a high tech durable building or a low-budget solution. For a low-budget option, students from the Centre for Human Habitat and Alternative Technology (CHHAT) designed Adaptable Bamboo Geodesic Domes (project winner of the Buckminster Fuller Challenge Student Category 2016). These are adaptable and lightweight modular domes, made from natural, local or recycled materials. Their simple short construction time makes them ideal for emergency shelters after natural disasters, or as communal areas in schools. This is a great option to build together an outside dome space with students, where they can learn several subjects. CHHAT describe the geodesic dome constructed out of bamboo as “deployable structures, easy to knock down and construct considering the functional, technical, ergonomic and economical equations of the context. The dome provide for community needs to cater to the large scale activities of schools, medical camps or evolution spaces of temporary and permanent requirements”¹⁴.

¹³ <http://www.solardome.co.uk/blog/2014/07/10/circular-class-rooms-a-logical-progression/>

¹⁴ <http://www.chhat.org/space-for-many/>



Fig. 5.2 - Dome geometry and frequencies



Fig. 5.3, 5.4- Solar domes



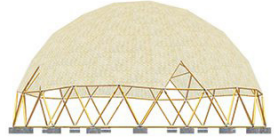
Fig. 5.5, 5.6 - Montreal's geodesic dome by Buckminster Fuller



ELEVATION

OUTERMOST SKIN

The outermost skin is a layer of waterproofing PVC flex sheet to protect the structure from the natural weathering processes.



ELEVATION

INTERMEDIATE SKIN

The intermediate skin consists of a layer of bamboo mat and a layer of styrofoam for insulation.



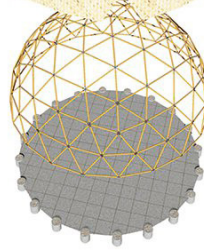
PLAN

STRUCTURAL FRAME

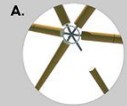
The structural frame consists of bamboo struts fixed together with steel reinforcement bars and a steel cable running along the joineries to pull the structure in compression.

BASE

The structure does not require foundation. The base in case of temporary and emergency shelter are made out of tarpoline sheets and for permanent solution, are made out of pre-stressed concrete paver blocks.



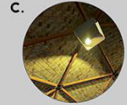
EXPLODED VIEW



Joinery detail of the repetitive module



Steel cable running through the joinery to pull the structure in compression



Lighting cut from recycled oil containers



Joinery detail to hold the structure at the base.



Fig. 5.7, 5.8 - Adaptable Bamboo Geodesic Domes



Fig. 5.9 5.10, - Climatron Geodesic Dome Conservatory - Missouri Botanical Garden

Zomes

The zome geometry was codified mathematically by the American engineer Steve Baer in the sixties, to design a cluster of solar-powered zome homes for himself and his wife outside Corrales, New Mexico. Based in Baer's unusual geometry, his friend and thinker Nooruddeen Durkee, coined the term zome in 1968 combining the words zonohedron and dome. The zonohedron geometry was originally defined and studied by E. S. Fedorov, a Russian crystallographer. A zonohedron is a convex polyhedron with point symmetry, every face of which is a polygon with point symmetry. Zomes combine this geometry with that of a dome. It results as geometric volumes composed by rhombus organized in precise angles, forming a double spiral structure. Same as in domes, zomes also have different frequencies, which defines its volume's height.

In recent years, the unconventional zome building-design approach with its multi-faceted geometric lines has been taken up by French builders in the Pyrenees. Yann Lipnick of Zomadic Concepts in France has developed an extensive study and multiple project construction of zomes in many different materials. Lipnick highlights the universal appeal and healing atmosphere that zomes provide. When a zome is built with natural raw materials it is called a biozome. The biozome expands and generates energetic fields. It is therefore different from the dome, which contains and protects.

Zomes and domes are great adaptable structures for learning environments that can be easily be co-created with children. These can be modular, demontable, transportable, used permanently or in different places.

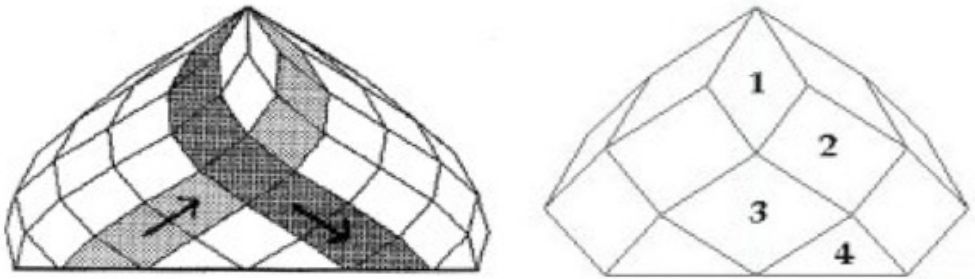


Fig. 5.11 - Zome geometry and frequency



Fig. 5.12 - Modular zome workshop, architect Oscar Senmache (Peru)





Fig. 5.13-16 - Biozomes with different materials

Circular spaces

One of the most inspiring urban schools is the Fuji kindergarten in Tokyo, by Architect Takaharu Tezuka (Japan), known to create imaginative and versatile personal spaces. In the architecture of kindergartens, he created a children-centred design thinking. This design process results in an architecture that really lets kids to be kids. Tezuka has a clear vision that architecture is capable of changing this world, the life of people. And Fuji kindergarten is one of his successful attempts to change the life of children. The Fuji Kindergarten is a circular building, based on a plan as an endless circular ring. As it is known, children love to keep running in circles. This kindergarten has an endless circulation over the roof, where children can run freely and endlessly. This has been proven to be fantastic for children.

They have studied the movement that children do in average. The perimeter of circumference of the building is of 183 meters. And here each child makes 4,000 meters a day as an average. Children of Fuji kindergarten have the highest athletic abilities among other kindergartens in Tokyo. The principal says that the children do not need any particular special training. The teachers just put them on the roof and let them play free. The kindergarten is completely open most of the year. There is no boundary between inside and outside, so the building's architecture is basically a roof. Children can be under it, or over it. Tezuka claims that children love to be outside, so that is what we should offer them in priority. Under rain, snow, or hot sun, we should leave them experience the world freely.

Outside they have lots of space to run, trees to climb, and many kinds of water points that children use them to play, wash hands and feet, etc. The circular circulation is the Fuji kindergarten's geometric key. It is very helpful to let children be free, and that is what teachers do. If a child wants to leave a class he can. Eventually he comes back, because the space is a circle! "Children leave and come back, it is a natural process", says Tezuka.



Fig. 5.17, 5.18 - Fuji kindergarten (Japan) by Takaharu Tesuka

BioArchitecture

Michael Rice is a BioArchitect who receives the truth and offers the impulse to utilise the beauty of creation in the expression of form. With interior designer Zana Zu, who feels the truth of space and the people who inhabit it, and invites the maximum potential and beauty of both, they work together as ZeMArc. ZeMarc share their vision for the design of learning environments as follows:

“Schools can, if designed and built consciously, be beautiful spaces for children and teachers to explore, express, expand and enjoy their full potential.”

All beings come into this life knowing how to naturally move towards this state, and it is our passion to support them in the buildings where this is most achievable. There are many factors that need to come together harmonically in order to achieve this; from functionality and affordability to maintenance and flexibility of end use. However, we believe that Beauty is the most important element to be naturally integrated into any design and build process. Beauty, and our innate desire to sense and create it, is both a visual vehicle and fractal pathway to designing and manifesting the perfect environments for remembering, learning and emerging into Bio-Architecture is the art and science of creating and constructing spaces and places which embody and ensoul the essence and expression of beauty. Through the conscious utilisation and integration of Natures patterns, proportions and protocols, BioArchitecture bridges sacred intent with practical formation and offers a pathway to magical *Manifestation*.

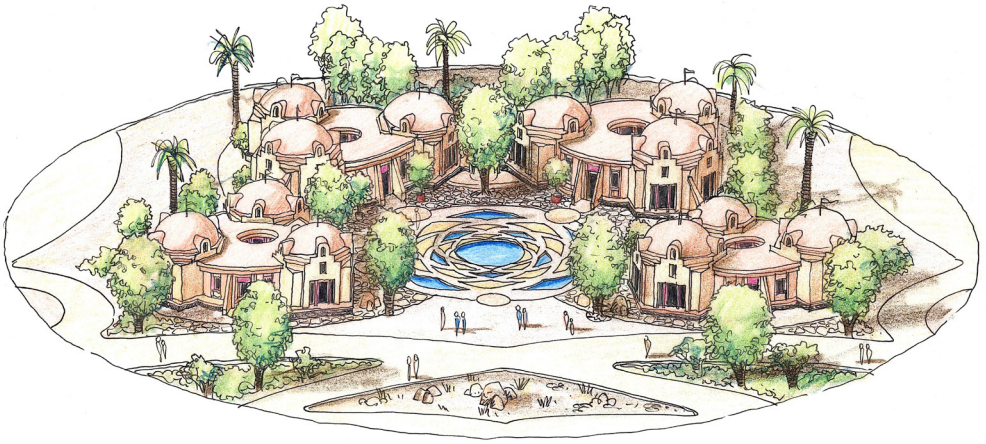
As with all living and thriving organisms, the holistic health of its system is the result of the harmonic integration between the inner and outer states. Bio-Architecture provides the fractal form and sacred structure within which beauty can sing and dance."

"Inner Space

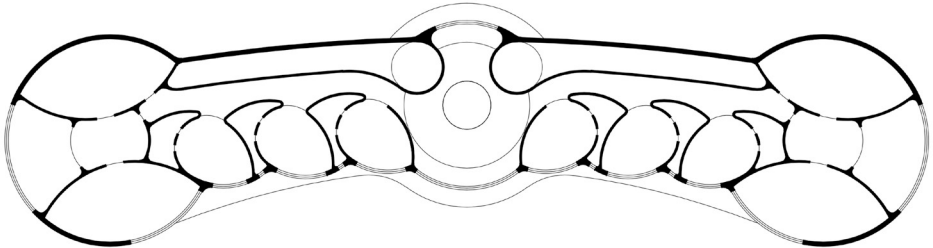
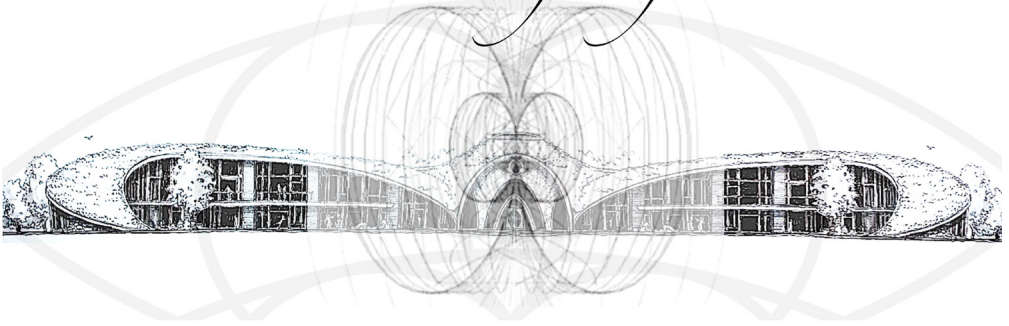
The movements of shape, light, colour, texture, material and other environmental elements and finishes all come together in a sensory synthesis which supports Life to express its full Potential."

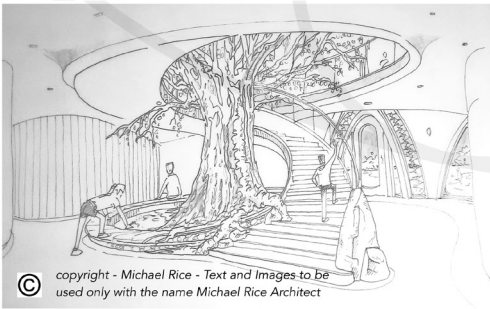
"Sacred Geometry is the Blueprint of Creation, which maps and moves information and energy across dimensions, and through all of space and time. It provides portals of possibility that anchors the primal desire of all Life; to explore and express potential, truth, beauty and Love"

(Michael Rice Architect).



School of Life





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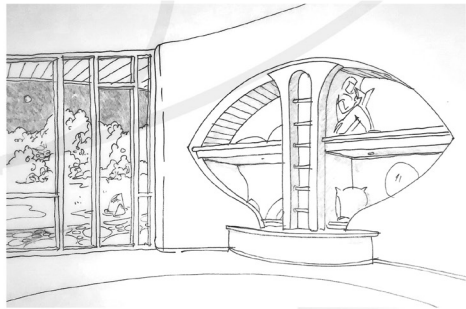


Fig. 5.19-21- Michael Rice Architect

Curved walls and acoustic ecology

In the Fuji kindergarten's interior space, there are no boundaries, no corners and no dark corridors. Natural light enters through the glass windows and doors, which establish continuity and transparency between inside and outside. As there are no wall's divisions, there are no acoustic barriers at all. In Tesuka's approach, spaces for children should not be silent.

Tesuka argues that if you put many children in a silent box, some of them get really nervous. Children sleep better with sound; they don't sleep in quiet spaces. Children need alive sounds to feel well. In Fuji kindergarten, due to the continuous curved walls, sound propagates and circulates fluidly. As a result, in this kindergarten children have amazing concentration.

Architectural forms that invite to explore

For architect Tesuka the key for children-based architecture is: "Don't control them, don't protect them to much. They need to tumble sometime, they need to get some injury. That makes them learn how to live in this world". He argues that these days we try to make everything under control and we should lose that. At the Fuji kindergarten, existent tall trees were incorporated in the architecture, and became part of the rooftop playground. There are nets around trees, so children can climb the trees freely, and fall in the net. Kids needs small dosage of risks, because in this situation they like to help each other. This develops social care for each other. Schools tend to be overly protective. If children do not experience in schools this kind of collective risking adventures and solidary care, society loses this quality.

Another example by Tesuka Architecture is the Ring Around a Tree kindergarten (Japan), whose facade surrounds a tree and has different levels that also encourage exploration and curiosity.

Cosy environments

Some children like cosy places, where they can be alone or gather in small groups to rest, to hide, to be concentrated, to read,... These spaces can be shaped like caves, huts, nests, tipis, coccons, tree house, hobit houses, hanging nets,...

Architects Haugen/Zohar Arkitekter designed a circular outside hut space for children in Trondheim (Norway). In Norway, all seasons are equally attractive to children that enjoy outside activities all year round. They wished to combine an enclosed space for fire, storytelling and playing. With a very limited budget, they reused leftover materials. Inspired by the Norwegian turf huts and old log construction, they created a wooden construction of 80-layered circles. The circles have varied radiuses and relative center point in relation to each other. Every circle is made out of 28 pieces of naturally impregnated core of pine that are placed with varied spaces to assure chimney effect and natural light.

Ancestral circles

Open air circular spaces may be created to gather children in ancestral circular practices which favour love and expression. I.e: activities could be early morning salutation to the sun and nature, circular dances and chanting, percussion circle, celebration of Solstices and Equinox, observation of the sky, relation to the four directions, marking geometric directions,...

Architect Carlos Martín de la Moneda (Spain) has been designing such spaces, based on the criteria of Sacred Geometry, the oral tradition of the master builders, making the created space a space for harmony, inner evolution and realization. Each project is an opportunity to create a space to broaden the view and evolve.





Fig. 5.22, 5.23 - Fuji kindergarten (Japan) by Takaharu Tesuka



Fig. 5.24 - Ring Around a Tree kindergarten, by Takaharu Tesuka



Fig. 5.25 - Ring Around a Tree kindergarten, by Takaharu Tesuka



Fig. 5.26 - Hanging nets by Prakash Nair



Fig. 5.27 Tree house by Prakash Nair



Fig. 5.28, 5.29 - Hut (Denmark) by Haugen/Zohar Arkitekter



Fig. 5.30, 5.31 - Astronomical Park (Japan), Ancestral Pole Dance (England)



Fig. 5.32 - El Jardín de Rocas (Spain) by Carlos de la Moneda.
Aerial photo by Gobierno de Aragón

Challenging cooperative parcours

The Play Landscape be-MINE in Belgium, by team Carve and Omgeving, creates a unity with the mountain and its past: a pole forest as a landmark, an adventurous prismatic play surface on the flank of the mountain and a coal square on the top of the “terril”. This adventurous play-scape challenges children physically, to play together and use their motor skills. The sensation of an increasing height and difficulty level of the *parcours* asks for collaboration and mutual encouragement. Cooperation and stimulation are therefore intrinsically connected with the play experience.

Green roof and vegetable gardens

The Farming Kindergarten (Vietnam) by Vo Trong Nghia Architects, was designed based in the priority of children’s access to green lands and playgrounds in heavy urbanised areas. Located next to a big shoe factory, it was designed for 500 children of the factory’s low income workers. The building was conceived as a continuous green roof with vegetable gardens. The green roof is a triple-ring shape. It provides food and agriculture experience to children, and an extensive playground to the sky. While playing, children learn the importance of caring for agriculture, and recover their connection and relationship with nature. Energy-saving sustainable methods are applied including green roof as insulation, green facade as shading and solar water heating. Factory wastewater is recycled to irrigate greenery and flush toilets. As a low-budget construction, it combined local materials and low-tech construction methods, which minimized environmental impact and promoted local industry.

Sustainability and self-sufficiency

The Uruguayan non-profit organization Tagma, in partnership with Earthship Biotope and architect Michael Reynolds (USA), are at the core of the initiative “A Sustainable School”, which aims to build a sustainable public school in every country in Latin America, to create a network of symbolic examples in the region. Two schools were built to present: one in Uruguay (Jaureguiberry, 2016) and another in Argentina (2018). The sustainable schools are built in bio-construction and provide a space to teach the 7 principles of sustainability: the use of recycled materials; treatment of grey and black water; thermal conditioning; application of renewable energy sources; collection and purification of rainwater; organic food production, and the human factor. In addition, outside of school hours, these schools are community centres to foster awareness on sustainability.

Environmentalists and designers John and Cynthia Hardy created an off-the-grid school in Bali where children get a green education. At Green School kids learn how to build, garden, create, to give locally. They wanted to motivate communities to live sustainably, and to show people how to build with sustainable materials. At the Green School in Bali they used local bamboo, grown using sustainable methods, in innovative and experimental ways that demonstrate its architectural possibilities.



Fig. 5.33, 5.34 - Play Landscape be-MINE (Belgium), Carve and Omgeving



Figs. 5.35-36 - Farming Kindergarten (Vietnam), Vo Trong Nghia Arch.

The centerpiece of campus is the spiraling Heart of School, a double helix that results as a freestanding bamboo building. There is a range of architecturally significant spaces from large multi-storey communal gathering places to smaller classrooms. Campus buildings include classrooms, gym, assembly spaces, faculty housing, offices, cafes and bathrooms. The result is an integral green community with a strong educational vision that seeks to inspire students to be more curious, more engaged with environmental care and more passionate about the planet. The result is a truly inspirational teaching and learning environment. Their advice is simple: be local, let the environment lead, and think about how your grandchildren might build.

Open space

Also at Green School, in Bali, IBUKU architecture imagined the kindergarten building as a childhood fantasy. The building has no walls, there is a visual continuity between inside and outside, and the entrance is a bamboo arch. It is supported by a central bamboo basket-like column with a skylight in the centre.

This tower in the middle and the circular open space really works for children interaction. This open space under the roof is qualified through a series of play zones. There are different types of furniture that can be adapted to different activities.

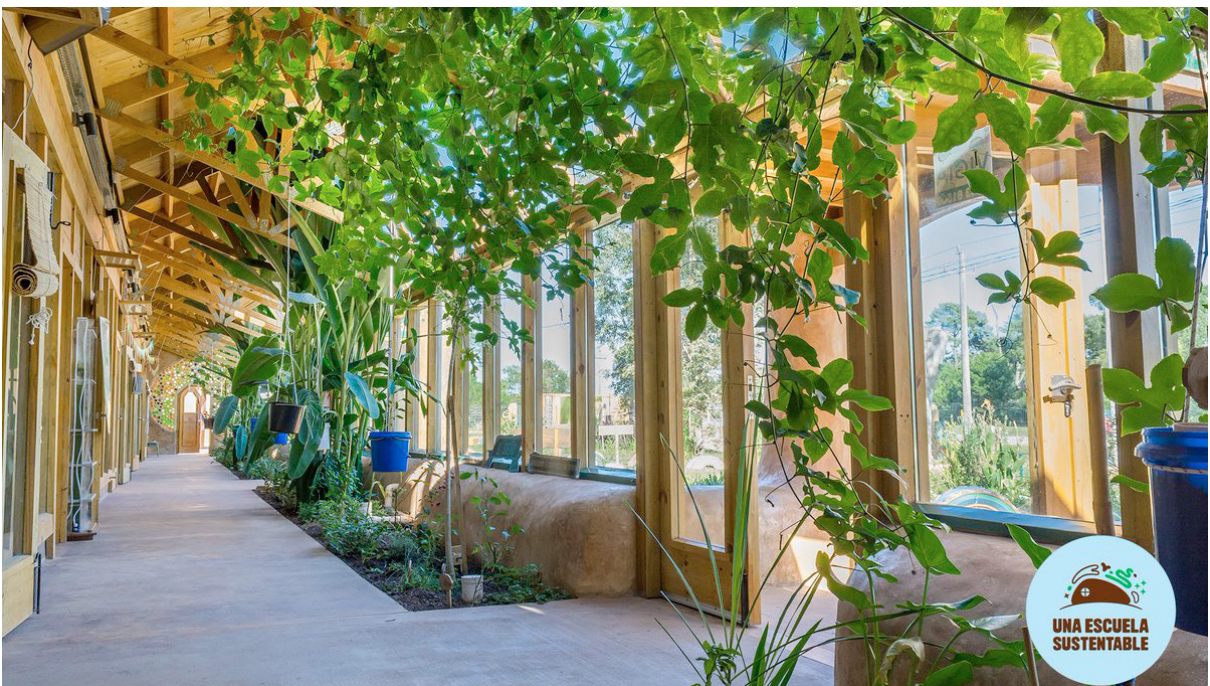


Fig. 5.37, 5.38 - Sustainable School (Uruguay) by Earthship Biotecture



Fig. 5.39 - Green School Bali (Indonesia) by IBUKU architecture



Fig. 5.40 - Green School Bali (Indonesia) by IBUKU architecture



Fig. 5.41 - Early Childhood, Elementary and Middle School of Syracuse (Italy)
by Claudio Lucchesi



Fig. 5.42-43 - Early Childhood, Elementary and Middle School of Syracuse (Italy) by Claudio Lucchesi

Permeability

In the Early Childhood, Elementary and Middle School of Syracuse, Italy, architect Claudio Lucchesi (Urban Future Organization) has explored the concept of permeability and a continuity between inside and outside.

"The school is conceived as a fluid, dynamic path. A single continuous ribbon guides the development of the building and is always available for dialogue with the landscape. An architecture to be discovered at every step, described through the school activities and the harmonic cadence of light that from the large windows floods the rooms with balanced generosity. The classrooms, with an enveloping and stimulating shape, open both towards the internal courtyard and towards the gardens where there is a vegetable garden, the ecopark, the events space and sports activities, with volleyball court and a four lane track: this last one penetrates the building becoming protagonist during the school sport races from 50 up to 150 meters. The building favors dialogue with the natural elements, with a precise will to be permeated by the green, the sky, the light.

A plot of thin vertical wooden planks form the skin of the building, thickening to shield the areas to the south and opening, like a diaphragm, in those facing north. The combination of the white colors of the classrooms and the light chestnut tones of the wood make it feel comfortable and relaxing as well as focused on concentration. All around gardens, hedges and trees, are destined to wrap the school of their perfumes during the course of the seasons which, in the natural circuit, are renewed and evolve together with the students in total communion with nature and its moods." (Claudio Lucchesi / Urban Future Organization)

No walls, interactive spaces

Architect Prakash Nair (USA) develops innovative school design with Fielding Nair Internactional. He is a pioneer architect focused on improving the school's layout with practical architectural ideas and lots of fun! Prakash is the architect of the Anne Frank Inspire Academy and Educational Resource Center in San Antonio, Texas, USA. The main qualities of this school are: no walls, no bells, no teachers, no rooms. Children are free to move everywhere. The school has a complete interaction purpose: with a strong connection to the community, to nature with the nearby woods, and to IT technology with dedicated open spaces.

Another example of open space is found at the Ørestad Gymnasium, by architects 3XN, in Copenhagen, Denmark. This building was created to promote a new vision for secondary school education, based on reflective and collaborative learning. The architects created an open-plan building organized around a central staircase. It has no walls, no classrooms and spaces are only loosely defined by permeable borders.

This architecture open space design allows teachers to innovate teaching methods. The architectural space avoids separations and promote interaction without limits. It is a community space that works according to interdisciplinarity. Classes are taking place in these open spaces and use IT teaching. The staircase is the focal point of the building and the symbol of the school. Here students can meet, and get some exercise with the frequent up-and down trips. The architecture and design of this building challenges traditional teaching methods. Teachers agree that they have to prepare and teach differently, taking into account constant noise and movements.

Participation

In the Early Childhood, Elementary and Middle School of Syracuse, Italy, by architect Claudio Lucchesi and Urban Future Organization, the participatory path is documented on the website scuoleinnovative.it, thanks to the contributions of private partners such as teachers, school managers and, above all, pupils. "It clearly reveals the desire and need to experiment with new/different forms of spaces and places to grow in which to be usefully stimulated to undertake a self-generative path of ideation, training, evolution, design, innovation. The provision of interoperable and scalable spaces allows an engaging teaching, in line with the needs of the POF and at the same time capable of modulating and adapting to the physical and demographic conditions of a continuously evolving neighbourhood. Spaces of connection become habitable elements of sensory permeability and informal use and not areas of mere passage, as well as places for informal activities lend themselves to be places of conviviality, small bookstore/stationery and cafeteria: a plasticity that allows to open up to local community by configuring the plexus as a real civic center. The proposed architecture allows, in fact, to make the place recognizable and recognized by completing a system of urban services, already present in the territory, assuming the role of engine for the enhancement of social, educational and cultural needs. The Feasibility Project will be accompanied by a precise action to involve local actors, thanks to the use of specific participation techniques such as public debate, focus groups and neighbourhood walks." (Claudio Lucchesi / Urban Future Organization)

Community friendly

The Canuanã School, located in large farm in Tocantins, run and funded by the Bradesco Foundation, provides education for disadvantaged local children. It also provides accommodation for farm workers, teachers and 840 children, with numerous school buildings, a refectory and a small hospital. The building designed has a huge timber roof canopy, under which the ambiances feel relaxed, comfortable and appropriate in its tropical environment.

At the Pies Descalzos School (Barefoot School) by architect Giancarlo Mazzanti, located in Cartagena, Colombia, some spaces are also shared with the communities. More than just a school, it seeks to create new facilities and community centres, such as libraries, places for sports, learning spaces, where communal activities can take place. It has been a driving force for change, and offered the neighbourhood new alternatives for personal and community development.

Emotional intelligence and happiness

The founders of Riverbend School (India), SPI Incubator, prioritise happiness, positivity and emotional intelligence, and architect Danish Kurani (USA) created an architecture that fosters these qualities. To help students build the relationships that are key to happiness, Kurani designed the campus like a village. The school centers around a public plaza with spaces for studying, living, reflecting, farming, and every aspect encourages socialising. Water is a key element for emotional intelligence. There is a peaceful meditation deck and lake, and a zen garden with soothing sounds of a river. There are pet stables and farming to develop empathy, care and a connection to the environment.

Colours and activities

Has seen before, colours have a strong impact on support specific kind of activities. There are colours and tonalities that invite to create, participate, learn, concentrate, play, etc. In the Nursery 8 Units garden in Spain for example, the colour blue promotes tranquillity, the colour green encourages contact with nature and the mixtures of colours (in the floor of common spaces) strengthen the processes of socialization and community at school.

The Kekec kindergarten in Slovenia, by Arhitektura Jure Kotnik, has a facade with colorful wooden planks that can rotate. These pieces consist of dark brown roughcast and timber slats revolving around their vertical axe. Aside from serving as a shading element, this colorful facade provides a playing and learning element. As the children manipulate the colorful wooden planks they simultaneously get to know different colors, experience wood as a natural material and constantly change the appearance of their environment.

At the Taka Tuka Land kindergarten in Germany, by architects Die Baupiloten, yellow is the dominant colour, inspired by the story of a lemonade tree. Yellow illuminates spaces. At the entrance and corridors there is a rightful lemonade gallery, in the hall the children's clothes are accommodated in lemon-coloured cupboards, there is a yellow membrane with plenty of spaces to hide, and the architectural high-point is the "lemonade-island" where the children are taller than the grown-ups. Its oblique surfaces invite every child to play in streams of yellow lemonade.

Optical and acoustic space

At the Carl Bolle Elementary School in Germany, by architects Die Baupiloten, the corridors are full of hidden corners with coloured lights, mirrors and figures that promote communication, movement and the investigation of scientific phenomena. Die Baupiloten invited the students to workshops to learn about their ideas and desires regarding the re-designing of the school. Based on the story of the "Spy with the shimmering cloak", and in accordance with the school's sports-oriented motto of "language and movement", the hallway was converted into a leisure area that encourages exploratory learning. They experience the architecture through optical and acoustic space, moving along climbing walls, observe space from different perspectives, or finding some time alone in the various reading hatches.

The students can explore the colour spectrum, learn about complementary colours, experience another view through a periscope, reflect on light conductors, or even invent codes to send secret messages to communicate with the other children. There is a "Listening Wall" which works like an oversized organ that plays music and tells stories. When a child sits or leans on one of the keys, a song or audio book will be played. And there is a "Wall of Disguises" where children can invent secret languages, control reflected light, and design codes. The wall is adorned with small, specially-layered plexiglass panels that can be turned to reflect the coloured light in different ways or let the light shine through. The light reflectors at the base and on the walls of the structure contain the entire colour spectrum and project complementary colours on the opposite wall.



Fig. 5.44-45 - Ann Frank Academy (USA) by Prakash Nair



Fig. 5.46- Ørestad Gymnasium (Denmark), by architects 3XN



Fig. 5.47-48 - Canuanã School (Brasil), by Rosenbaum + Aleph Zero



Fig. 5.49-50 - Riverbend School (India) by Kurani



Fig. 5.51 - Nursery 8 Units (Spain) by LosdelDesierto

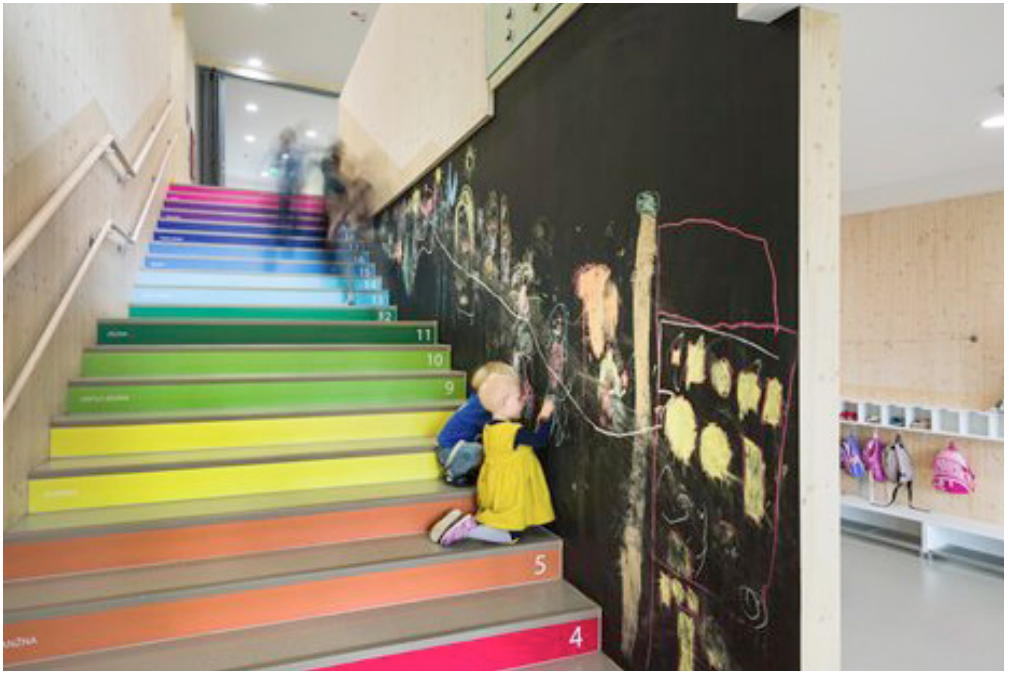


Fig. 5.52-53 - Kecec kindergarten (Slovenia) by Arhitektura Jure Kotnik



Fig. 5.54- Taka Tuka Land kindergarten (Germany), by Die Baupiloten



Fig. 5.55 - Taka Tuka Land kindergarten (Germany), by Die Baupiloten

Spaces' interaction

In the Guastalla kindergarten in Italy, by MCA architecture, architectural elements (shapes, organization, the choice of materials, sensory perceptions related to light, colors, sound, tactile) are designed to stimulate the child's interaction with the surrounding space. Areas of connection between classrooms and laboratories are designed to be experienced with curiosity and pleasure: along the route there are widening, play and relationship areas, niches where you can stop, transparent elements to watch out or peek activities the other children.

Flexible spaces and versatile furniture

Creating spaces with multipurpose areas allows students to link with what surrounds them. Mixing elements and objects favours teamwork, inspires students and combines academic responsibilities with fun. Versatile furniture stimulates creativity for its multiple uses. At the Vittra school in Stockholm (Sweden), designer Rosan Bosch created a stimulating learning environment for students. It has no classrooms or walls. It uses dividers to create flexible laboratories. From within this flexible and adaptable space principle, different types of learning emerged

Public school Het Veer (School 01) in the Netherlands, designed by i29 interior architects, is a school for children with learning and concentration difficulties. References in the design were concentration, playful and movement. Here each piece of furniture was designed as a playful multipurpose object, and it is not directly clear how they should be used. Students can sit, lie down, hang out and study. As a result, children get concentrated on their environment and experiment creatively how the furniture can be used.

In Fuji kindergarten (Japan), by architect Tesuka, all furniture is wood based, and there is almost no decoration. There are lightweight wood boxes of different sizes and heights. On one hand, it helps to organize the space. And on another hand, children love to play with them, stepping in, making constructions, and dragging each other around.

At the Ama'r Children's Culture House in Denmark, by architect Dorte Mandrup, the building is organized as a mountain. Interior spaces are visually connected and bound together by dynamic circulation. The spaces are adaptable for varied use and accommodate age groups from 0-18 years with changing needs. It offers flexible spaces and customized furniture, which have been proven to enhance children's creativity and active participation.

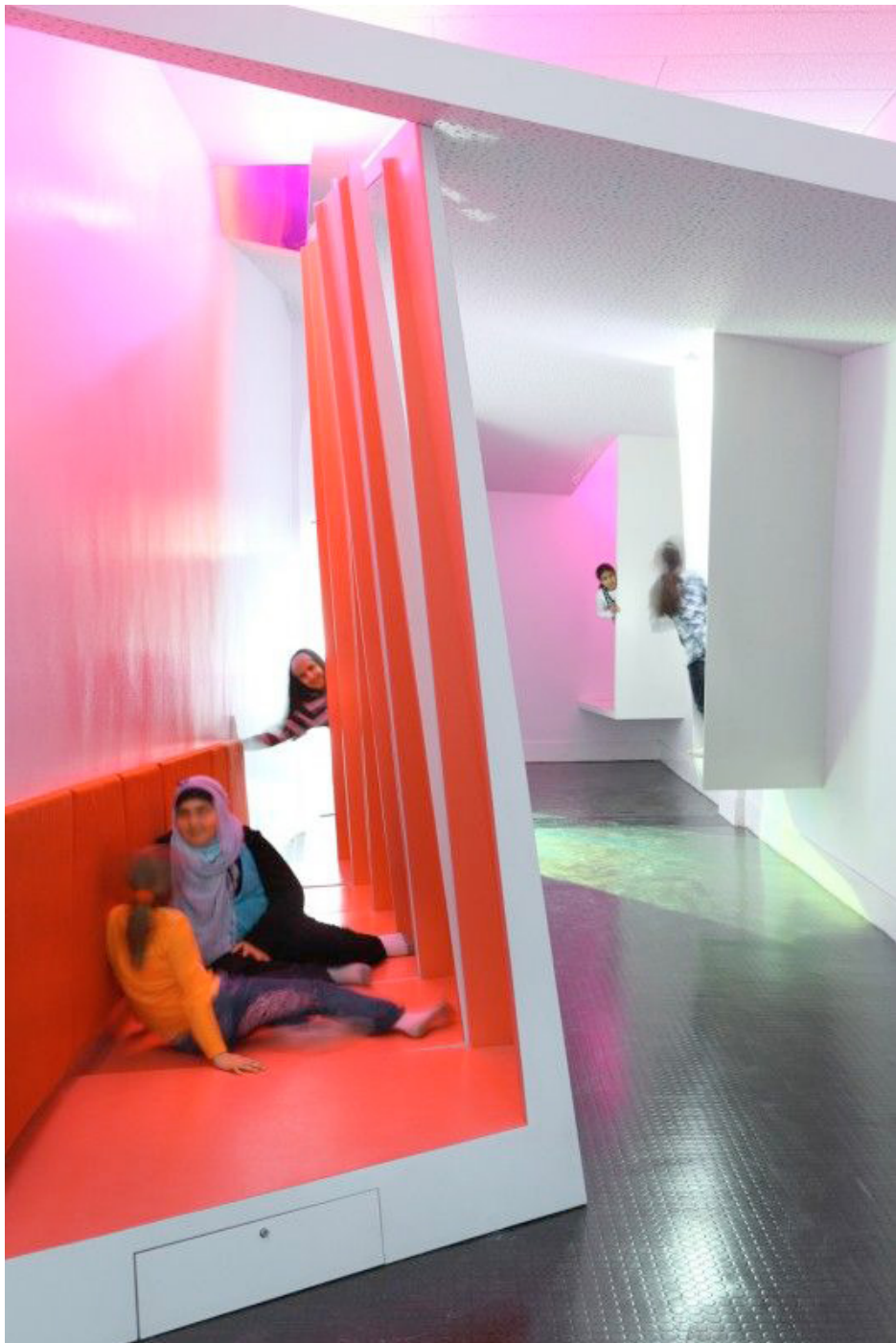


Fig. 5.56 - Carl Bolle Elementary School (Germany), by Die Baupiloten



Fig. 5.57- Carl Bolle Elementary School (Germany), by Die Baupiloten



Fig. 5.58- Carl Bolle Elementary School (Germany), by Die Baupiloten



Fig. 5.59-60 - Guastalla kindergarten by MCA architecture



Fig. 5.61 - Vittra school (Sweden), by designer Rosan Bosch





6

**THE 7 PETAL
SCHOOL**

The 7 Petal School is an integral educational

The 7 Petal School is an integral educational proposal addressing the educational needs of today and tomorrow's children. It is called the 7 Petal School because it is based on 7 pedagogical domains of holistic human development (holistic comes from the Greek *holo* and it means "all").

The 7 Petal School is based on the philosophy that a holistic and integrated education is essential for a complete human being, for a proactive and responsible society, and for a healthy planet. In other words, this proposal attends to all facets of human development, in a complete way, harmonized and articulated.

The 7 Petal School is sustained by a deep philosophy of existence, connecting, and living in Solidarity. It is a school/culture that:

- Honours the past
- Consciously projects a new society, a planetary co-existence with genuine care for our planet
- Lives happily in the present.

It is based on the philosophy of *Educación 3000®* (*Pedagogía 3000®* in Spanish), an integrated and applicable educational culture that was born with Noemi Paymal in 2001 in Ecuador. This philosophy expanded rapidly, firstly in Latin America and later on all continents. To date, it is present in 53 countries pushing to re-evolutionize education worldwide with harmony and practicality.

The School of the 7 Petals, like all schools of the Third Millennium, is about Awareness. It is a frequency first built in the heart, then envisaged with everybody, and finally co-created physically.

The 7 Petal School is simple to understand, easy to implement, and does not require expensive resources. It adapts to any geographical, social, economic, cultural, and ecological condition.

The 7 Petal Schools are organized into 7 pedagogical areas which are interlaced and complementary. These areas, represented by colours, are the following:

1. Blue Petal - Physical and Kinaesthetic Development

The area of physical wellbeing (blue) includes Physical Education every day, in the form of all kinds of dances and sports (the least competitive as possible).

2. Yellow Petal - Articulated Cognitive Development

A cognitive, articulated and contextualized area, of a high academic level, this petal promotes diverging and original thought, creativity and logical-mathematical learning interlaced with other subjects (for example, Science, Technology, Engineering, Mathematics and Physics all together).

3. Pink Petal - Social and Multicultural Development

This area includes Social Sciences, Multiculturalism, Culture of Peace, Non-Violent Communication and social networks, providing social activities of exchange online and on site.

4. White Petal - Aesthetic Development

This area of Arts and Creativity uses all means of creative expression.

5. Green Petal - Ecological Development

An area that provides environmental education in all its forms, as well as the implementation of alternative energies.

6. Red Petal - Hands-on Development

Area of the applied sciences, production, hands-on activities and workshops (red). It incentivizes and supports productive projects in the context of real life.

7. Purple Petal - Personal Development

An area of personal development that foments personal growth, ethics, values and Purpose in Life. You may find full information about the 7 pedagogical areas in the 7 Petal School book (Paymal 2017) ¹⁵.

The 7 Petal School operates as an upward spiral each Petal is interlaced with the other and goes on into an upward spiral awakening consciousness. The golden rule is to be flexible, open, creative, and encourage diversity, remaining aware that things are constantly changing and you will generate more ideas and actions as move ahead. Most importantly, enjoy it!

The 7 Petal Schools are innovative because they give the students an interconnected planetary vision and a vision of Peace. They also prepare the students concretely to co-construct a society with solidarity, along with ecological and multicultural views.

The 7 Petal Schools promote tools for a world where cultural differences are understood and accepted, focusing on peace with one's self, the others and the planet, honouring the past, taking on the present fully and projecting towards the future in a concrete, positive manner in solidarity with the others.

What will be the results of the 7 Petal Program?

At the end of the program, we will have youths who:

- Speak various languages, know different cultures and alphabets.
- Are experts in the use of computers and communication technologies.
- Know about fair Economy and applied Social Sciences.
- Know about real life and can manage whatever project they might want to undertake.
- Use their Emotional Intelligence to the fullest.
- Know their purpose in life.
- Live with Non Violent Communication and Culture of Peace.
- Have the capacity to constructively collaborate as world citizens and make significant contributions to both the local and international arena.
- Are happy and fulfilled, as well as responsible and pro-active.
- Use their creativity to the maximum, their lateral thinking, diplomacy and their Interpersonal and Intrapersonal Intelligences.
- They are able to concretely participate in the co-construction of a new world.

The 7 Petal Schools hence contribute to a worldwide durable Culture of Peace, providing a better quality of life for all, both within and outside. At the moment there are 7 Petal Schools being carried out in Peru, Mexico, Italy, Spain, soon in the United Arab Emirates, Portugal and other countries.

Download free of charge:

<http://www.pedagoogia3000.info/index.php/en/component/phocadownload/category/7-books-3000?download=25:the-7-pet-ls-school>



7

HOW TO START A SCHOOL FOR THE THIRD MILLENNIUM

Where and how to start? How to co-create an integral school for the Third Millennium? The new education is something that can only be re-created according to local culture and necessities. Education is a bio-system that cannot be copied, like a “copy-paste”. It needs to be felt and lived. The new schools are alive and in constant movement.

Dream, co-re-create and make your own Education. They are the personal ideas, beliefs, aspirations, visions, local geography, history, culture, social and economic dynamics that will shape each school in their own and unique ways. Next follows a practical step by step approach for starting an integral school in tune with these changing times. These steps provide advices, ideas, and hints on how to begin and encourage a pedagogical synergy from the start. The important thing is to start, focusing more on the essence than on the technical aspects, which will always be in the process of change anyway. It is the experience, the journey, the learning, the growing and the co-creation that counts.

The school should be carefully thought through before building. Co-creating an integral school demands indispensable steps (next follows an excerpt from the “7 Petal School” book):

Step 1: Envision the school together

The first step for co-creating our School is to envision and project it with all the stakeholders, parents, teachers, children, youths, neighbours, grandparents, the communities and families in general. And the six following steps basically point to a solid preparation of the adults who will accompany the process. How do you “envision” a school? You get

together, talk, project, visualize, draw, and celebrate. And we listen and take into account to everybody involved. Envisioning and get prepared for the School should take 25% of the time of the project. It is the most important step because it ensures the continuity of the project in team work. Furthermore, it creates the “spirit of the school”, projects its outlines, strengthens the team, in short, it gives the school a solid base.

Step 2: Personal preparation of the adults

Integral preparation is indispensable, both personal as well as collective preparation of the co-creators of the new school. This preparation is a process that can take between 6 and 12 months. Preparing ourselves as a person ensures a thorough inner growth, reaching a sincere and permanent self-knowledge. Also to assure emotional stability of each and every one is extremely important.

This can be done using a range of techniques like:

- Physical exercises with conscious breathing
- Anti-stress techniques
- Grounding and rooting exercises
- Exercises of balance between the two brain hemispheres
- Exercises that develop Emotional Intelligence
- “Reconnecting” exercises that helps elevating consciousness
- Therapies for personal healing
- Investigating today’s children and the various existing educational tendencies.

Step 3: Preparation in group

This consists of:

- Getting to know each other
- Listening to each other
- Doing activities and excursions together
- Using coaching and team-building techniques for the integration of group and teamwork
- Taking classes in Non Violent Communication and having some techniques of Culture of Peace
- Organizing study groups and doing practices on the topics under study.

Step 4: Defining educational lines and exploring pedagogical tools

After that it is important to explore and live the new techniques and pedagogical tools, first by yourself and later in a small group, adjusting along the way. Be aware and investigate on what is happening in the world in relation to pedagogy, Education 3000 (Pedagogooogia 3000), technology, ecology and personal growth, setting up a network of exchanges.

Step 5: defining the general outline of the school

It is also necessary to generate a consensus about the general outlines of the school, taking into account criteria of each member of the group. Always being aware of innovations and be open to changes and improvements. And above all the golden rule is to be happy and celebrate the steps we take.

Step 6: setting up networks

It is important to set up local, national and international networks in order to share ideas, experiences, get advices, feel accompanied and/or continue with self-studies. Share what you do by all possible means.

Step 7: merge yourself in the local situation

It is essential to learn about the local cosmovision and to get to know the local reality well. The school should go hand by hand with the local community. It is a good idea to organize visits with the children, like for example to barns, municipalities, sports infrastructures, parks, technical institutions, shops, markets, factories... and invite the main actors of these organisation to the school. Regular social and ecological local actions should be encouraged. The idea is to form alliances with everyone and make the school part of the local life, with a lot of enthusiasm. The most important is that everyone is involved. This means going back to the first step, to the intention and the projection of all the stakeholders of the school (children, parents, teachers...) allowing the concretization of the collective vision and co-constructing the physical school.

Appendix 1

Educatiooon 3000

and Architecture 3000 Network

Architecture 3000 is an international network of Educatiooon 3000 (Pedagoogia 3000 in Spanish) which includes architects, designers and pedagogues, wishing to improve the Educational system around the world, specially through the design of innovative and diverse learning environments based in today's children characteristics and needs. We wish to co-create many beautiful 7 Petal Schools around the world.

We are interested in including Universal Geometry in our design and concerned for ecology and sustainability. Our objective is to co-create environments that are healthy, harmonious, pleasant, friendly, more "humane", in balance with local resources, and energy efficient. We wish to share freely ideas, tools and techniques that may help the design of the School of the Future, Now.

Email: info.educatiooon3000@gmail.com

Website: <https://www.educatiooon3000.info>

Appendix 2

Universal Geometry practical activities

Practice 1

Explore geometry in your surroundings.

Option 1: Compile examples of different scales of spheres: eyeballs, head, molecules, bubbles, Earth, moon, sun, planets, stars, oranges, apples, tomatoes.

Option 2: For small children, gather all kind of fruits and vegetables, observe the outside shape. Cut sections and observe a different geometry inside (i.e. carrots, artichokes, tomatoes, lemons, watermellon, cucumber,...). Taste them!

Option 3: For older students, study closely the actual geometry behind each ball used for sport, looking for Archimedean shapes. See: <http://paulbourke.net/geometry/sportsballs/>



Practice 2

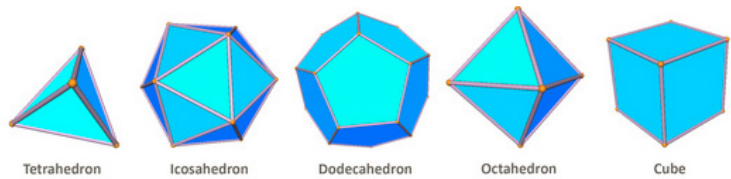
Build paper models of the 5 Platonic Solids, representing the five elements.

Download patterns:

<https://www.geometrycode.com/free/platonic-solids-fold-up-patterns/>

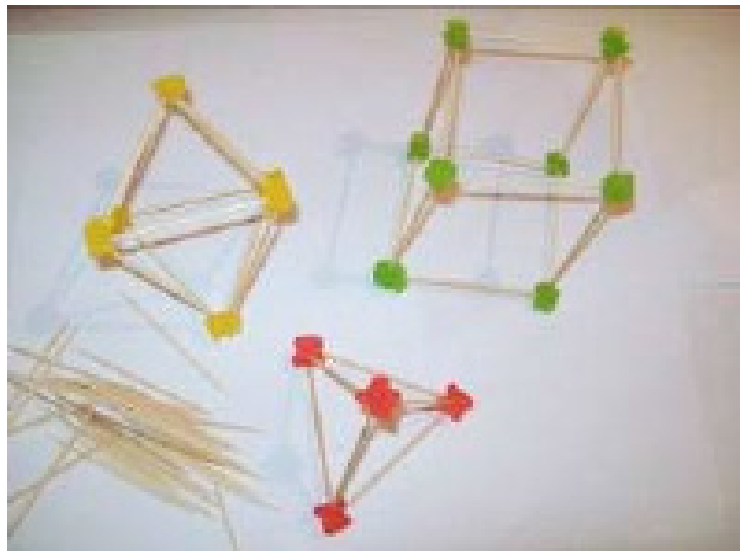
Print, color, cut, fold up and glue the models.

You may hang them on a mobile structure made up with wood sticks and thread.



Option

Build the polyhedra with tooth sticks and gums or elastics.

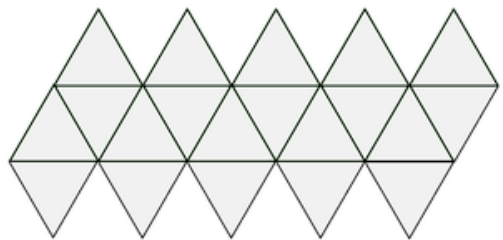
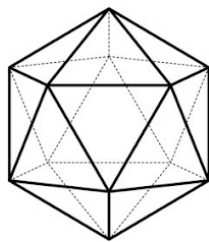
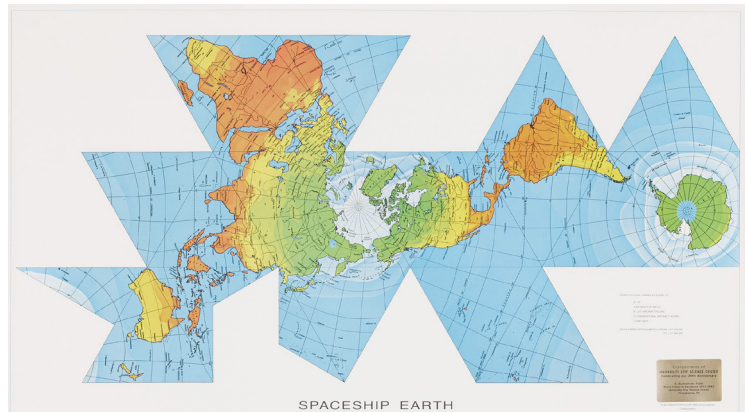


Practice 3

Build a paper model of planet Earth with an icosahedron shape.

Download pattern:

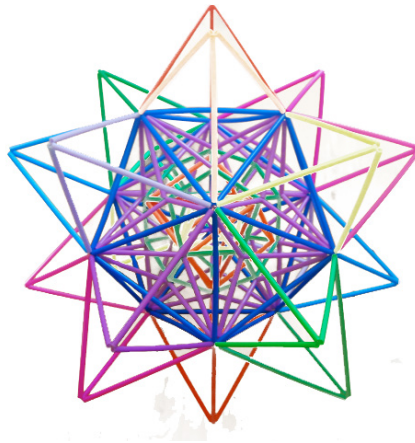
<http://atlasofplaces.com/Dymaxion-World-Map-Richard-Buckminster-Fuller>



Practice 4

Build a Star Matrix, using paper straws and thread. The Star Matrix is built in the following order:

- 1- Build the yellow octahedron
- 2- Build the red tetrahedron around the octahedron
- 3- build the green hexahedron around the tetrahedron
- 4- build the dodecahedron around the hexahedron
- 5- Stellate the dodecahedron resulting as a stellated dodecahedron
- 6- Build the icosahedron around the stellated dodecahedron
- 7- And finally stellate the icosahedron resulting as a stellated icosahedron, the Star Matrix.



Dimensions:

- Tetrahedron - 11,8 cm each edge - 6 edges
- Octahedron - 5,6 cm each edge - 12 edges
- Hexahedron - 8,8 cm each edge - 12 edges
- Dodecahedron - 5,7 cm each edge - 30 edges
- Icosahedron - 14,1 cm each edge - 30 edges
- To stellate the dodecahedron - measure the diagonal of the pentagon of the dodecahedron - 9 cm
- To stellate the icosahedron - measure the edge of the triangle of the icosahedron - 13,7 cm

Practice 5

Build up the Platonic Polyhedra in body scale. Children and adults can step in to experiment it, play in it, meditate.

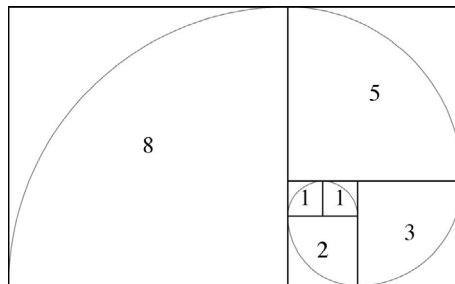
Dimensions:

- Tetraedron - 1,63 m each edge - 6 edges
- Octaedron - 0,74 m each edge - 12 edges
- Hexahedron - 1,18 m each edge - 12 edges
- Dodecahedron - 0,62 m each edge - 30 edges
- Icosaedron - 0,9 m each edge - 30 edges

Practice 6

Use the Fibonacci spiral.

- 1- Hang on the classroom wall a poster of a Fibonacci spiral.
- 2- Colour a Fibonacci spiral.
- 3- Draw a Fibonacci spiral on the floor and ask the children to walk on it following the design.



Practice 7

Explore the Golden Ratio or Golden Spiral in nature:

- 1- Explore around you, or on the web
- 2- Try to gather as many examples as you can
- 3- Study and compare them. Measure them.
- 4- Use them to make artefacts, sculptures, collages, or as inspiring materials for drawings and paintings.

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Noemi and team started a network for the 7 Petal Schools, a practical and integral design for Schools easily adaptable to any country, culture and situation. These Schools are extremely innovative and creative, oriented to Peace Culture and preparing children and adult to actively co-build a new Society, more harmonious, peaceful, cooperative and sustainable.

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