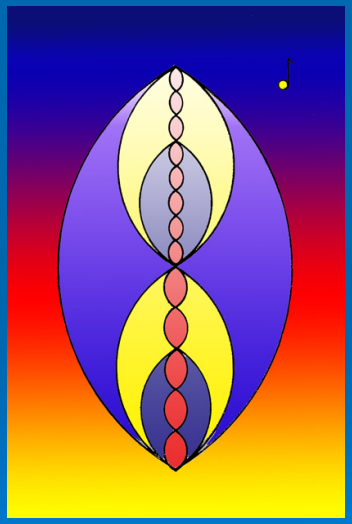
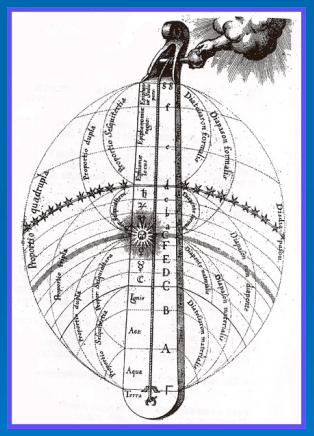
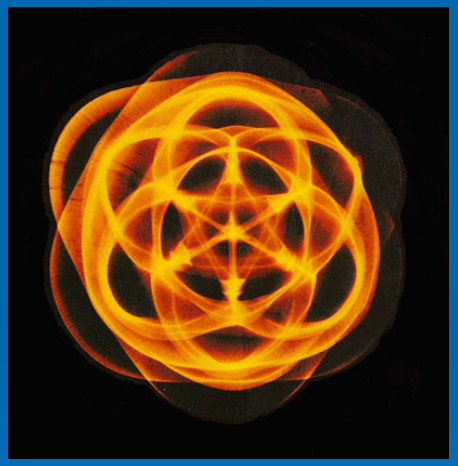
SG201.Ia The Monochord, Music & Cymatics

Online Module SG 201
Interm I





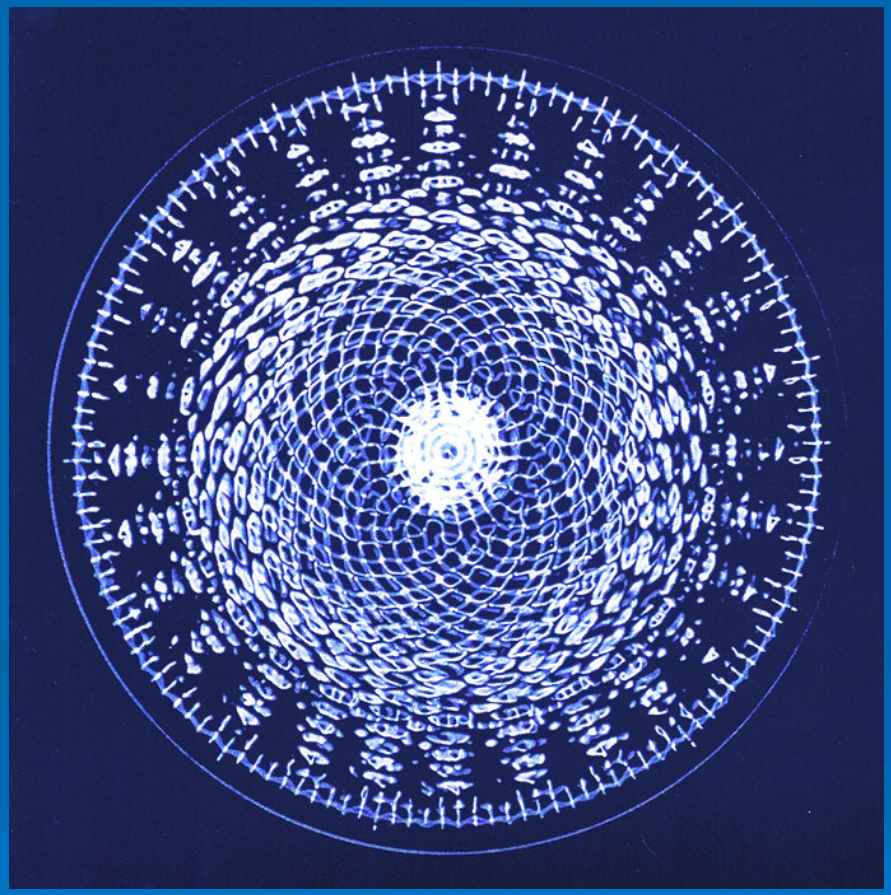


Presented by AYA
& the Sedona School of Sacred Geometry
P. O. Box 3714 Sedona, AZ 86340

www.SchoolOfSacredGeometry.org
phi@schoolofsacredgeometry.org
www.StarWheels.com

SG201.Ib The Monochord, Music & Cymatics - Contents

SG201.Ic The Monochord, Music & Cymatics



Sonic water image. Frequency: 102.58 Hz.
Alexander Lauterwasser
www.wasserklangbilder.de

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SG201.Id. Introduction to SG201
Music & Sacred Geometry

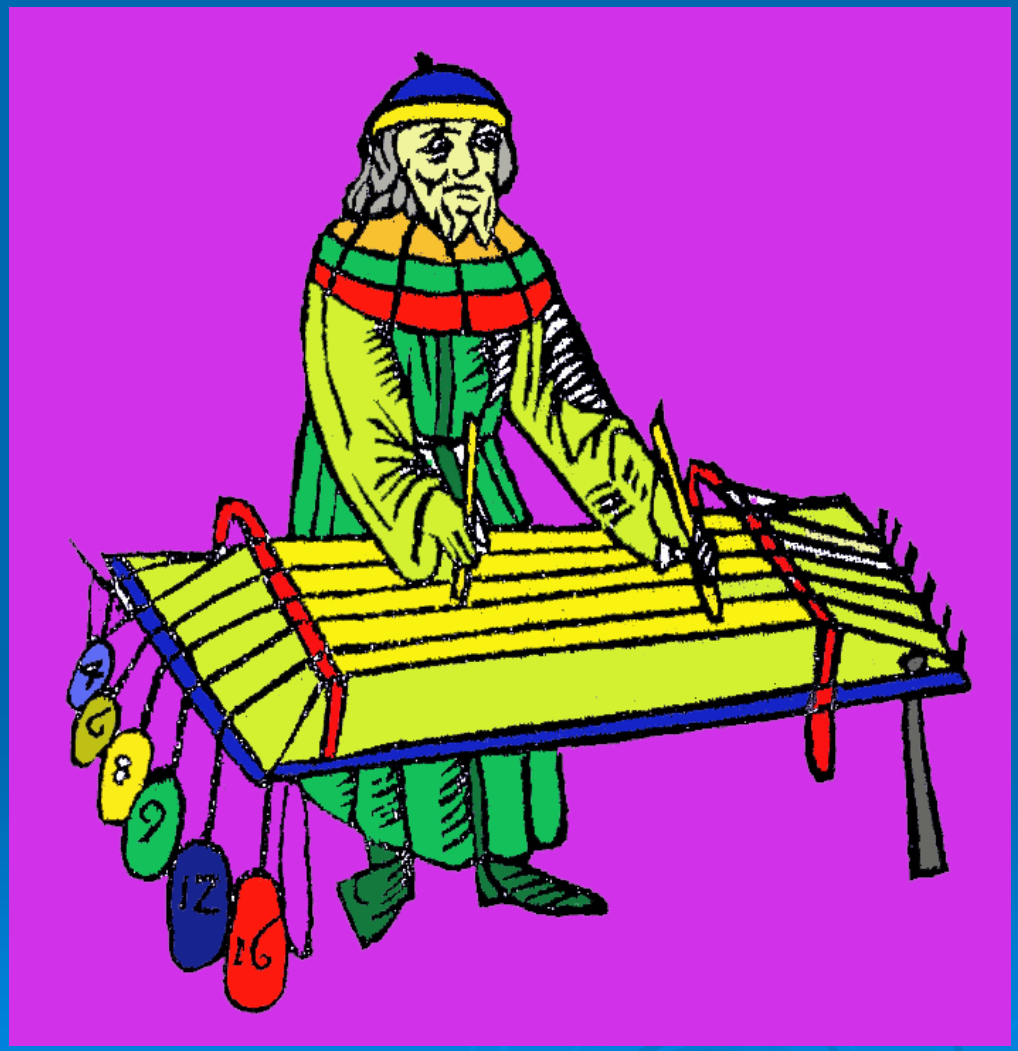
We are first making a brief historical review of the cosmogonic aspects of ancient music in China, India, Egypt and Greece. The resonant and harmonic qualities of the musical tones and scales these ancient peoples chose as the foundation of their civilization were able to sustain their cultural order for millennia.
Ancient music was first and foremost an expression of the *order of the universe* and was therefore based on the harmonics of the Overtone Series and the corresponding simple geometric ratios of whole numbers.

The *monochord* (*one string instrument*) is the traditional way of understanding the natural physics of sound and the relationship between frequency and wavelength, based on simple geometric ratios. The *harmonic series* and *overtones* have been essential knowledge to all ancient musicians seeking "*just intonation*".
Only recently, in the last 2 centuries, did this natural tuning get superseded by the "*equal temperament*" system, a convenient yet artificial way of playing music. This "equal temperament" system has progressively alienated modern westernized man from the naturally resonant rhythms of the cosmos and his inner nature.

The new art-science of *cymatics* is a powerful reminder illustrating the emerging quantum wisdom: sonic waves create the vibrational nodes we call 'reality'. By resonance and conscious intention, they can create non-local, self-referential vortices of manifestation. Current discoveries in the technological, medical & healing applications of sound are spiraling back to the musical harmonic wisdom of ancient cultures.

Yes, life is a glorious dance of standing waves, fine-tuned to the PHI cosmic constant, and based on simple harmonic ratios we call 'beautiful' or 'soulful' music.

SG201.1 - Chapter 1. Ancient Music



"There is Geometry
in the humming of
the strings.
There is Music
in the spacing of the
spheres"
(Pythagoras)

SG201.1.1 Musica Speculativa

In the ancient tradition - and discipline - of *musica speculativa*, music was understood as a mirror (Latin = *speculum*) of reality, the best way to understand - and enter - the Cosmos. Penetrating the mysterious pleasure of music was the best initiation to the mysterious beauty of human life, nature and the universe. Music was a cosmological, mystical path.

In ancient cultures, the intelligence of the ear（with its sophisticated ability to capture microtones over 10 octaves - whether inner or outer sounds), together with the intelligence of the heart were the intimate pathways to spiritual wisdom. This preeminence of sounds/tones (as guiding signals) and of hearing/listening (as an essential practice of life) has been lost in our times due to the usurping take over of the eye - a sense that mostly captures external shapes & data.

How does one know music? Through *harmonics*. Early enough, all sacred cultures around the world heard and recorded what is now called the Overtone Series, the natural "quantized" organization of sound waves transference. The prevalent diatonic musical scale, with its main chords of the fifth and the fourth, became the human-made reflection of this infinite Overtone Series.
The Overtone Series really is a cosmological code of harmonic ratios reflecting the dynamics of the cosmos, from atomic quanta to galactic super-clusters. It is a cosmic language of vibrational information. All early civilizations were founded on their own version of this primordial scale of musical harmonics and this was sacred knowledge to them, encoded in their musical instruments, monuments, astronomy, calendar and ceremonies. All these ancient musical systems "instinctively" go back to the few archetypal ratios of whole numbers that create the full consonance of the octave (1:2) or the near-consonance of the fifth (3:2) and the fourth (3:4). This is live Sacred Geometry or shall we say Sacred Harmonics.

***"Music is a higher revelation than all wisdom or philosophy".* Beethoven**

SG201.1.2.1 Chinese Music (1)

Music of ancient China was regarded as the sound recreating on earth the primordial order of the universe. Chinese music theory is therefore closely related to number symbolism, sacred geometry and the cyclic interplay of the Yin & Yang cosmological principles.

An ancient Chinese myth tells of the discovery of the ”Foundation Tone," which, in addition to being a musical note of specific pitch, also had political implications, since each dynasty was thought to be the guardian of the Foundation Tone.
The Foundation Tone was produced when *Ling Lun*, the founder of Chinese music and a mystic-scholar, went to the western mountain area of China and cut a bamboo pipe in such a way that it produced the correct sound. He is said to have traveled to a distant land and made a set of 12 flutes with bamboo. This set of flutes could produce 12 tones and became the basis of music.

The ancient Chinese defined, by mathematical means, a series of 12 frequencies called the *Shi Er Lü* (= 12 lü) from which various sets of five, or six, or seven frequencies, pentatonic, hexatonic and heptatonic scales, were selected to make the major scale familiar in the West. But the Chinese aesthetics prefers to use interval rather than scale. The 12 *lü* approximate the frequencies known in the West as F, G flat, G, E flat, and E.

The ancient Chinese system of tuning encompasses the closest approximations to the just intervals. Depending on the melodic progression, scale pitches are selected from 23 different ratios within the octave so that each principal interval in the progression is a just intonation.

**↑ 9,000 years old flutes.
Jiahu archeological site,
Henan, China.**

SG201.1.2.2 Chinese Music (2) Pentatonic Scale

The most familiar Chinese scale is the *pentatonic*, five-tone music scale, based on the traditional 5 elements. The five tones are classified as: *Kung, Shang, Chueh, Chih* and *Yue.*

The 5 tones are correlated with many aspects of nature and the cosmos, as well as to the human energy system: five organs (heart, liver, lungs, kidneys and spleen), five senses (mouth, nose, eyes, ears and tongue), and five fingers on each hand.

According to Chinese tradition, any of these five tones can affect a human being's internal organs and might act as a regulatory mechanism. Music can increase metabolism, open thought processes, and regulate the heart.

Traditional Effects of the 5 Chinese Music Tones:

"Kung-based melodies **are classified as noble, Earth-related, and affect the spleen. Often listening to such music makes one tolerant and kind.**

Shang melodies **are heavy and, like metal, unbending. This music affects the lungs; and frequent listening makes one righteous and friendly.**

Chueh-based music **heralds the arrival of spring and awakens all life anew. This kind of music affects the liver. Listening to it makes one kindhearted and conciliatory.**

Chih music **is highly emotional, like fire. It affects the heart. But listening to it makes one generous.**

Yue-based tunes **are melancholic, like placidly running water. They affect the kidneys. Listening to these tunes makes one mentally balanced and gentle."**

(Dr. Zhiping Chen. //spectacularvancouver.wordpress.com)

↑ Ancient Zhong Bells can produce two tones, a third apart.

www.britannica.com

SG201.1.2.3 The Chinese Guqin

"The gǔqín (Chinese "*ancient stringed instrument*") is a plucked seven-string music instrument of the zither family. It has been played since ancient times, and has traditionally been favored by scholars as an instrument of great subtlety and refinement, as highlighted by the quote '*a gentleman does not part with his qin without good reason*', as well as being associated with the ancient Chinese philosopher Confucius. It is sometimes referred to by the Chinese as '*the father of Chinese music*' or '*the instrument of the sages*'". *(Wikipedia)*

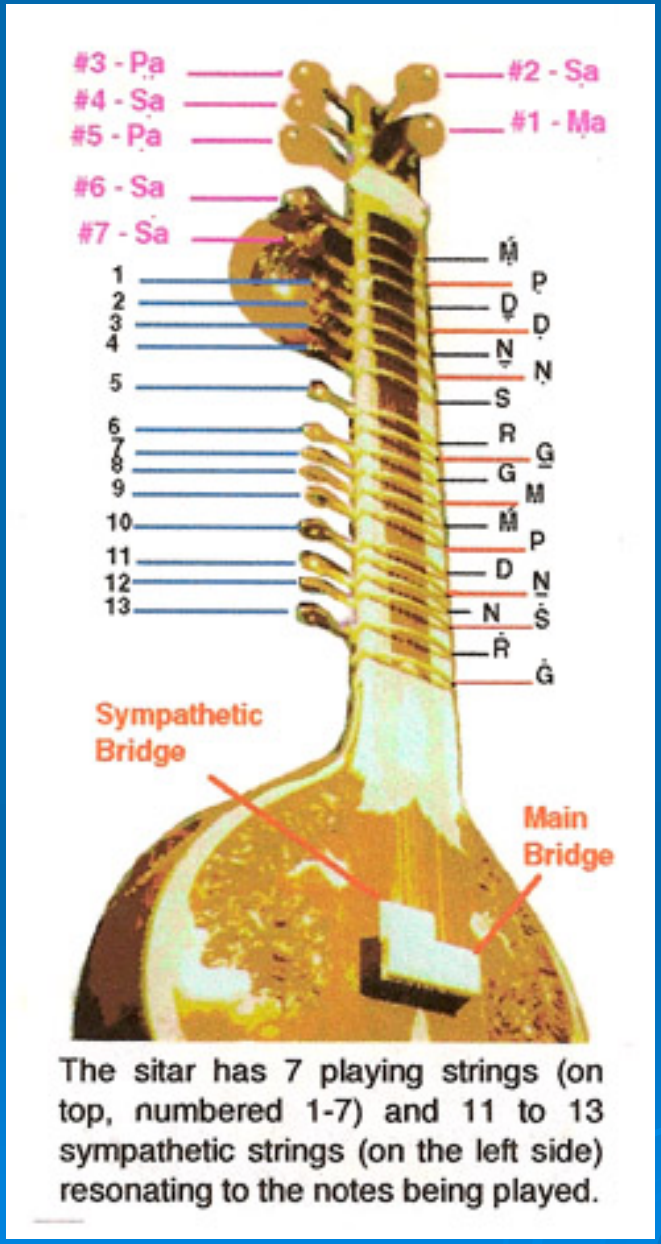
Traditionally, when playing the Guqin, one should allow the natural sounds to resonate from the strings rather than trying to force the note out of the string.

"Some players say that the sliding on the string even when the sound has disappeared is a distinctive feature in *qin* music. It creates a 'space' in a piece: playing without playing, sound without sound. In fact, when the viewer looks at the player sliding on the string without sounds, the viewer automatically '*fills in the notes*' with their minds. This creates a connection between player, instrument and listener. With a really good *qin*, silk strings, and a perfectly quiet environment, all the tones can be sounded."

(Wikipedia)

Xu Kuanghua playing an ancient qin in the film, *Hero*.

The Guqin has a musical scale based on harmonic overtone positions: 1/8, 1/6, 1/5, 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 7/8.



The sitar has 7 playing strings (on top, numbered 1-7) and 11 to 13 sympathetic strings (on the left side) resonating to the notes being played.

SG201.1.3.1 Indian Music (1)

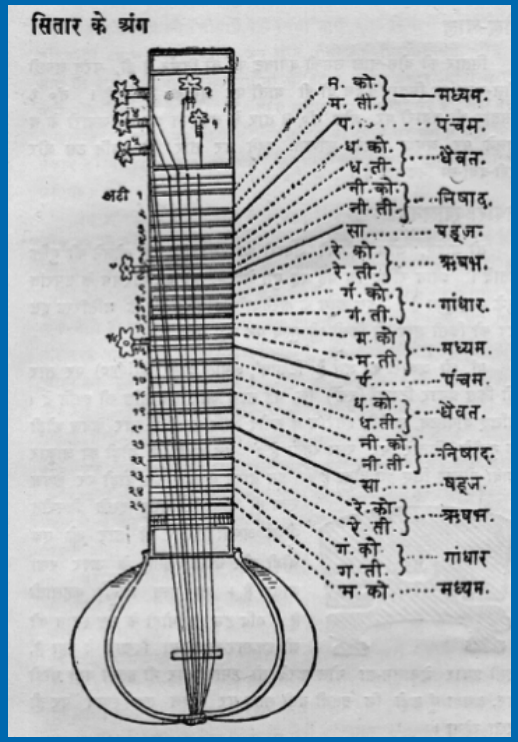
In Indian music, the musical event is not so much happening in the notes one blows or plucks as it is happening IN BETWEEN the notes.

The real musical transmission is enacted in the complex matrix of '*rich silence*' between the notes, through the subtle weaving of overtones, as they directly affect bodies, minds & spirits.

In the same way, movies of *cymatic* designs reveal that the nodes of coalesced sand are mostly inert, while the dynamic currents of manifesting sounds are in formation between the nodal landscapes.

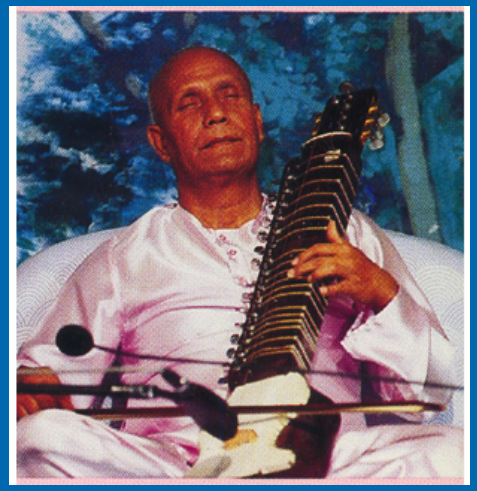
SG201.1.3.2 Indian Music (2) Sympathetic Strings

//chandrakantha.com



↑ The *sitar* has 6-7 playing strings with about 15 sympathetic strings running underneath.

← Popular in the Bengal area of India, the *esraj* is an instrument played with a bow. In addition to the the 4 bowed strings, the *esraj* has 15 to 34 sympathetic strings.
Some of the sympathetic strings operate with *Djjwori blocks* to create additional harmonic overtones.



↑ Sri Chinmoy playing the *esraj.*

"Silence is the source of everything. It is the source of music and it is music itself. Silence is the deepest, most satisfying music of the Supreme."

Sri Chinmoy

SG201.1.3.3 Indian Music (3) Seven Swaras (1)

SA - RE - GA - MA - PA - DHA - NI - SA

The seven notes (*swaras*) of Indian music scale are collectively known as the *Sargam* (an acronym of the first 4 *swaras*) or the *saptak* (*seven* = "octave"). The full names of the 7 swaras are: *shadja, rishabh, gandhar, madhyam, pancham, dhaivat* and *nishad*, usually shortened to Sa, Re (Ri), Ga, Ma, Pa, Dha, and Ni and written S, R, G, M, P, D, N.

A dot above / below = higher or lower octave. An accent above / a line below = sharp or flat.

"*Sargam is the Indian equivalent to solfege, a technique for the teaching of sight-singing. Sargam is practiced against a drone. The tone Sa is not associated with any particular pitch. As in Western moveable-Do solfege, Sa refers to the tonic of a piece or scale rather than to any particular pitch.*" (Wikipedia).

Traditionally held to have originated with the sound of an animal, the 7 *swaras* are mapped onto the 7 *chakras* in ascending order: SA (*muladhara* = base) to NI (*sahasrara* = crown). Flat/sharp modulations of the notes associate them with the left/right side of the chakras and the corresponding energy channels (Ida and Pingala *nadis*).

The word *Swara* came from two syllables - '*Swa*' meaning the self and '*ra*' meaning to shine. That is, only when you feel the *swara* inside you, you can throw light on it and make it shine.

SG201.1.3.4 Indian Music (4) Seven Swaras (2)

Carnatic Swaras and Western Notes -A Comparison		
No.	Carnatic Swara Name	Note in the Western System
1	Sa or Shadja	C
2	Suddha Rishabha	D flat
3	Chatussruti Rishabha	D
4	Sadharana Gandhara	E flat
5	Antara Gandhara	E
6	Suddha Madhyama	F
7	Prati Madhyma	F sharp
8	Panchama or Pa	G
9	Suddha Daivata	A flat
10	Chatussruti Dhaivata	A
11	Kaisiki Nishadha	B flat
12	Kakali Nishadia	B

In the harmonic music system used in the West, each note is separated from another note by a defined frequency interval, as produced by mechanical means (pressing a key or plucking a string).

In the Indian melodic system, each note is separated by relative intervals.
And *swaras* can only be produced by the human voice.

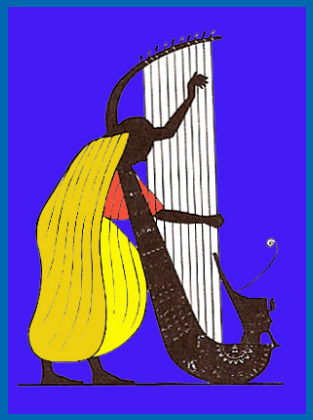
Therefore, a *swara* can only be learnt by listening and learning.

For example, a *Kaisiki Nishada* and a *Kakali Nishada* are not separated by exact frequency of 100.

Only by listening and singing them, you can learn the precise way to sing a *swaram*.

Remember: only you the Sacred Singer of Life can make the *swara* SHINE!

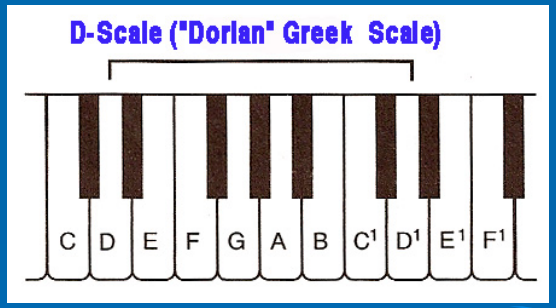
SG201.1.4.1 Egyptian Music



Egypt's knowledge of sacred geometry & music and the Egyptian understanding of the musical harmonic nature of the universe was the original source of the teachings later expounded by the Pythagorean School and the philosophers of classical Greece.
Music was mandatory in the educational system of the ancient Egyptians as musical harmony was the foundation of all other knowledge. Plato based the laws of his ideal *Republic* on the Egyptian music system due to the psycho-physiological effects of music on human nature.

As explained later (◆SG201.1), the incommensurability between 12 fifths and 7 octaves results in the so-called '*Comma of Pythagoras*'. According to M. Gadalla, in his *Egyptian Rhythm* (2002), the Egyptians used a fine division of the octave into 53 equal intervals (now called Mercator's Comma or 53 ET) based on the "*integrity of the Perfect Fifth*". Egyptian music was also aware of each interval being further divided into 3 *buk-nunu* (Egyptian = *mouth of the baby*) or equal parts.

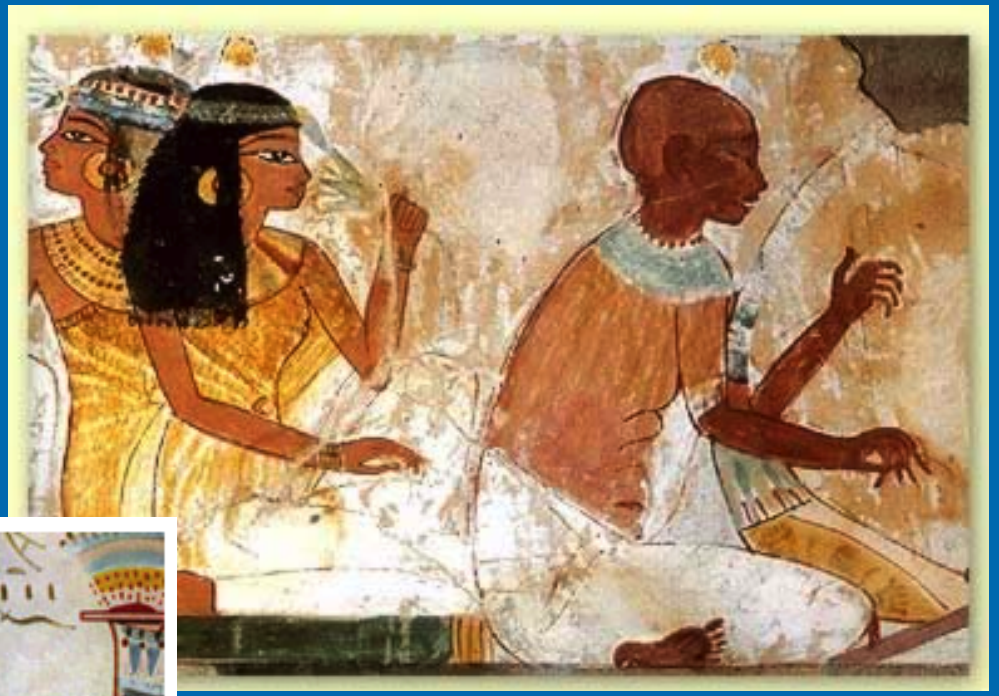
Gadalla explains that the most popular sequence of the *diatonic scale* (7 tones) throughout Egyptian history was the D-Scale (known in Greece as the *Dorian scale*) and based on the ratio of the perfect fifth 2:3. This was the sacred dance between 2 (*Auset* or *Isis*) and 3 (*Ausar* or *Osiris*): all interval relationships can be reduced to 3x/2y or 2x/3y.

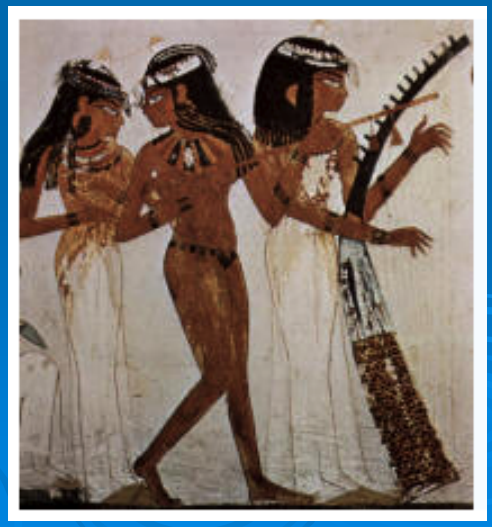


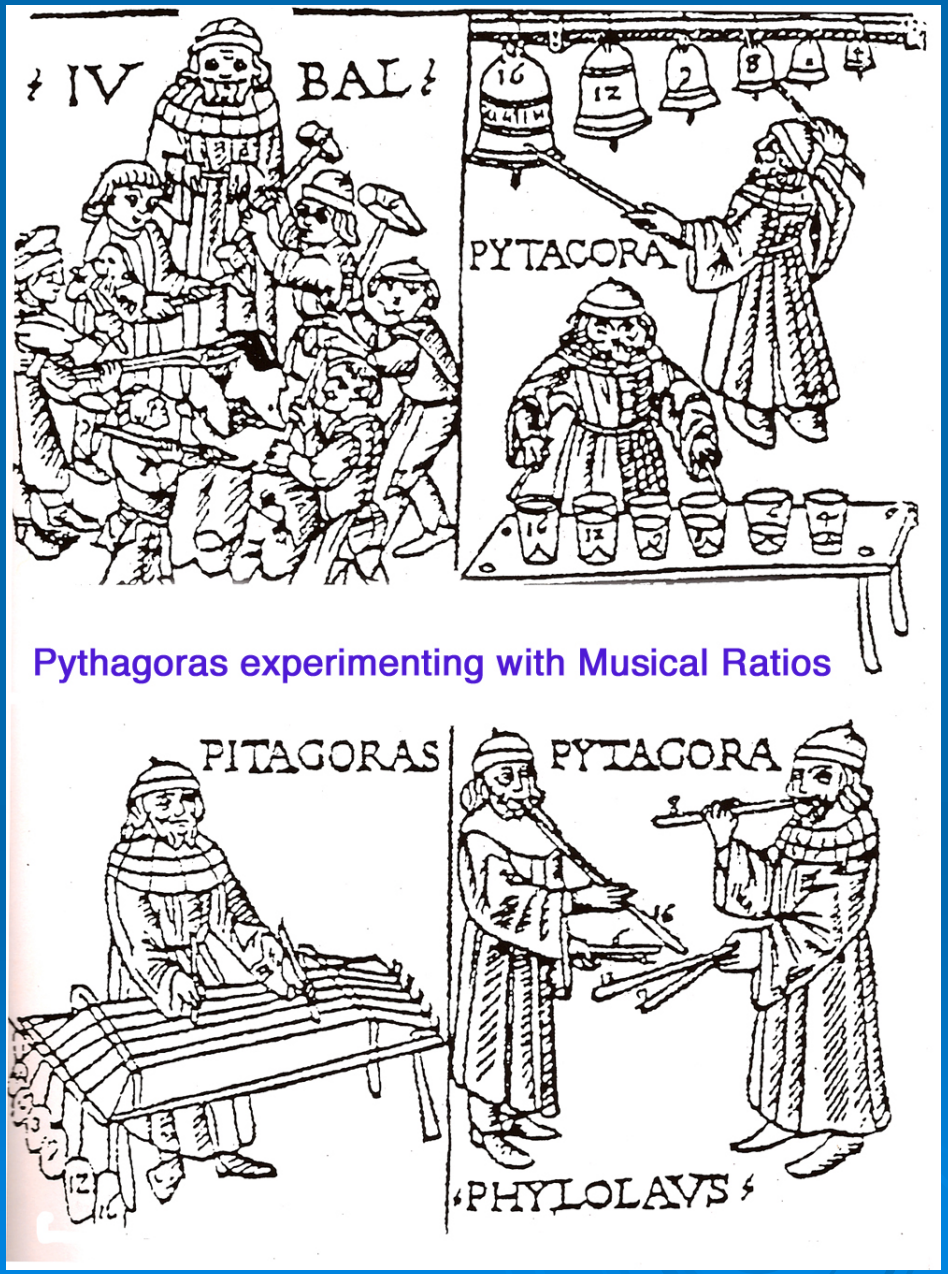
← The Ka-Nun (Greek *lyra*) was the tuning instrument positioned at the center of the band. Usually with 24-26 triplet strings. All instruments were tuned to the Ka-Nun (the *canon* or *ruler*): it has open strings for gliding tuning, while the melody string allows fret tuning.

SG201.1.4.2

Egyptian Music (2)







Pythagoras experimenting with Musical Ratios

SG201.1.5.1 Pythagoras (1)

The "Father" of Musical Harmony

Pythagoras is credited with establishing and teaching the relationship between number ratios and sound frequencies. Of course, he was just reformatting a more ancient knowledge collected during his travels to Egypt, Chaldea and possibly India. [◆SG102]

He is shown here experimenting with bells & water glasses (top right), stretched strings (bottom left) and various sized pipes (bottom right).
The same numbers reappear as simple ratios of pleasant sounds: 16 - 12 - 9 - 8 - 6 - 4.

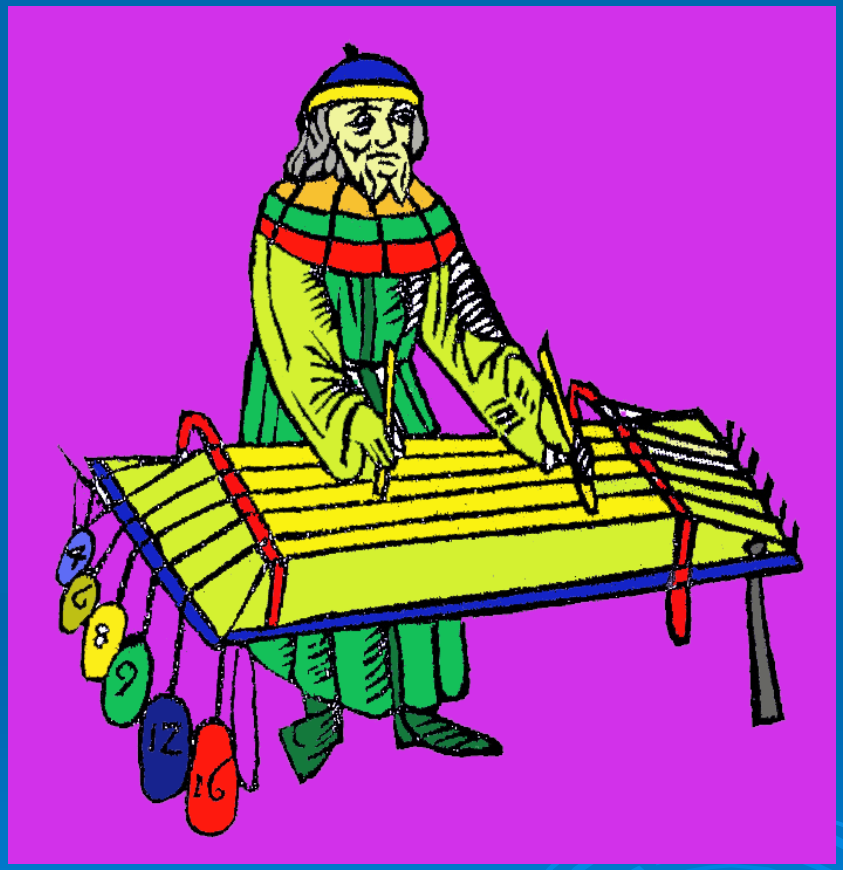
Jubal is a Biblical character said to be the '*ancestor of all who played the lyre and pipe*'. He is portrayed here overseeing an experiment with the sounds of hammers of various weights.

← Pythagoras. *Medieval woodcut.*
(Gafurio's *Theorica Musice*. 1492)

SG201.1.5.2 Pythagoras (2)

Pythagoras shown writing, in medieval fashion, with a desk on his knees.
As the reputed founder of music theory, Pythagoras is associated with the figure of Music (above him, on the archivolt). Music was one the Seven Liberal Arts forming the basis of medieval education.

Chartres Cathedral, France.
Archivolt forming the tympanum of the Virgin Portal, West façade.
c. 1145-1170.



Pythagoras experimenting with stretched chords to establish the proper relationships between number ratios and sound frequencies.

SG201.1.5.3 How Pythagoras Healed by Music & Words (1)

Quotes from Iamblichus *'Life of Pythagoras'* (1)

Iamblichus (c, 250 - c. 325 CE) was a Neo-platonic philosopher who attempted to write a 10 volumes *Encyclopedia of Pythagorean Thought*. The first volume of this unfinished corpus is an extensive '*Life of Pythagoras*'. Here are some quotes relevant to the use of music as a healing modality.

"Pythagoras conceived that the first attention that should be given to men should be addressed to the senses, as when one perceives beautiful figures and forms, or hears beautiful rhythms and melodies. Consequently he laid down that the first erudition was that which subsists through music's melodies and rhythms, and from these he obtained remedies of human manners and passions, and restored the pristine harmony of the faculties of the soul.

For his disciples, he arranged and adjusted what might be called 'preparations' and 'touchings', divinely contriving mingling of certain diatonic, chromatic and enharmonic melodies, through which he easily switched and circulated the passions of the soul in a contrary direction, whenever they had accumulated recently, irrationally, or clandestinely - such as sorrow, rage, pity, over-stimulation, fear, manifold desires, angers, appetites, pride, collapse or spasms. Each of these he corrected by the rule of virtue, attempering them through appropriate melodies, as though some salutary medicine.

In the evening, likewise, when his disciples were retiring to sleep, he would thus liberate them from the day's perturbations and tumults, purifying their intellective powers from the influxive and effluxive waves of corporeal nature, quieting their sleep, and rendering their dreams pleasing and prophetic. But when they arose in the morning, he would free them from the night's heaviness, coma and stupor through certain peculiar chords and modulations, produced by either simply striking the lyra, or adapting the voice."

SG201.1.5.4 How Pythagoras Healed by Music & Words (2)

Quotes from Iamblichus *'Life of Pythagoras'* (2)

From the same source (Iamblichus), here is another passage describing the haling powers Pythagoras extended through his words and presence.

"According to credible historians, his (Pythagoras) words possessed an admonitory quality that prevailed even with animals.

The Daurian bear, who had severely injured the inhabitants, was by Pythagoras detained. After long stroking it gently, feeding it on maize and acorns, and compelling him by an oath to leave alone living beings, he sent it away. It hid itself in the mountains and forest, and was never since known to injure any irrational animal.

At Tarentum, he saw an ox feeding in a pasture, where he ate green beans. He advised the herdsman to tell the ox to abstain from this food. The herdsman laughed at him, remarking that he didn't know the language of oxen; but that if Pythagoras did, he had better tell him so himself. Pythagoras approached the ox's ear and whispered into it for a long time, where after the ox not only refrained from them, but never even tasted them. This ox lived a long time at Tarentum, near the Temple of Hera, and was fed on human food by visitors till very old, being considered sacred.

Once happening to be talking to his intimates about birds, symbols and prodigies, and observing that all these are messengers of the Gods, sent by them to men truly dear to them, he brought down an eagle flying over Olympia, which he gently stroked, and dismissed."

(From *'The Life of Pythagoras'* by Iamblichus, quoted in *The Pythagorean Sourcebook*, K. S. Guthrie).

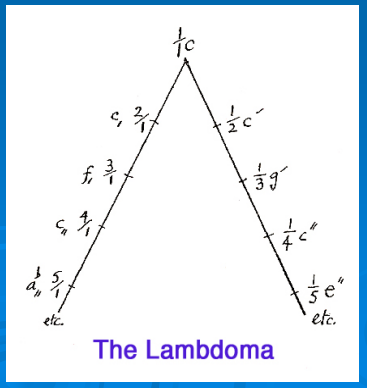
SG201.1.6.1 The Lambdoma & Pythagorean Table (1)

The German scholar Albert von Thimus (1806 - 1878) uncovered, in a treatise of Iamblichus, the hint that the Greeks has already discovered both the musical overtones & undertones and expressed them in a diagram symbolized by the Greek letter *Lambda*. This is called the *Lambdoma*.

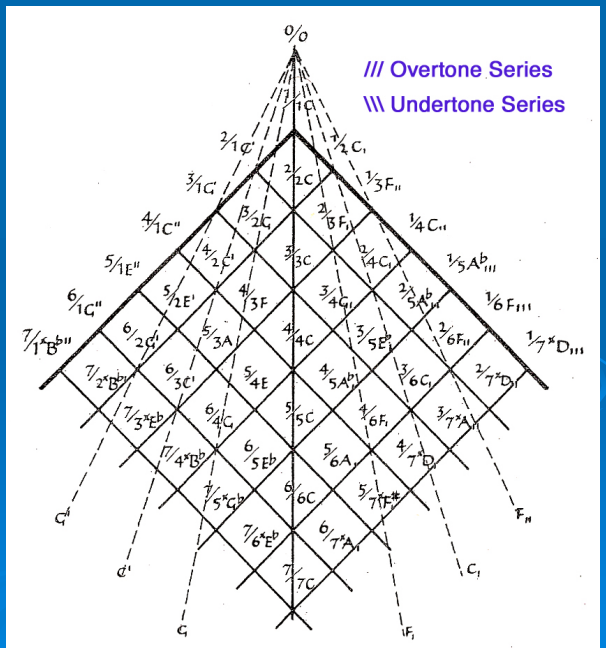
By filling in the intermediate tones and stretching the angle to 90°, the Lambdoma can be expanded into a matrix called the *Pythagorean Table.*

"All is Number"
Pythagoras

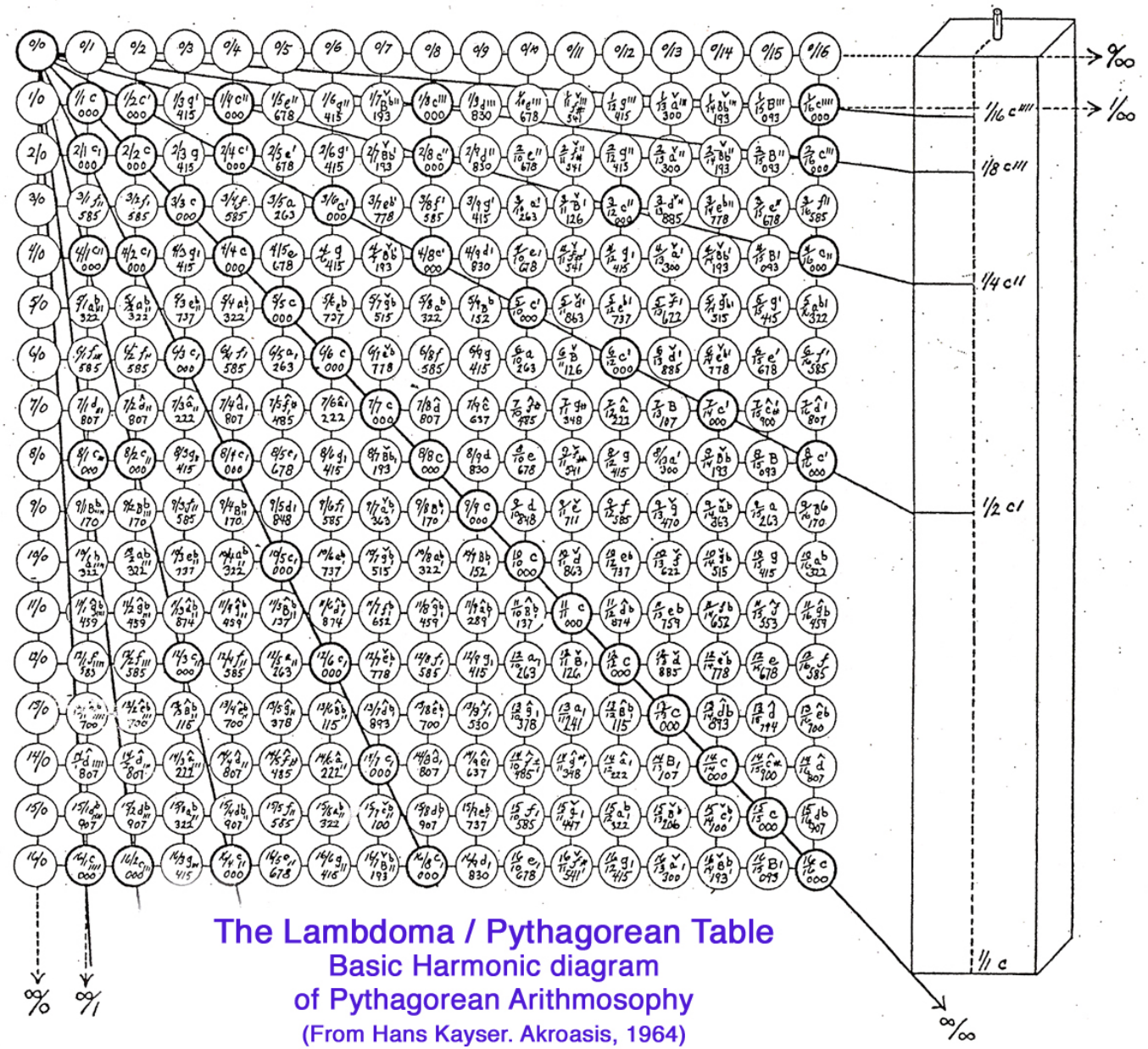
The *Lambda* Progression (from the 11th Greek letter *lambda*). This embodies the two geometric series: 1-2-4-8 (left, even, feminine) and 1-3-9-27 (right, odd, masculine). These are the two 'legs' of Lady Arithmetica,
Plato, in his *Timaeus*, uses the Lambda to describe the World Soul. [◆SG202.6]



The Lambdoma



The Pythagorean Table



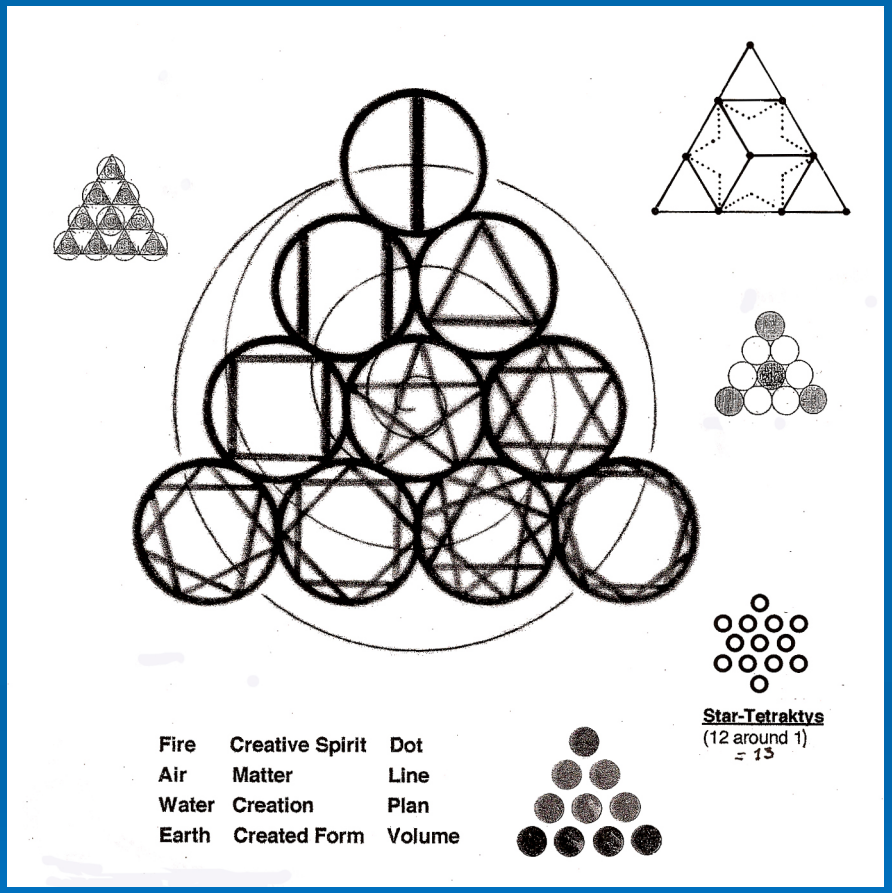
The Lambdoma / Pythagorean Table
Basic Harmonic diagram
of Pythagorean Arithmosophy
(From Hans Kayser. Akroasis, 1964)

SG201.1.6.2 The Lambdoma & Pythagorean Table (2)

[◆SG201.3]
(The new Lambdoma Keyboard)

Note: on the right of the diagram stands a monochord with 5 octaves (C to C'''') obtained by halving the string length.

SG201.1.7 The Holy Tetraktys



1 + 2 + 3 + 4 = 10 or Decad.

For the Pythagoreans, the Tetraktys symbolized the Perfection of Number: Unity starting at One, proceeding through 4 levels of manifestation, and reuniting with Unity (1 +0 = 1)

As Geometry, the Tetraktys represents the point (1), the line (2), the area (3) and the volume (4).

As Music, the Tetraktys contains the mathematical harmonic ratios of the musical scale: octave (1:2 or Diapason), perfect fifth (2:3 or Diapente), perfect fourth (3:4 or Diatessaron) and double octave (4:1).

As a Triangle Number, the Tetraktys shows the dynamic quality of triangular growth. It incorporates both the Odd (un-limitedness) and the Even (limitedness), whereas Square Numbers are exclusively composed of odd integers and Oblong Numbers of even integers. Since the universe is a sacred dance of Limited & Unlimited, the Tetraktys was called '*Kosmos*' (world order or adornment), '*Ouranos*' (Heaven), '*Pan*' (the All) and '*Pure Harmony*'.

As a Cosmogram, the Tetraktys came to be an inclusive paradigm and diagram of the universal 4-level pattern of cosmic manifestation: 4 elements, 4 dimensions…

SG201.1.8 The Comma of Pythagoras

In music, octaves (1:2) and fifths (2:3) do not match: they are mathematically incommensurable. These two ratios are antagonistic, like the square and the pentagon or the $\sqrt{2}$ geometries and the Phi geometries. It takes ascending through 12 fifths to reach about the same note as when ascending the octaves. And, even then, there is a slight discrepancy: 12 consecutive fifths reach slightly further than 7 octaves. The note heard at 7 octaves differ from the note heard at 12 fifths by a small amount called the '*Comma of Pythagoras*'.

Comma of Pythagoras = 1.0136

Mathematically speaking, the ratio 2:1 (Octave) doubled 7 times = 128 or 2^7. In other words, a note 7 octaves higher than the original note has a frequency 128 times greater. On the other hand, the Fifth has the ratio 3:2 = 1.5 and, when expanded 12 times, we have 1.5^{12} = 129.75. So there is a difference of 129.75 / 128 = 1.0136. This is the Comma of Pythagoras. It is also worth 24 cents [8424 (12 fifths) - 8400 (7 octaves)]

Robert Temple, in his book *The Crystal Sun*, a masterful exposure of optical technologies in the ancient world, makes very interesting comments about the Comma and explains that it was known, with great exactitude, to the Pythagorean School.

> ***"A value of the Comma computable to an astonishing 9 decimal places appears in the form of an arithmetical fraction preserved in the ancient Greek Pythagorean treatise Katatome Kanonos (Division of the Canon). There we are told that the number 531,441 is greater than twice 262,144. Twice 262,144 = 524,288… If we carry out the division, we obtain the number 1,013643265, namely, the Comma of Pythagoras expressed to 9 decimal places."***
>
> **(New edition of the *Sirius Mystery* by Robert Temple)**

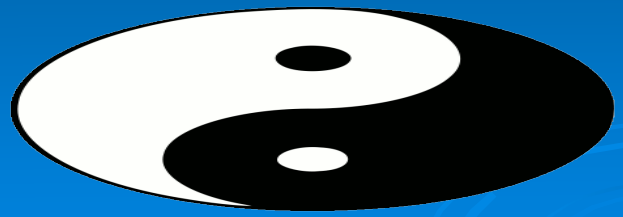
Note: the identical number to 9 decimal places is given in '*Math and Music*', published in 1995!!!!!

SG201.1.9. Cosmic Harmonia

The Pythagoreans were questing for the Larger Whole that could reconcile the antagonistic parts (the octave & the fifth) and account for the Comma of Pythagoras within the intuited larger multi-dimensional context of 'Cosmic Harmonics'. It was a quest similar to the scientific search for the Grand Unified Theory.
The Pythagoreans called this primordial principle Harmonia, after Harmonia, the daughter born of the Goddess of Love Aphrodite (Venus) and the God of War Ares (Mars).

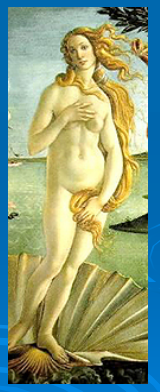
A solution was found by the Chinese, in the 16th century: they invented the system of '*equal temperament*'. Adopted by Bach, this compromise is now universally accepted. Equal temperament solves the problem of the incompatibility between octave and fifth by cheating in a 'distributed' way and shaving a portion of each note to create 'semitones'. Therefore, on a modern piano, notes sound slightly 'flat' and contemporary music is now globally 'flat'. Of course this compounded by the fact that electronically synthesized sounds lack the extra depth of harmonic overtones. On the other hand, equal temperament has the advantage that music can be transposed from key to key without having to retune the instruments.

The perennial search is on again, at the cutting edge of human consciousness, for the principles & laws of Universal Harmonics, for the magical fruit of happy love between Venus & Mars, for the Tao uniting Yin & Yang.



Ares/Mars
God of War,
Father of Harmonia

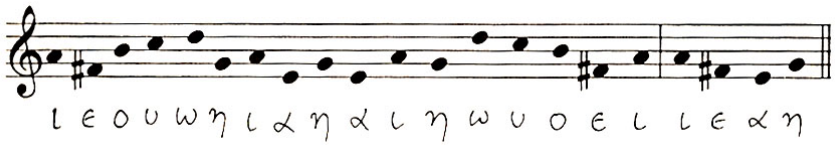
Harmonia



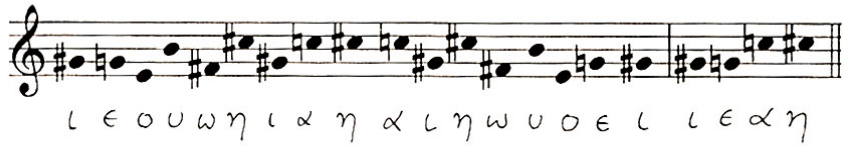
Aphrodite/Venus
Mother of Harmonia

SG201.1.10.1. The Seven Vowels (1)

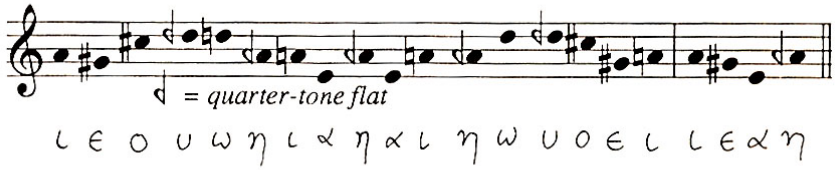
In all gnostic traditions, the vowel sounds are tonal bridges to Spirit. They depend on the phenomenon of harmonics - which is the foundation of music.
When hearing, speaking, chanting or modulating vowels, we are entering the realms of harmony, number ratios and frequency resonance at the source of the manifested universe.
All sacred traditions invariably link the chanting of their set of vowels (and their harmonic modulations on wordless sounds) to the planets, the chakras, higher-dimensional communication and healing. There are entire schools devoted to the ascension through the *sound current ("shadba")* and the sonic transition of the soul out of the human shell.



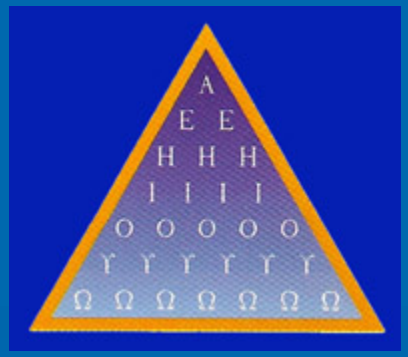
Example 5.i: Moon low, Phrygian mode, diatonic genus



Example 5.ii: Phoenician system, Dorian mode, chromatic genus

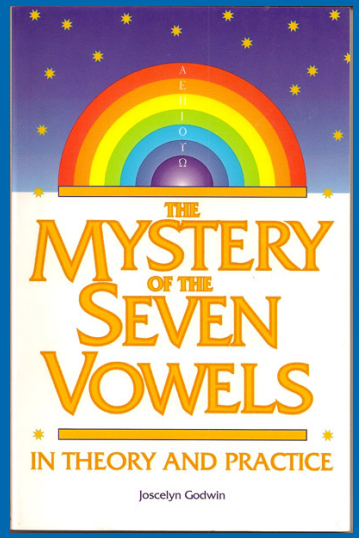


Example 5.iii: Moon high, Lydian mode, enharmonic genus



↑ The 7 vowels in the Greek language. They are arranged in the shape of the Triangular Number "7" (total = 28).

← Examples of vowel-songs in the Greek musical system which offered a total of 63 ways of transcribing any vowel-song into music.

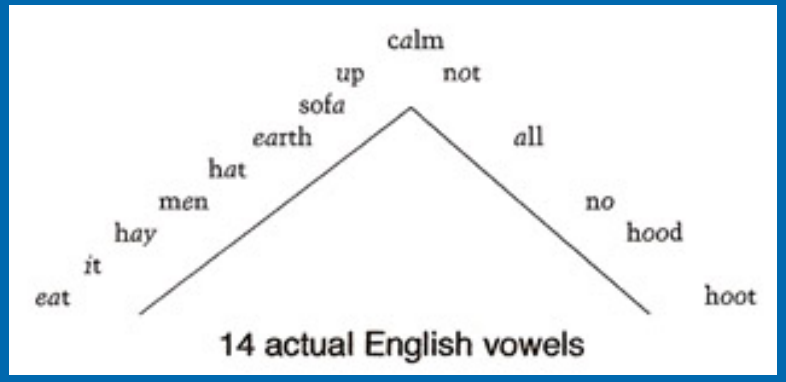


(All images from Joscelyn Godwin. *Mystery of the 7 Vowels*)

SG201.1.10.2 The Seven Vowels (2)

The vowel sounds, the softer, feminine-like aspect of speaking, are theoretically limitless as they merge imperceptibly into each other - just as musical pitches do.

But the convention of language selects a few prominent vowel sounds for each specific culture.

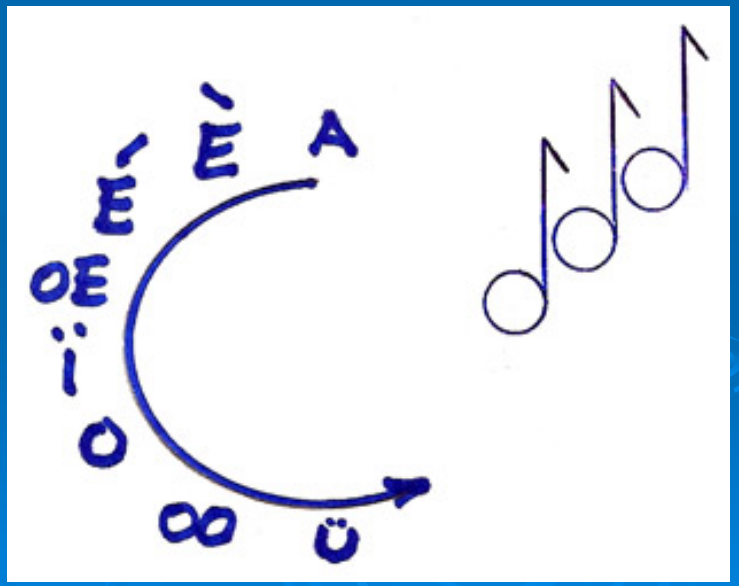


14 actual English vowels

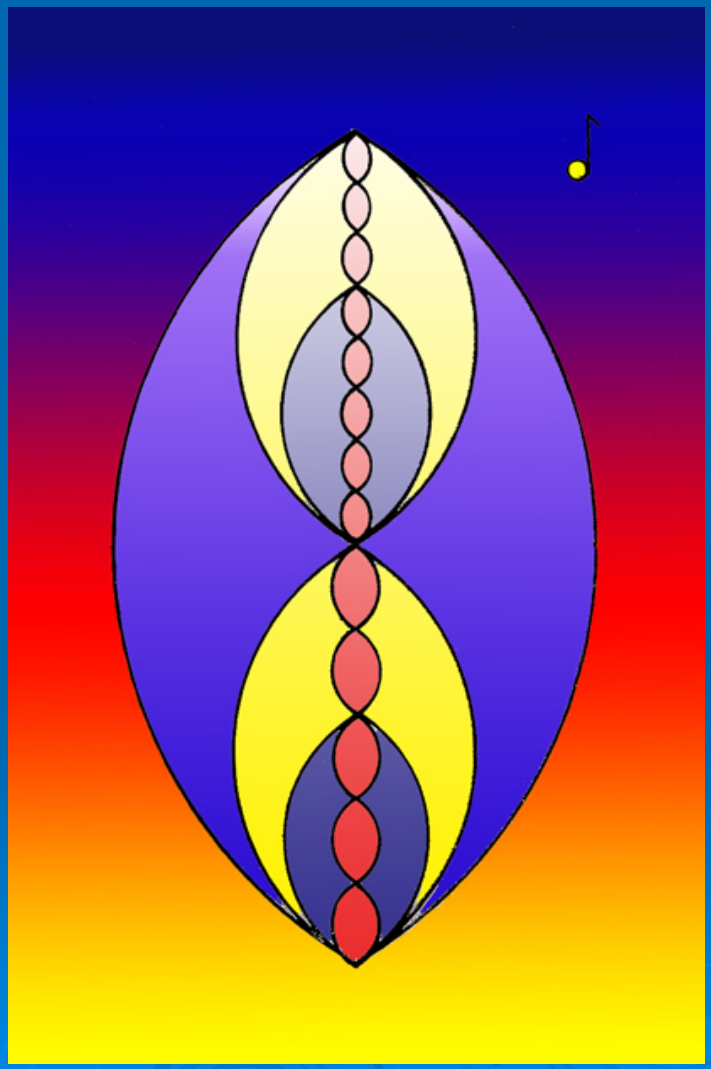
Chanting Practice

Let's practice chanting vowels sounds. We will follow the natural dynamics of the mouth, from wide open on the first vowel sound "A" to almost closed (with lips pointing out) on the sound "Ü". Keep each sound resonating at least 5-10 seconds.

A -
È -
É -
OE -
I -
O -
OO -
Ü -



SG201.2 - Chapter 2. The Monochord & Overtones



SG201.2.1 Sacred Geometry and Music

As we have briefly seen, the intimate relationship between mathematics, music and the cosmos has been the foundation of ancient sacred civilizations. In the western cultures, this understanding was passed on and expanded by the Pythagorean School. "*Nada Brahma*" keeps shouting the Vedic-Hindu wisdom ("*The universe is Sound*").

Indeed, for the ancients, the world was an ongoing choir and nature, on all scales, the crystallization of this chant. The structure of music, based on simple geometric ratios and the natural resonance of overtones, explains the structure of the universe.

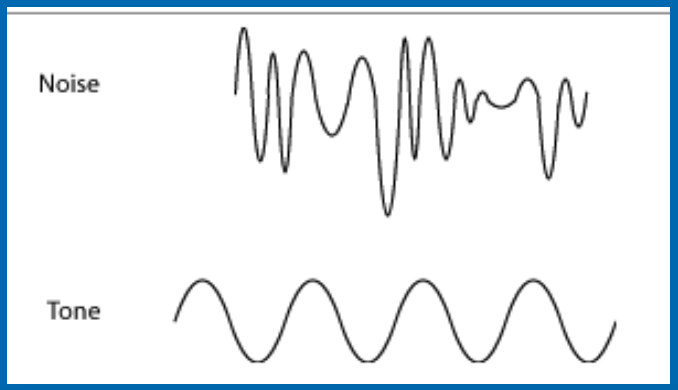
In this chapter, we will briefly explore the physics of sound waves and their resulting harmonics or overtones. We will use the traditional teaching instrument called the *monochord* to understand the basic musical ratios in terms of geometry.

"There is Geometry
in the humming of the strings.
There is Music
in the spacing of the spheres"
(Pythagoras)

SG201.2.2 Standing Waves

Musical tones are produced by standing waves contained by musical instruments. Most sound waves in daily life are not standing waves: they spread out, interfere with many other waves and lose strength very fast.

Standing waves are only created when the sound waves are contained and can bounce back & forth between two surfaces so that the waves can reinforce each other in an orderly fashion. This container is called a "musical instrument".



← *Noise* is a jumble of sound waves.

← A *tone* is a very regular set of waves, all the same size (amplitude) and the same distance apart (wavelength).

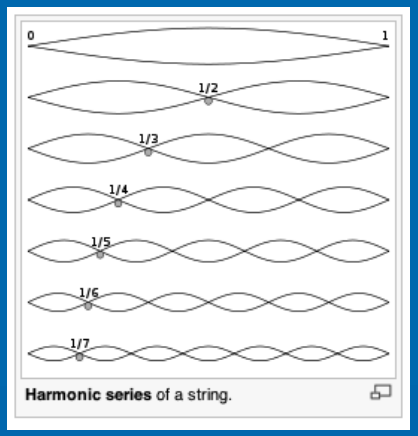
In order to get the necessary constant reinforcement, the musical container has to be the perfect size (length) for a certain wavelength, so that waves bouncing back or being produced at each end reinforce each other, instead of interfering with each other and canceling each other out.
There is a whole set of standing waves, called *harmonics*, that will fit into any music "container" of a specific length. This set of waves is called a *harmonic series*.

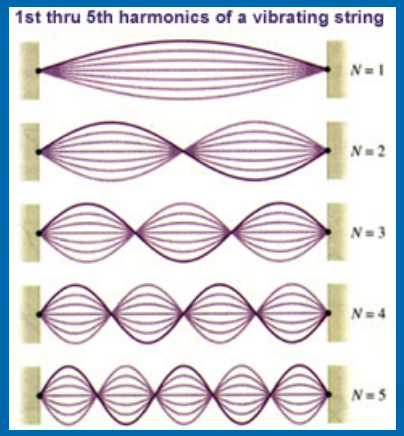
The longest wave is called the *fundamental*. It is also called the *first harmonic*.
The next longest wave that fits is the *second harmonic*, or the *first overtone*.
The next longest wave is the *third harmonic*, or *second overtone*, and so on.

SG201.2.3.1 Harmonic Series (1)

Pitched musical instruments are often based on an approximate harmonic oscillator such as a string or a column of air, which oscillates at numerous frequencies simultaneously. At these resonant frequencies, waves travel in both directions along the string or air column, reinforcing and canceling each other to form standing waves. Interaction with the surrounding air causes audible sound waves, which travel away from the instrument.

Because of the typical spacing of the resonances, these frequencies are mostly limited to integer multiples, or *harmonics*, of the lowest frequency, and such multiples form the *harmonic series*.

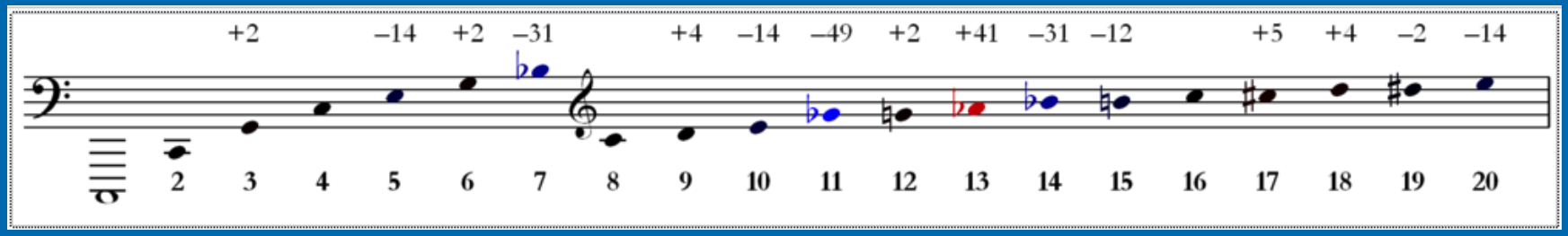




The simplest case to visualize is one vibrating string, as in a *monochord*. The string has fixed points ("*nodes*") at each end, and each harmonic mode divides it into 2, 3, 4, etc… equal-sized sections resonating at increasingly higher frequencies. Similar arguments apply to vibrating air columns in wind instruments, although these are complicated by having the possibility of *anti-nodes* (that is, the air column is closed at one end and open at the other) or conical as opposed to cylindrical bores.

In most pitched musical instruments, the fundamental (first harmonic) is accompanied by other, higher-frequency harmonics. The fact that a string is fixed at each end means that the longest allowed wavelength on the string (giving the fundamental frequency) is twice the length of the string (one round trip, with a half cycle fitting between the nodes at the two ends). Other allowed wavelengths are 1/2, 1/3, 1/4, 1/5, 1/6, etc… times that of the fundamental.

SG201.2.3.2 Harmonic Series (2)



An illustration of the harmonic series as musical notation. The numbers above the harmonic indicate the number of cents it deviates from *equal temperament*. Red notes are sharp. Blue notes are flat. (*Wikipedia*)
Note that the deviation between natural harmonic tone & tempered tone is more pronounced on # 7, 11 and 13.

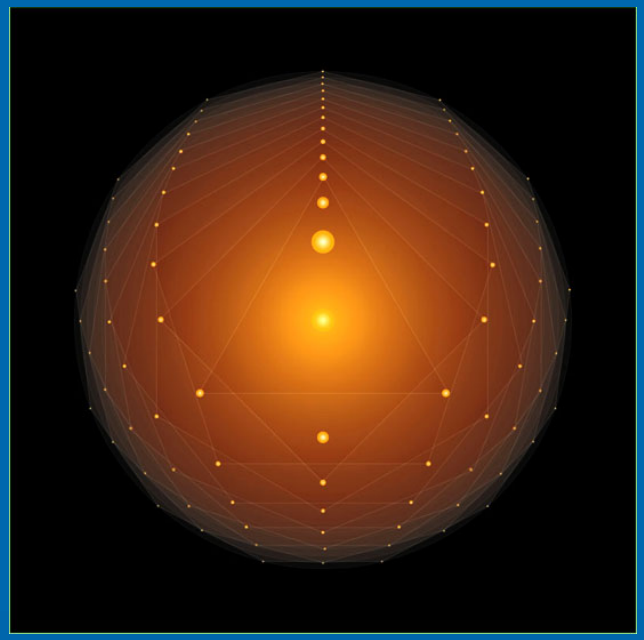
The harmonic series is an arithmetic series (1×f, 2×f, 3×f, 4×f, 5×f, ...). In terms of frequency (measured in cycles per second, or hertz [Hz] where f is the fundamental frequency), the difference between consecutive harmonics is therefore constant and equal to the fundamental. But because our ears respond to sound nonlinearly, we perceive higher harmonics as "closer together" than lower ones.

On the other hand, the octave series is a geometric progression (2×f, 4×f, 8×f, 16×f, ...), and we hear these distances as "the same" in the sense of musical interval. In terms of what we hear, each octave in the harmonic series is divided into increasingly "smaller" and more numerous intervals. (*Wikipedia*)

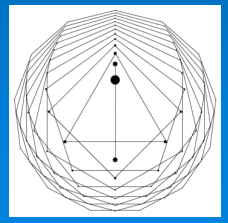
The *second harmonic* (or *first overtone*), twice the frequency of the fundamental, sounds an octave higher.
The *third harmonic*, three times the frequency of the fundamental, sounds a perfect fifth above the second.
The *fourth harmonic* vibrates at four times the frequency of the fundamental and sounds a perfect fourth above the third (two octaves above the fundamental).

Harmonic Law #1: Doubling the harmonic number means doubling the frequency (which sounds an octave higher).

SG201.2.3.2 Harmonic Series (3)



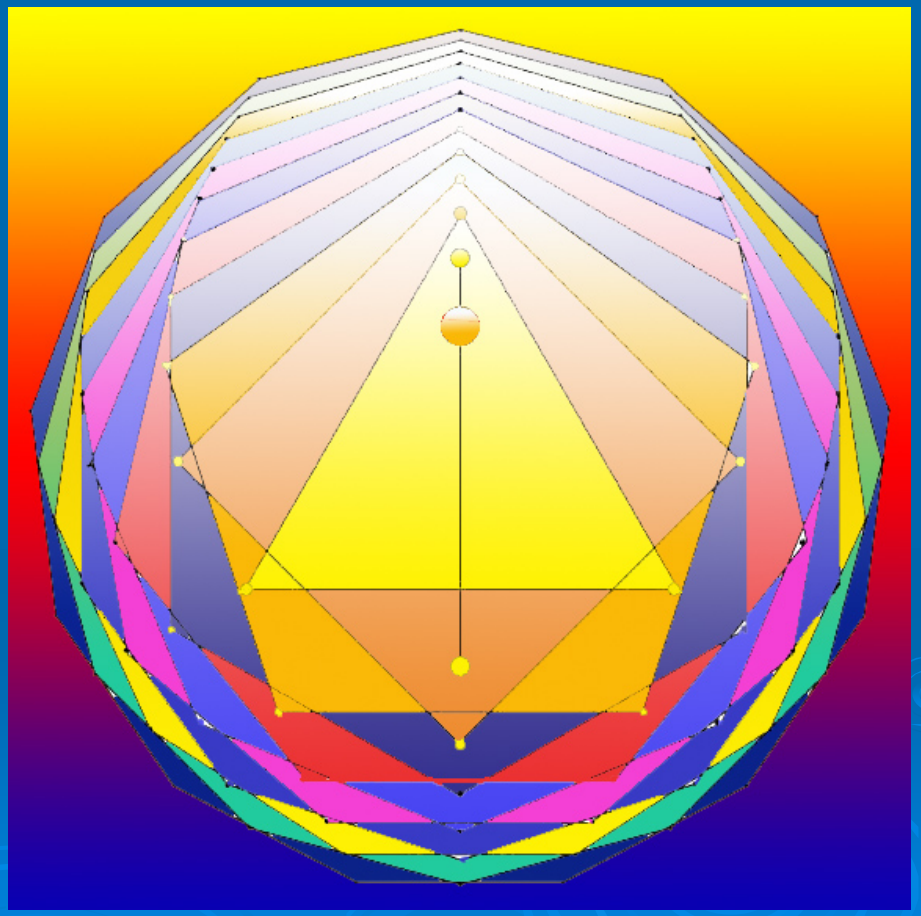
Logo of the
***Seattle Harmonic Voices* choir,**
a vocal ensemble dedicated to expanding the possibilities of the human voice, specially through overtone chanting. The geometry of the logo is based on the natural Harmonic Series.



grauwald.com

The Harmonic Series can be visualized as the progression of polygonal expansion inscribed in a circle.

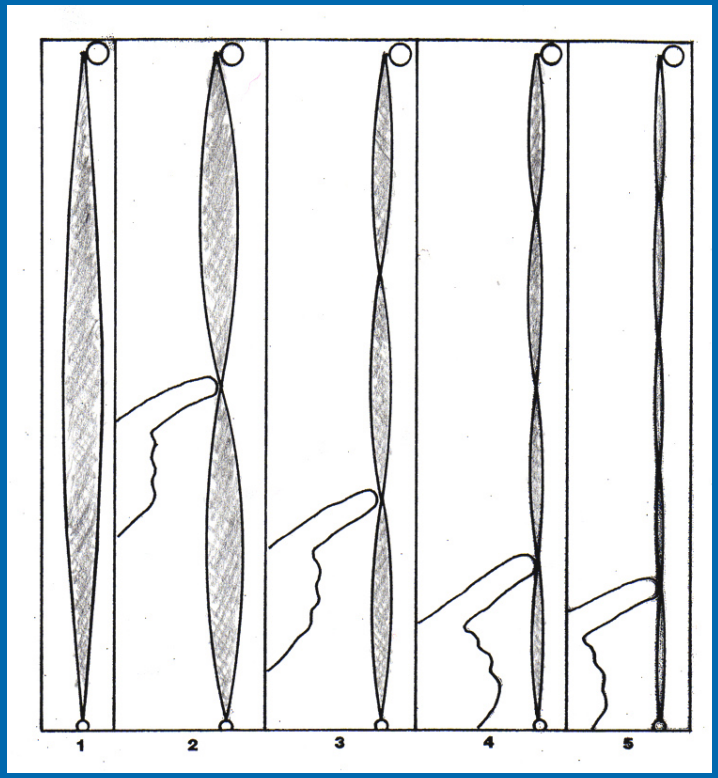
(See The Vesica as Polygon Generatrix [◆SG108.1])



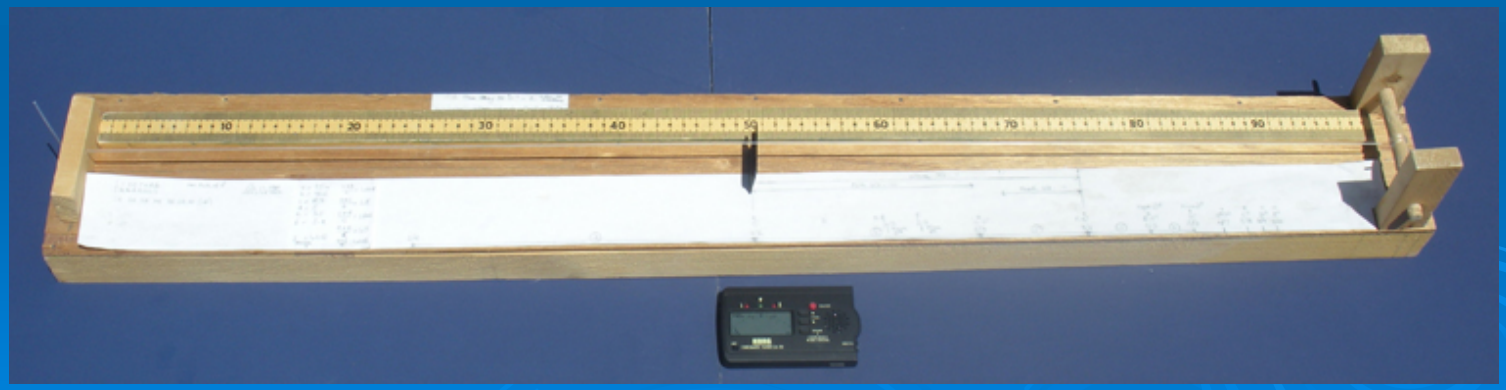
SG201.2.4.1 The Monochord (1)

The monochord is a "*one-string harp*", a musical instrument very easy to build. Made out of a sound box and a string attached to both ends, the monochord is used to investigate the properties of tuning and, by using a moveable bridge, to illustrate the fact that numerical ratios underlie musical harmony. Trough the mediation of simple integers (1, 2, 3 & 4) and their ratios, the *Overtone Series* is the architectural foundation of music:

Octave (unison or diapason) = 1:2
Fifth (diapente) = 2:3
Fourth (diatessaron) = 3:4

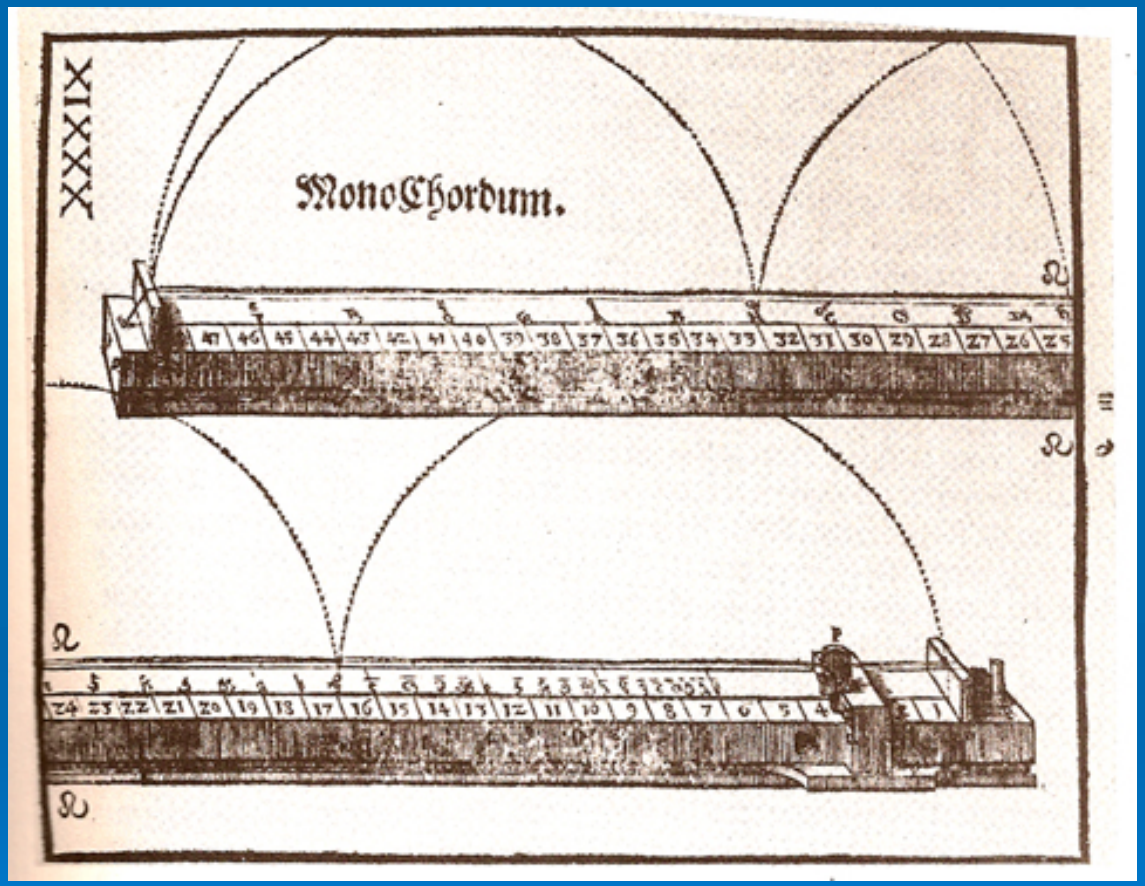


1. A vibrating string (base tone).
2. Node = 1/2 = Next octave. (Diapason).
3. Nodes = 1/3 = Fifth (Diapente)
4. Nodes = 1/4 = Fourth (One octave higher) (Diatessaron)
5. Nodes = 1/5 = Major third.



A monochord of base length 100 cm. The moveable bridge is set at 50 cm (= 1/2) for the higher octave. The electronic tuner verifies that the frequency is doubled as the distance is halved.

SG201.2.4.2 The Monochord (2)



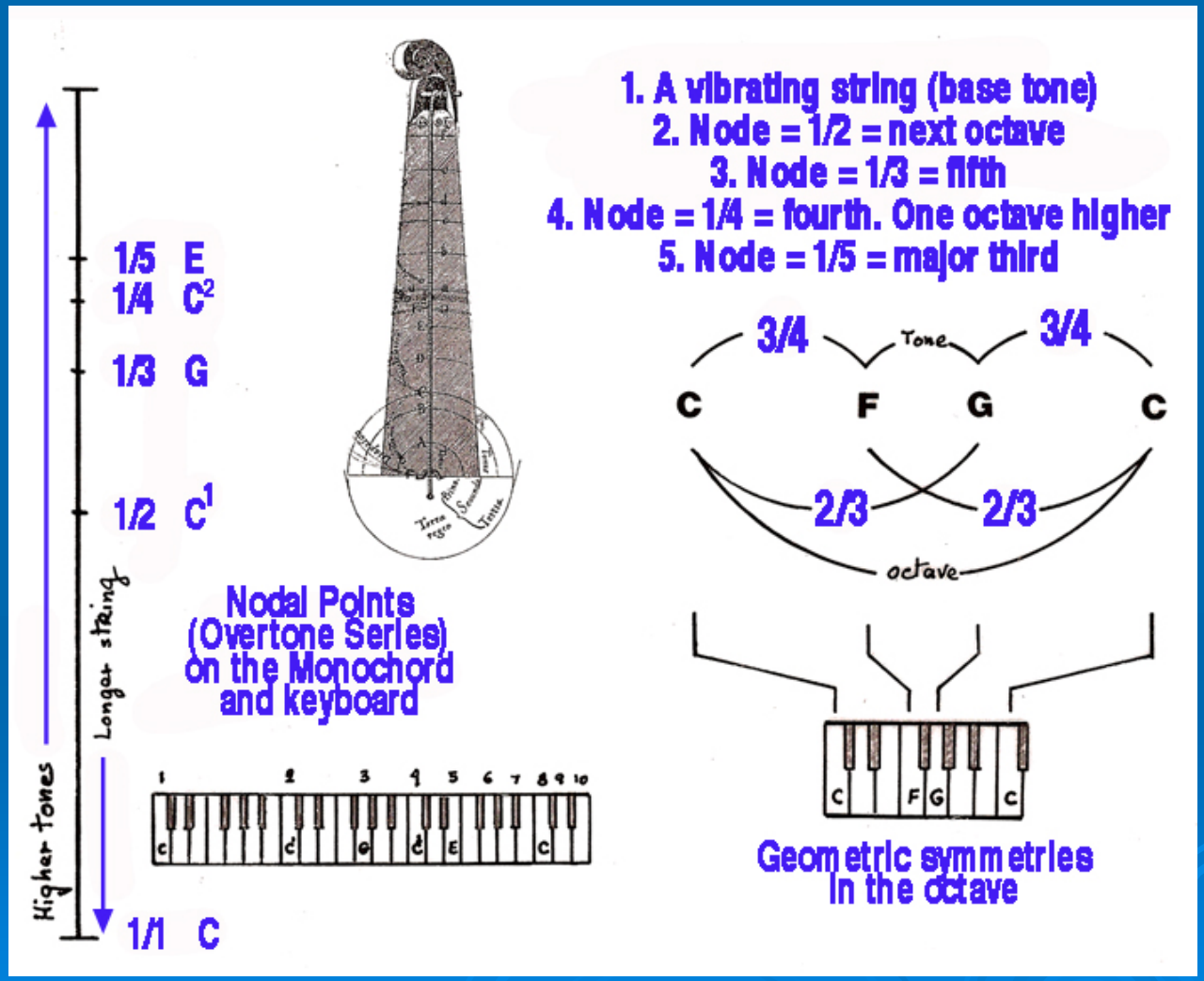
↑ Monochord. Engraving from *De Organographia* by Michael Praetorius. 1619.

One can see on this drawing the single string stretched between the fixed bridges #1 and #48. "P" is the moveable bridge.

On this harmonic table, above the divisions 1 - 48, are written the music notes in ancient German alphabetic notation.

Above it, astrological signs point to the main chords. The sign for Leo marks the octave proportion (1:2).

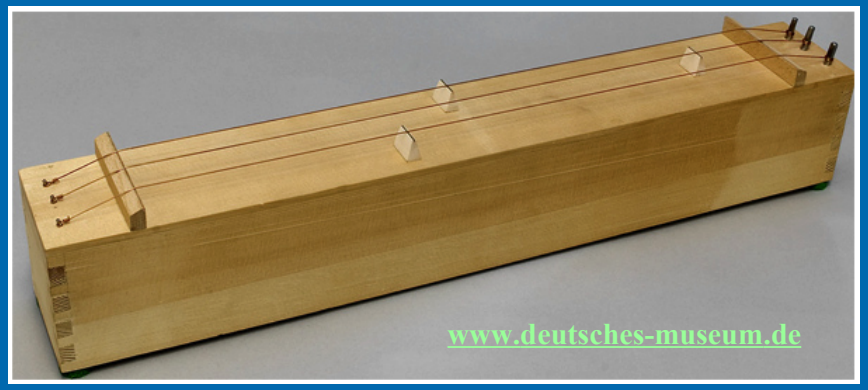
SG201.2.4.3 The Monochord (3)

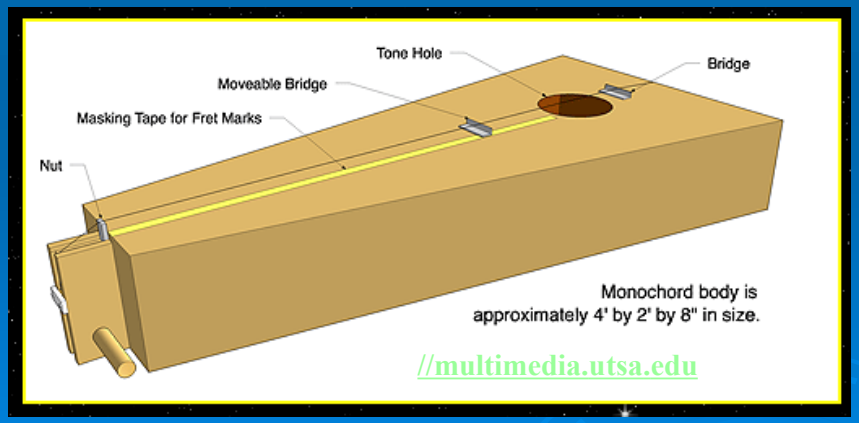


When a string is plucked, it naturally first vibrates as a unit, then in 2 points, then 3 points, then 4 etc… This is how the harmonic (overtone) series is produced.

Overtones are not as loud as the fundamental tone of the string but a musical ear can perceive them.

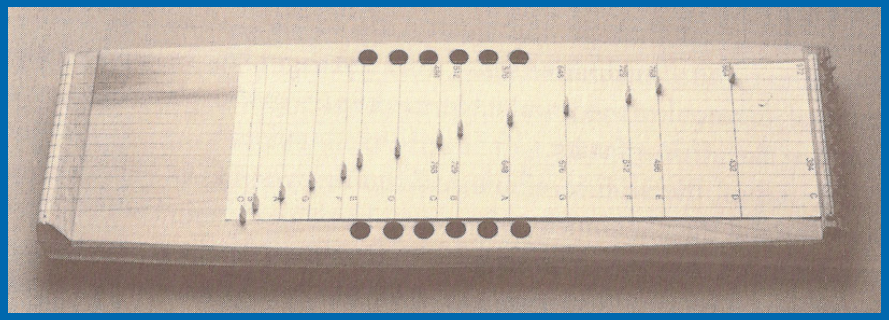
SG201.2.4.4 A Gallery of Monochords (4)





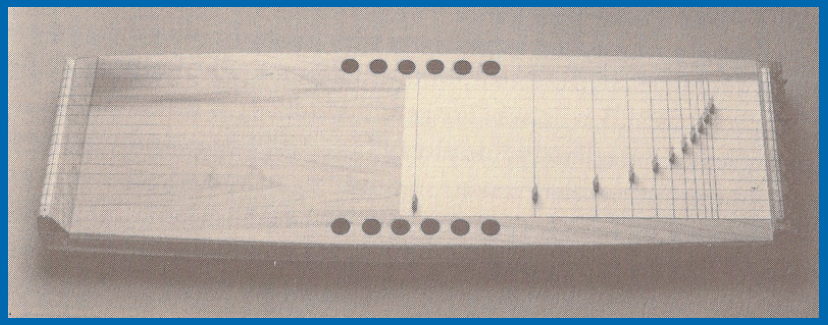
SG201.2.5 The Polychord

A *Polychord* is a multiple monochord: all the strings are identical, tuned to the same note (tension + pitch). Just like in a monochord, movable bridges bring out the harmonic and overtones ratios, arranged according to numerical proportions. But the polychord can, simultaneously, display & sound the harmonic intervals. The polychord shows graphically how musical intervals and tuning systems represent mathematical/ geometrical patterns of harmonic relationships.



↑ This *15-strings polychord* is described by Ptolemy (100-179 AE) in his treatise *On Harmonics*. It allows for the set up of a double-octave system or two different tuning systems side by side, for comparison.

The polychord above shows the traditional Pythagorean *diatonic* scale, first described in Plato's *Timaeus*, spanning two octaves. This was the Greek Greater Perfect System.



↑ The naturally occurring series of overtones is plotted on this *15-strings polychord*: whole string, 1/2 string (octave), 1/3 string (fifth), 1/4 string (fourth) etc…

Each overtone can thus be emphasized and the whole series can be played in a way that is more mathematically/harmonically true than on a piano (limited by the equal temperament convention).

Above two pictures from:
David Fideler. *Jesus Christ, Sun of God*. 1993.

SG201.2.6.1 Harmonics of Music (1)

Harmony: (Greek *harmos* = "a junction" and *arariskein* = to fit together. Indo-European base *AR = to join, fit)

Harmonia: according to Hesiod (Greek poet, 8th c. BE). Harmonia was the daughter of the God of War Ares (Mars) and the Goddess of Beauty Aphrodite (Venus).

Music and musical harmonies were the cornerstones of ancient philosophy, cosmology and temple traditions. Pythagoras, the western father of the theory of harmonic musical ratios, found that two strings sound more pleasant when plucked in proportions expressed in the smallest whole numbers: 1, 2, 3 and 4.

The 1 : 1 ratio is the UNISON. The UNISON is the identity of the musical pitch, as of two of more voices or tones, or the interval of a perfect prime. Figuratively, unison means complete agreement, concord and harmony ("*in unison*").

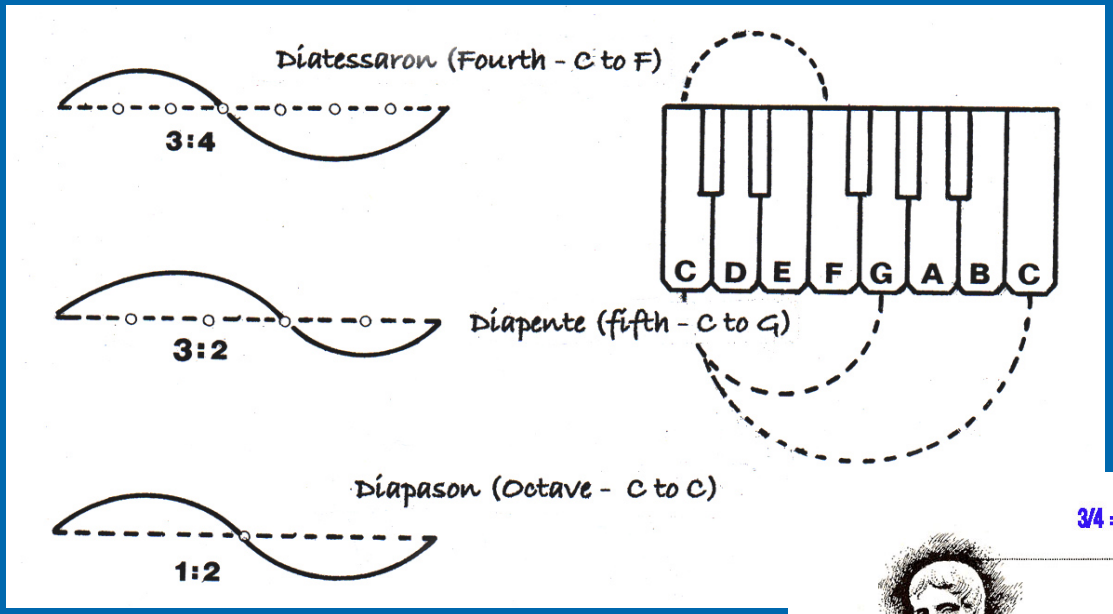
The 1 : 2 ratio is the DIAPASON. Nowadays called the OCTAVE (reaching through the 8 intervals of the scale), the diapason (from Greek *dia* = "through" + *pason*, pl. of *pas* = "all, the whole") creates the same sound as the full string but at a higher pitch. It is a concord throughout all the notes. Also defined as "*a swelling burst of harmony; complete harmony*" (Webster, 1970).
The diapason has the 1 : 2 = 0.5 ratio of the double square rectangle. This rectangle, basic to sacred temple layout, has a diagonal of $\sqrt{5}$.

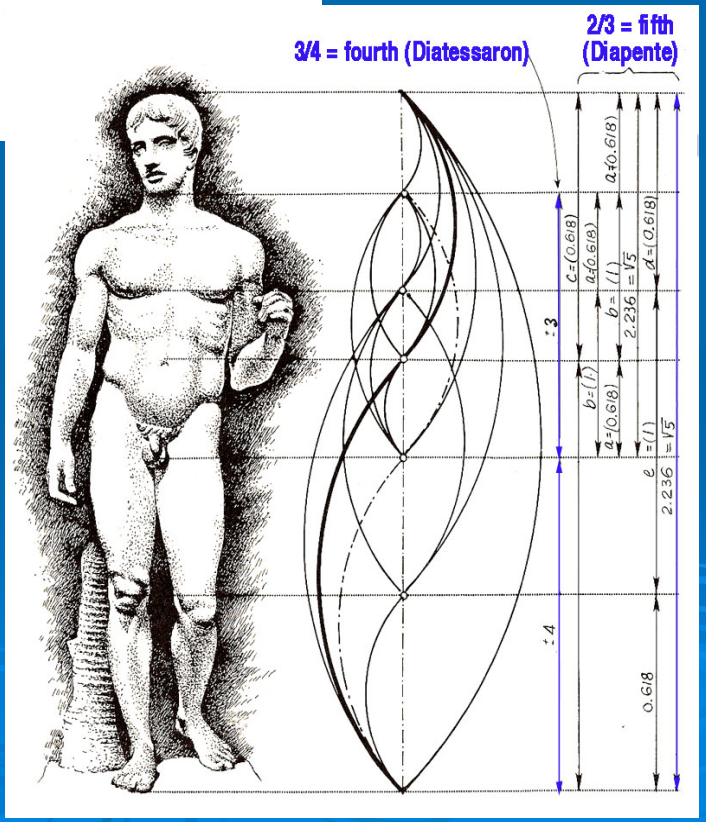
The 2 : 3 ratio is the DIAPENTE. The *diapente* (from Greek *dia* = through + *penta* = five) is today called the FIFTH and reaches through 5 intervals. It is the fifth tone of the ascending diatonic scale. For instance, C and G on a piano keyboard. Also called the "*dominant*". The diapente is considered the most pleasant musical harmony, specially when scaled up and down in the "*Circle of Fifths*". The 2:3 ratio is an approximation of the Golden Ratio.

The 3 : 4 ratio is the DIATESSARON. The *diatessaron* (from Greek *dia* = through + *tessares* = four) is the consonance we call the FOURTH. The fourth tone of an ascending diatonic scale. For instance C and F on a piano keyboard. Also called the "*sub-dominant*". The diatessaron is a musical rendition of the 3-4-5 Triangle.

SG201.2.6.2
Harmonics of Music (2)

(🡐 🡓 After G. Doczi.
The Power of Limits.)



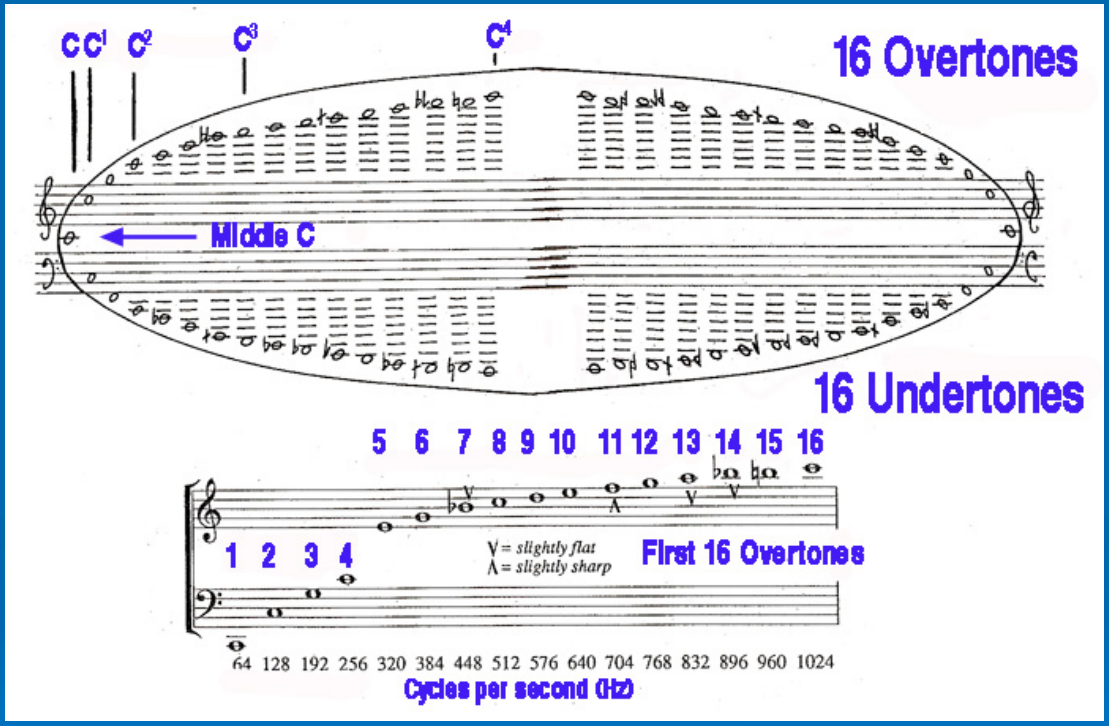


Harmonic diagram applied to the *Doryphoros* 🡒 by Polycleitos. It shows the root harmonies of music (octave, fifth and fourth) as the template of resonance for organic growth.

The same applies to all of nature.

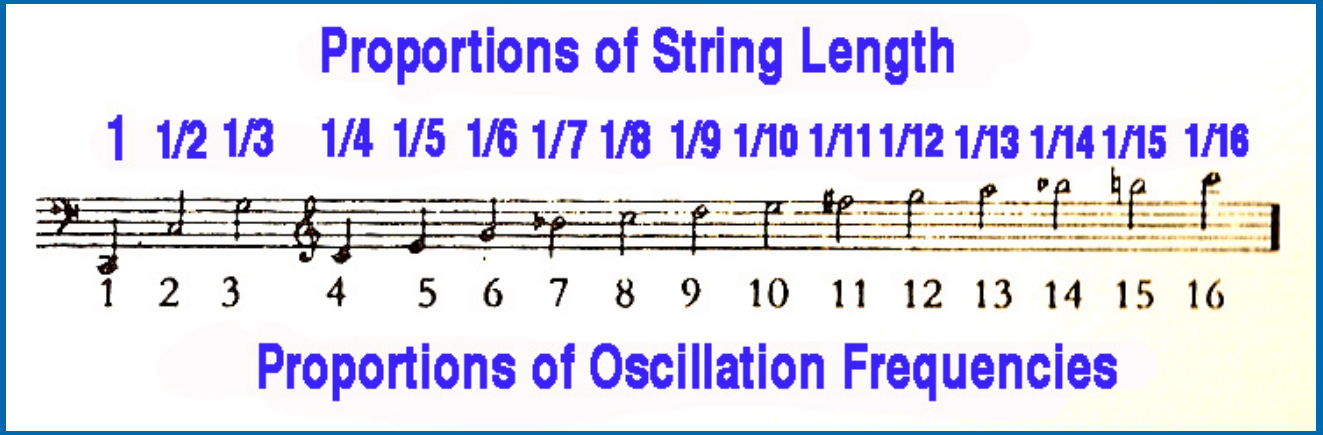
SG201.2.7.1 The Scale of Overtones (1)

The Harmonic Series is a natural phenomenon corresponding to the vibrational frequencies into which a musically resonant body tends to fall. As such, it is an expression of the inner structure of the universe and its symmetries of beauty…
The intervals thus created, as demonstrated on the monochord, are the basic ratios of the first integers…



Remember: **The longest wave is called the *fundamental*. It is also called the *first harmonic*.**
The next longest wave that fits is the *second harmonic*, or the *first overtone*.
The next longest wave is the *third harmonic*, or *second overtone*, and so on.

SG201.2.7.2 The Scale of Overtones (2)



The Overtone Scale, the natural tone scale of ALL MUSIC, displays whole number ratios. The vibration of any tone will be higher than that of the preceding tone by exactly one whole number: the 5th tone "E" vibrates with a frequency 5 times as high as the first tone "A" (G clef).

The monochord shows that in order to produce the 5th tone, only 1/5th of the entire string length is needed. If we divide the string into 12 equal parts and shorten the string in the points 6, 8 and 9, we obtain the proportions:

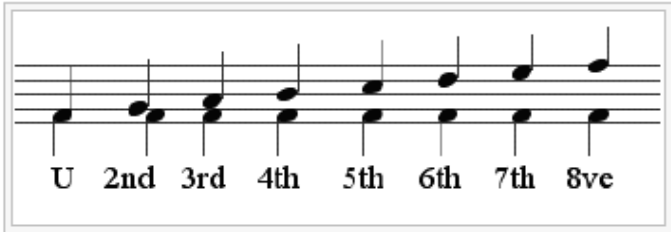
12:6 = 2:1 = one half = Octave
12:8 = 3:2 = two-thirds = Fifth
12:9 = 4:3 = three-fourths = Fourth

Octave	1 : 2
Fifth	2 : 3
Fourth	3 : 4
Major Sixth	3 : 5
Major Third	4 : 5
Minor Third	5 : 6
Minor Sixth	5: 8
Neutral Sixth	8 : 13
Major Seventh	8 : 15
Minor Second	15 : 16
Tritone	32 : 45

SG201.2.7.3 The Scale of Overtones (3)

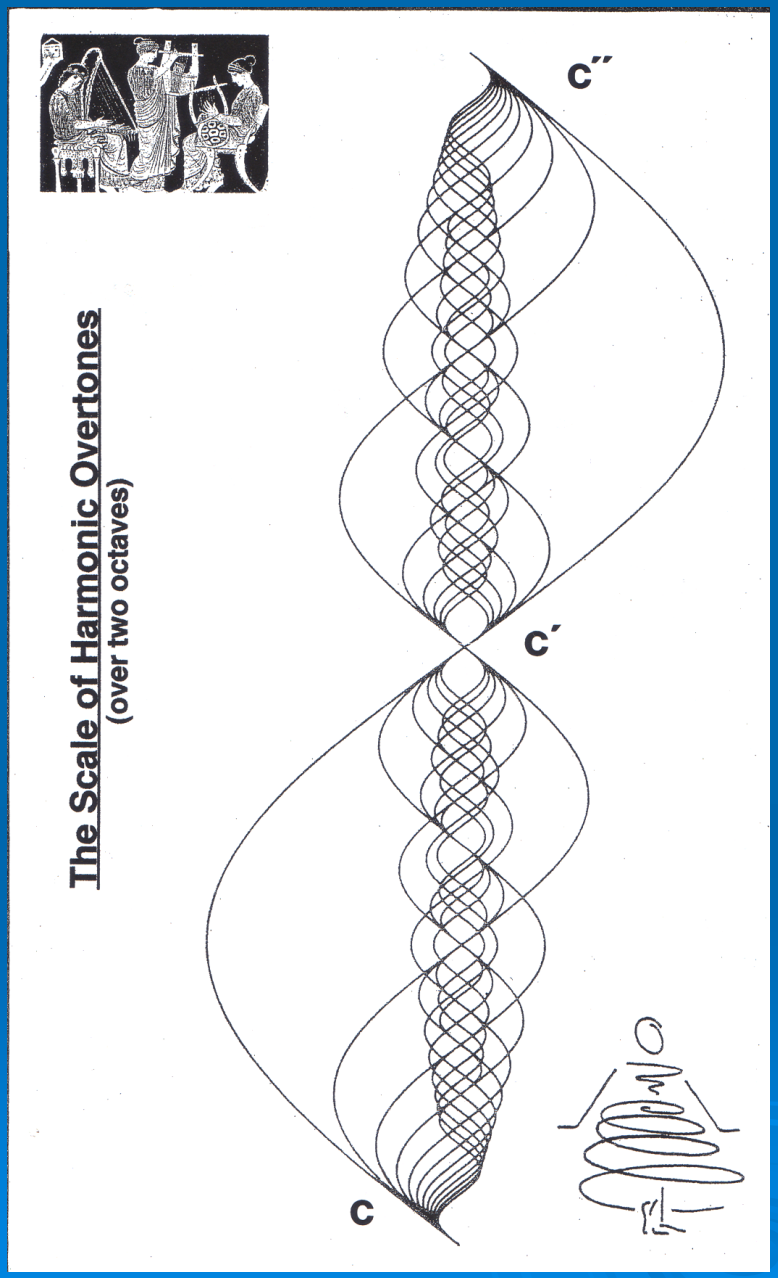
Proportions of Main Musical Chords

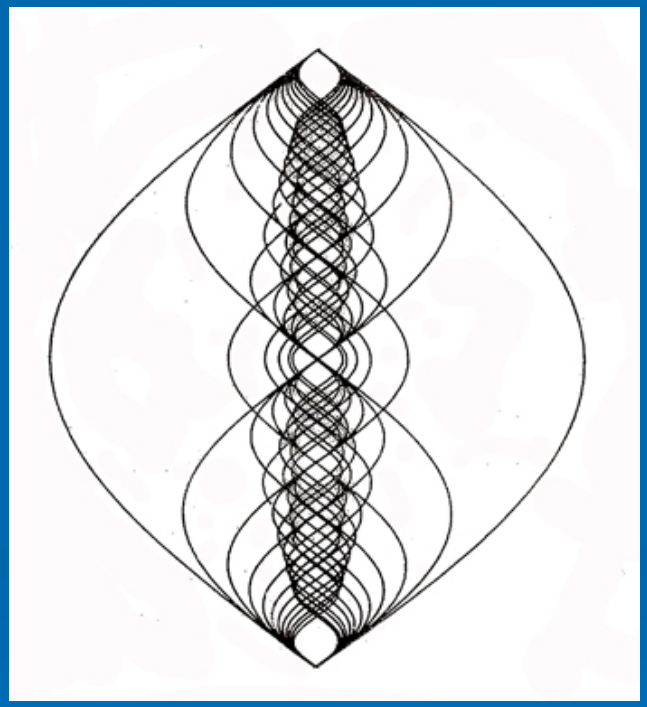
Harmonic Law #2:
The lower the proportions of numbers, the better the consonance (harmony).



Interval names
U = unison; 8ve = octave

SG201.2.7.4 The Scale of Overtones (4)





↑ Line design for StarWheel #108 "*Creation Ovum*".
(The design was created by re-folding the scale of overtones unto itself to form an egg-shape.)

SG201.2.7.5 Overtone Interlude

← ↑ StarWheel mandala #108
"Creation Ovum".

SG201.2.8.1 A new culture of overtones (1)

In his fascinating "*The Third Ear*" (1988), Joachim Ernst Berendt notes how we are witnessing a "*new living culture of overtones*": "*All of a sudden young people are singing overtones*".

Historically, in the western culture, the awareness & use of singing overtones was well alive in antiquity all the way to the heyday of Gregorian chant and then the "*coloratura singing*" vogue of the 17th century.
Berendt explains: *"Overtones develop from vowels, and the protracted vowel-related melismata within ancient choral singing's melodic lines almost inevitably made the alert listener aware of vocal harmonics - with the architectural proportions of the church or cathedral also playing their part".*

In other -mostly oriental- cultures, the "*noble and ancient art of overtone singing*" has been extensively developed and maintained as a spiritual technology: Tibet, North India, the Mongolian *Tuwan* tribe, some Buddhist monasteries in Japan and China and a few singers in the South American Andes. Everywhere the art of singing overtone vocal harmonics is used and received in a spiritual context. *"The richer and more differentiated the overtones in a culture, the more profound and highly developed its spiritual potential".* (Berendt).

In the West, the introduction of the tempered tuning system in the 18th century was the last blow to the awareness of overtones in western music. Equal temperament, in its arrogant rationality, superseded nature: not a single note is heard in its natural harmonic context anymore and musical notes are seen as isolated objects separated from their natural web of overtone resonance. [Compare with Indian Music ◆SG201.1.3]
The more rationally and efficiently westerners thought, the more they forgot about their music's overtones.
As Berendt points out: *"Western music has done with notes what science has done with nature: isolating, alienating, and sundering things from their natural context".*

The evolutionary mandala wheel has now turned and the new paradigm of co-creative consciousness welcomes the sacred doorway into holographic oneness offered by overtones and their harmonic "ladder to infinity".

SG201.2.8.2 A new culture of overtones (2) Quotes

"Can we view overtones as a kind of universal mantra tuning the entire planet - as the real universal language?"

Robert Laneri.

"Overtones light up music".
This is true physically and spiritually. The infinite cascade of overtones leads us to higher luminous dimensions.

"Overtones are contained within whatever individual note is sounding as co-resonating higher tones whose oscillatory frequencies are very much greater than the frequency of the fundamental.
In every note we produce on a percussion, wind or string instrument, AN ENTIRE SCALE vibrates: the overtone scale that contains all whole- and half-note intervals, initially widely separated and then becoming ever closer."

J. E. Berendt

"There cannot be music without overtones!… Between tones and overtones, there is constant feedback! The harmonics may be the outcome of a note being struck, but the fundamental would not have any impact as a note if the overtones failed to inform us of its character".

J. E. Berendt

"Overtones are closely related to the reality in which we exist as human beings, a reality which is most important for every one of us: the reality of our feelings."
Harmonics create a "feeling", also called "tone-color". Harmonic overtones actually weave the background music that sustains the universe and everything within it. They are colors and emotions.

SG201.2.8.3 Overtones (3) Overtone Singing

When heard for the first time, overtone singing seems almost impossible or at least very "magical": how can a single throat produce two independently moving melodies, or chords where the notes of the overtone series are superimposed? It is a form of sound yoga.

Teachers of overtone singing speak about "*supersounds*" and the mystical Way of Overtones, emphasizing the importance to allow the overtones to arise from within in a sonic form of inner meditation.

Robert Laneri, an Italian overtone singer: *"The first step is to hold a note for a long time and observe it. One takes the note and regards it as if under a microscope. A drop of water may not reveal much about itself at first glance, but when looked at more closely it contains the universe. That is also true of overtones… This is mainly a question of perception, of contemplation - not taking action. The note is, as it were, illuminated from within".*

Michael Vetter, a German teacher says that we must *"slow down our tempo of speaking to such an extent that a single breath is scarcely enough for a word. We must take time to really attend to what is happening in individual sounds and their transitions… for instance accompanying the path taken by the tongue from 'i' to 'u'…"*

David Hykes, a pioneer overtone singer, explains that the overtones can come out of various parts of the body as a "harmonic choir": belly, pelvis, chest, throat and head. *"Experienced practitioners of vocal harmonics can develop intensified musical consciousness in the area of the hypophysis ("third eye") or at the highest point of the cranium".*

And Tibetan Tantric sources point to the enormous amount of energy potentially available in overtone singing. We are all familiar with the stage phenomenon of a singer tuning to the frequency of a glass and breaking it at a distance by singing the exact tone. A lot more is possible and spiritual teachings issue warnings against using such energy without higher consciousness.

SG201.2.8.4 Overtones (4) Tuva Overtone Singing

The best-known of the traditional forms comes from *Tuva*, a small autonomous republic within the Russian Federation. The history of *Tuvan throat singing* reaches very far back… Human mimicry of nature's sounds is seen as the root of throat singing. The people of Tuva have a wide range of throat singing vocalizations:

"Sygyt" **meaning whistling, a technique that utilizes a mid-range fundamental and produces a high-pitched, rather piercing harmonic reminiscent of whistling. The tone sounds very bright and clear. Also described as an imitation of the gentle breezes of summer, the songs of birds.**

"Kargyraa" **a deep undertone technique. The vestibular folds, also known as the false vocal folds, are vibrated to produce an undertone exactly half the frequency of the fundamental produced by the vocal folds, and the mouth cavity is shaped to select harmonics of both the fundamental and the undertone, producing from four to six pitches simultaneously. This is sometimes described as the howling winds of winter or the plaintive cries of a mother camel after losing her calf.**

"Khoomei". **While *khoomei* is used as a generic term to designate all throat singing techniques in this region, it is also more specifically a technique where the drone is in the middle-range of the voice, with harmonics between one and two octaves above. Singing in this style gives the impression of wind swirling among rocks.**

"Chylandyk" **is merely a mixture of *sygyt* and *kargyraa*. Both styles are sung at once, creating an unusual sound of low undertones mixed with the high *Sygyt* whistle. It has also been described as the "chirping of crickets."**

"Dumchuktaar" **could be best described as "throat humming". The singer creates a sound similar to *sygyt* using only the nasal passage.**

"Ezengileer" **is a pulsating style, attempting to mimic the rhythms of horseback riding. It is named after the Tuvan word for stirrup, *ezengi*."**

Wikipedia.

↑ Tyva Kyzy (*"Daughters of Tuva"*) is the one and only all-female Tuvan throat-singing and folk music ensemble.

//tyvakyzy.com

SG201.2.9 The Monochord & Science

- **Kepler discovered his planetary laws - particularly the third- through working with a monochord.**

- **Max Planck developed the quantum theory by observing overtones on a monochord. Max Planck was inspired to work out his quantum theory by the well-known phenomenon that the notes in an overtone scale jump from one whole number to the next. In the same way, the "particle energy" in the atom changes not gradually but in "jumps" (quanta).**

- **In 1893, Max Planck wrote:**

"According to the postulate of quantization, the discrete intrinsic values of energy lead to certain discrete intrinsic values of the period of vibration. This happens in the same way on a tense string fastened at both ends. The difference between them is that on the string the quantization is conditional on an exterior factor, the length of the string, while here it is conditional on the quantum of energy resulting from the differential equation itself."

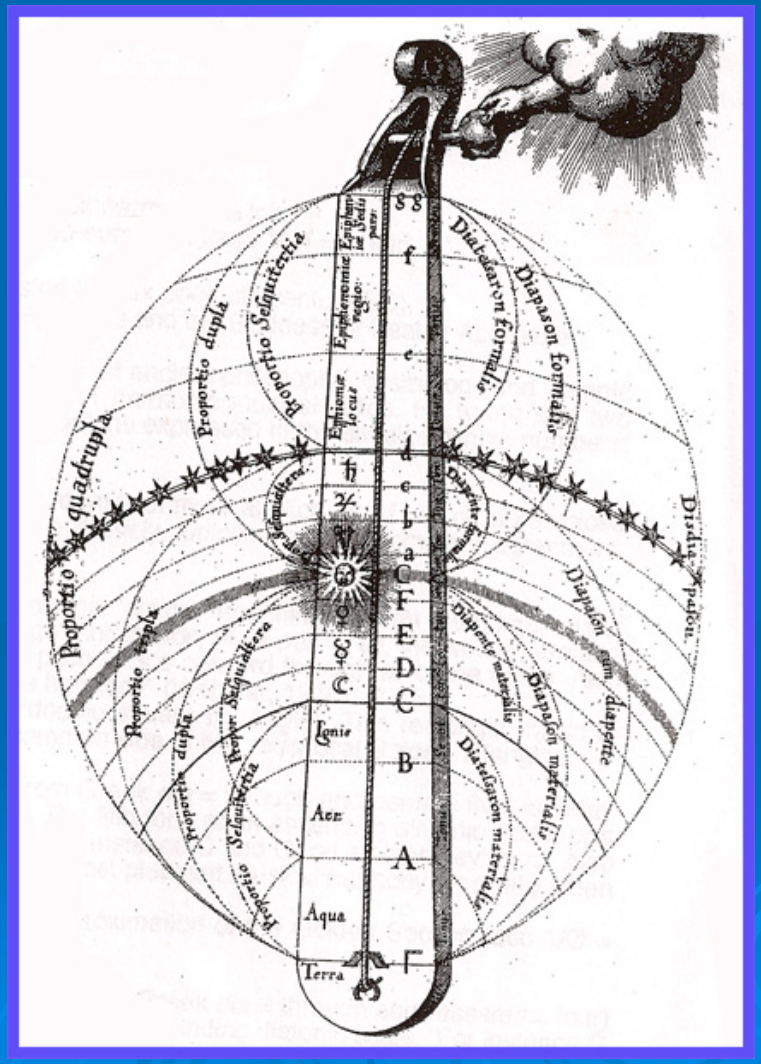
- **Heisenberg viewed reflection on the harmonic thinking developed by Pythagoras as being *"one of the strongest impulses within human science"*. He believed that the development of knowledge has *"confirmed Pythagoreans' belief to an inconceivable degree"*.**

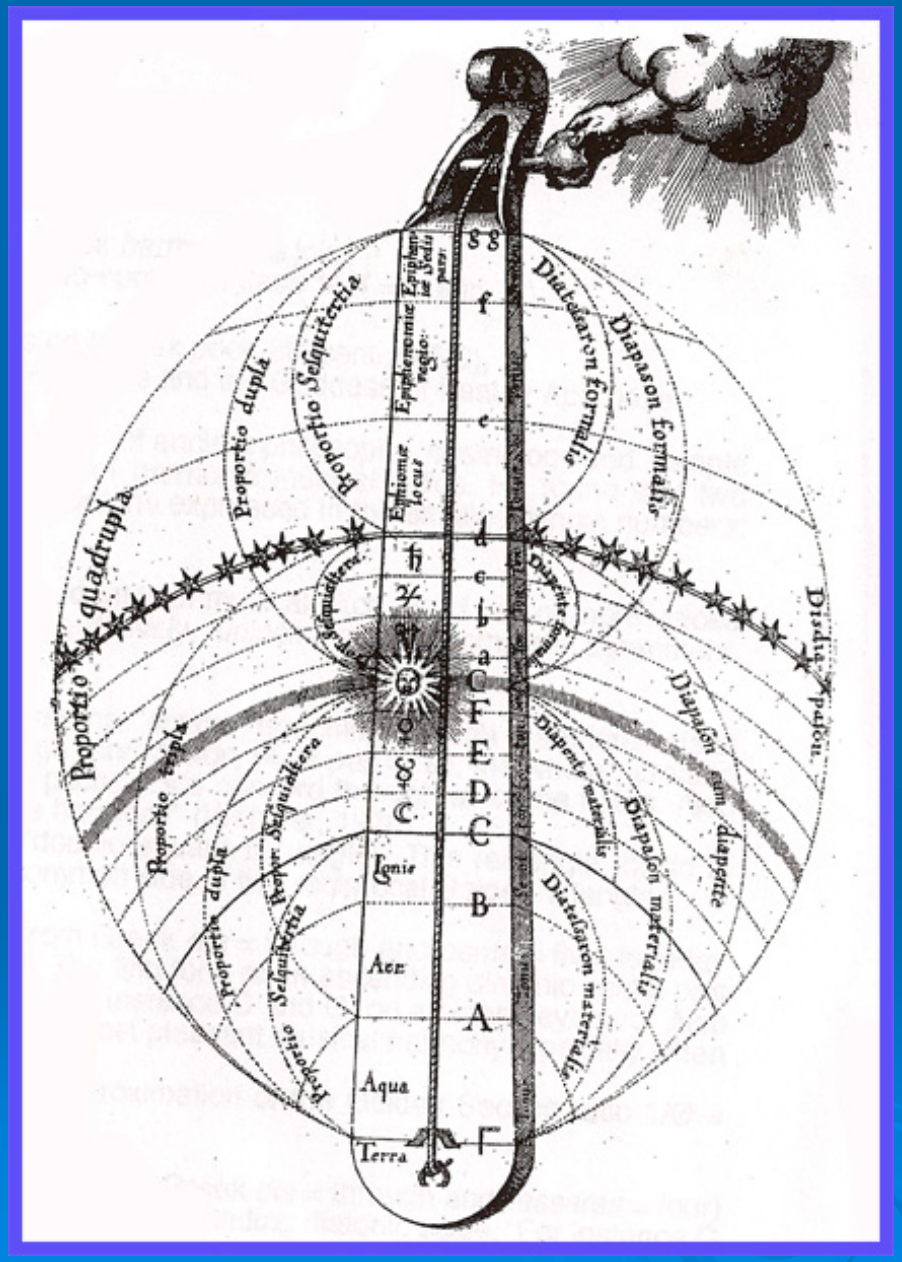
"Music and research work are born from the same source… and complement each other."

Albert Einstein

[◆ SG201.6.4]

SG201.3 - Chapter 3 The Universe as Music





SG201.3.1.1 The Universe as a Monochord (1)

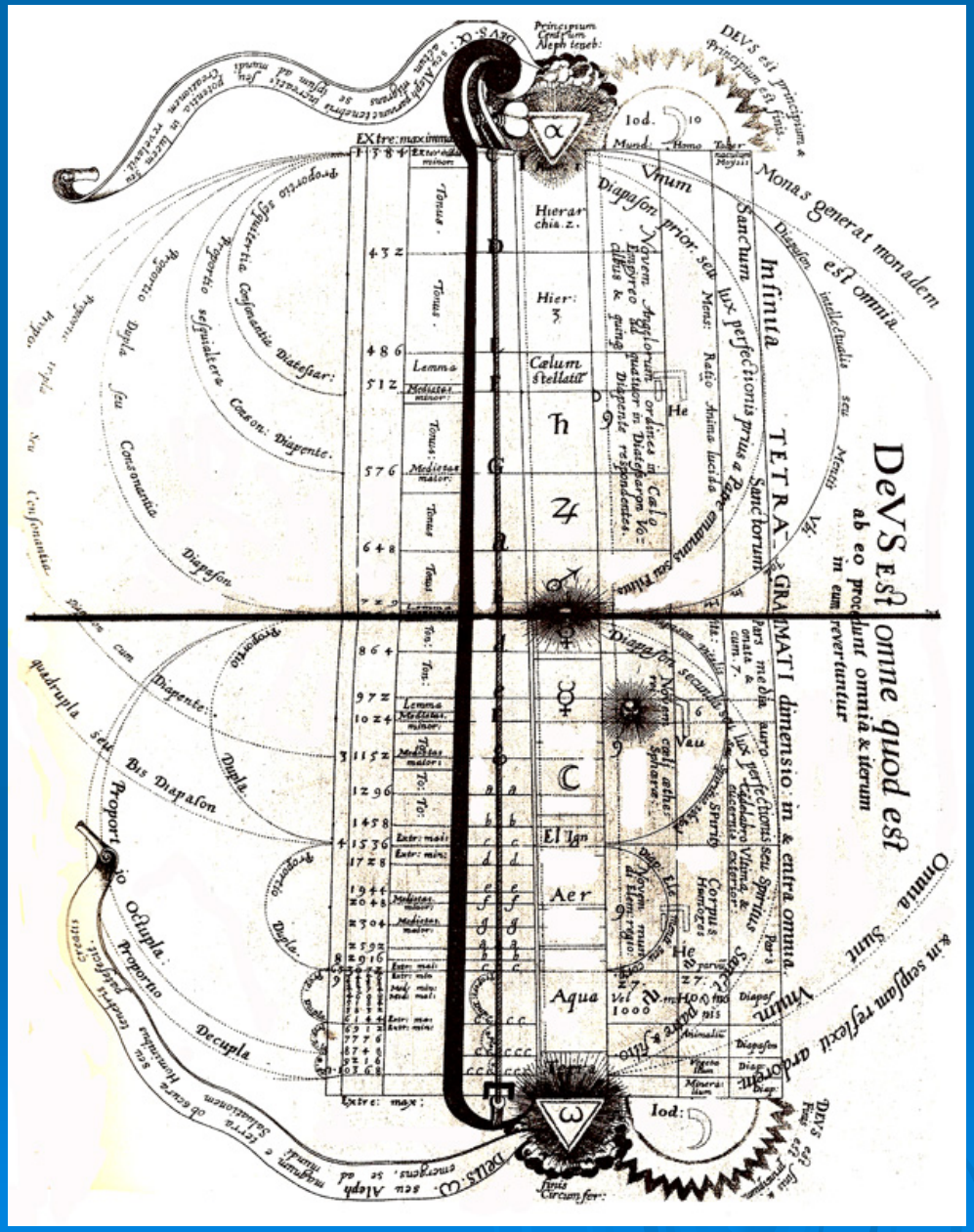
The "*Divine Monochord*" by Robert Fludd (1574-1637) [◆SG102] displays two octaves stretching from the Earth (low G marked by the Greek letter *Gamma*) up to "*gg*" for the highest region of the empyrean hierarchy.

On the left of the monochord sounding board, the 4 elements are followed by the 7 celestial bodies and the 3 realms of heaven: *Epiphaniae* = apparitions, *Epiphonomiae* = voices and *Ephiomae* = acclamations.

On the left of the diagram are the musical proportions. On the right are the Greek names of the musical intervals: *disdiapason* = double octave (4:1), *diapason* = octave (2:1), *diapente* = fifth (3:2), *diatessaron* = fourth (4:3).

Note: Diapente & the corresponding proportion should connect G to C. Also the F tones should be sharp.

Image: Robert Fludd.
Utriusque Cosmi Maioris, I a. 1617.
Text: Joscelyn Godwin. *Robert Fludd.* 1991.



SG201.3.1.2 The Universe as a Monochord (2)

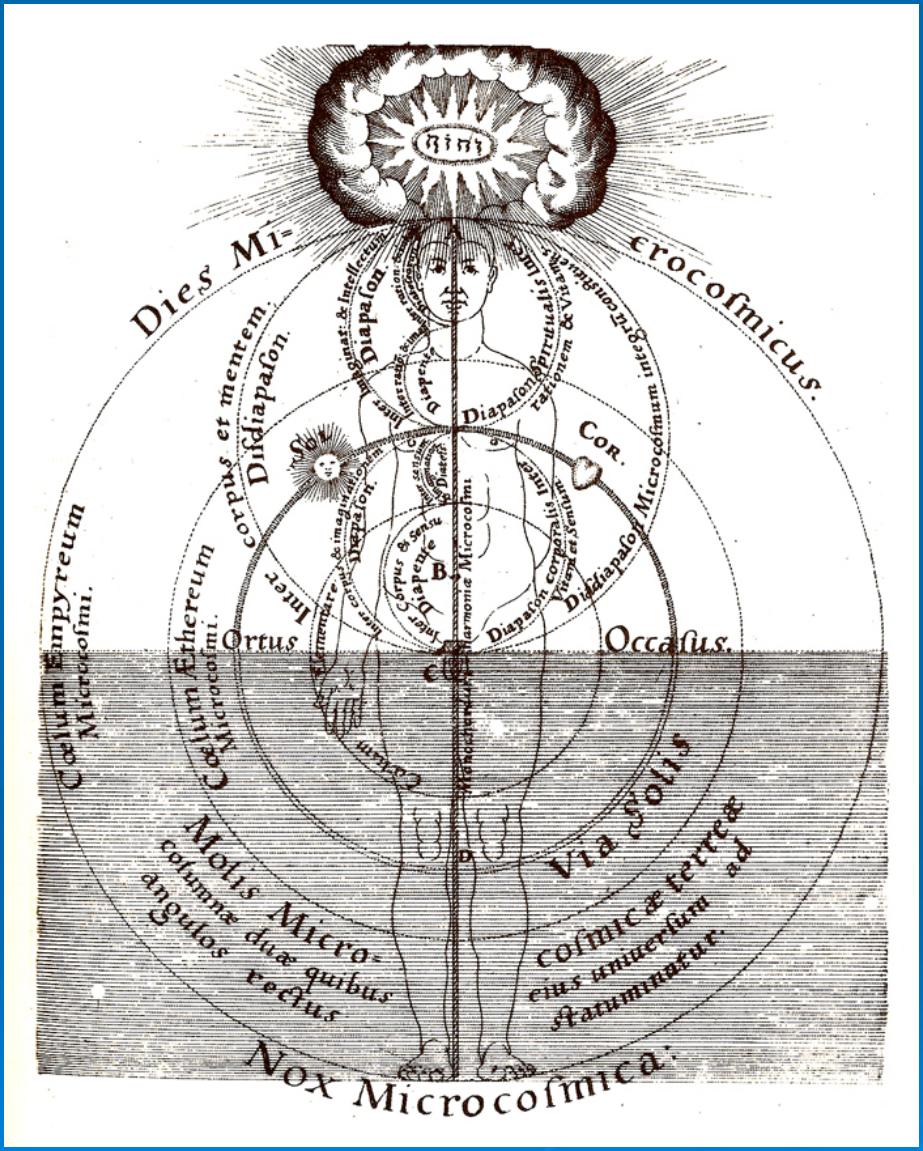
Fludd's "*The Great Monochord*" shows the Alpha & Omega of an elaborate cosmological system (the standard Ptolemaic universe), complete with planets, musical frequencies, spiritual hierarchies and Kabalah references.

Philosophical statements proclaim: *"The Monad generates the monad and reflects its ardor onto itself"; "The One is all things and all things are the One…"*

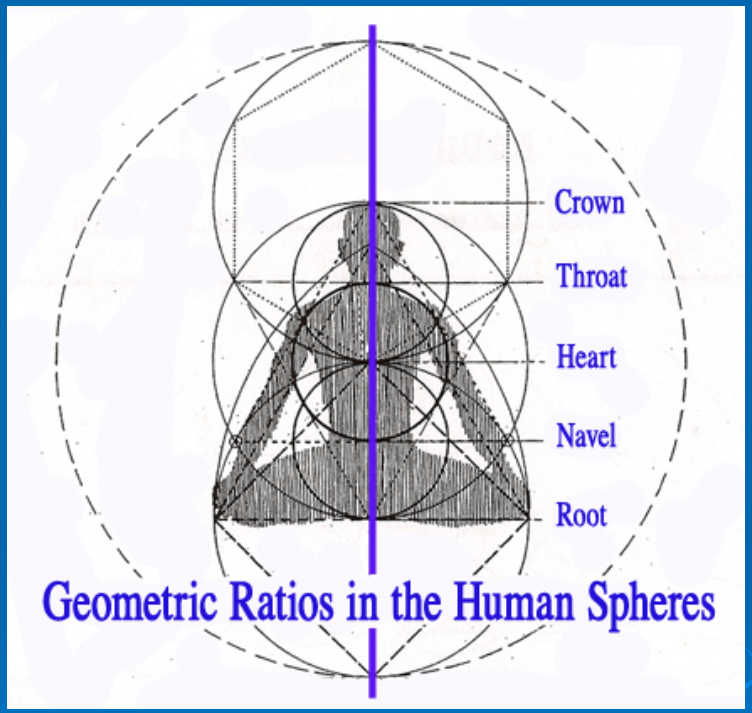
On the monochord are the notes of the diatonic scale: 3 octaves (C to c3) + 3 octaves alone (c4 to c6). On the left column, the numerals give the proportions of string-length for each scale-tone in the lowest possible whole integers while the intervals are marked by corresponding arcs. The right column shows the circles of the Ptolemaic universe: angelic hierarchies, fixed stars, 7 planets and 4 elements.

Image: Robert Fludd.
Anatomiae Amphitheatrum. 1623.
Text: Joscelyn Godwin. *Robert Fludd*.

SG201.3.2 The Universe as a Human Monochord



"*The diapason closing full in Man*". Robert Fludd.
Utriusque Cosmi Maioris, II, a,1. 1619



The cosmic monochord is the World Axis. harmonizing all dimensions.
The human monochord is the River of Light nurturing all the chakras.

SG201.3.3 Entrainment and Resonance

In 1665, Christian Huygens, a Dutch scientist, pointed out that two pendulum clocks would beat together when mounted side by side on a wall. They would swing in synchronous rhythm.
We now know that this phenomenon of "entrainment" is universal: two oscillators pulsating in the same field will tend to assume the same period - in physics, this is called "lock in", "mutual phase-locking" and "resonance".
This "phase conjugation" is optimized by the Golden ratio.

Entrainment & resonance phenomena have been found in the most diverse fields:

- ***Brainwaves entrainment:*** **the practice of entraining one's brainwaves to a desired frequency.**
- ***Human Interaction:*** **the synchronization of brain and heartbeats between audiences and popular facilitators, mothers & children, couples and all people sharing common love & creativity.**
- ***Biomusicology:*** **the synchronization of organisms to an external rhythm. Usually produced by other organisms with whom they interact socially. Examples: firefly flashing, mosquito wing clapping as well as human music and dance.**
- ***Chronobiology:*** **the alignment of a circadian system's period and phase to the period and phase of an external rhythm.**
- ***Meteorology:*** **an atmospheric phenomenon occurring when a turbulent flow captures a non-turbulent flow.**
- ***Physics:*** **resonance is the tendency of a system to oscillate with a larger amplitude at some specific frequencies rather than at others. These are known as the system's resonant frequencies. At a resonant frequency, the frequency of oscillation does not change with changing amplitude. Therefore, at these frequencies, even small periodic driving forces can produce large amplitude vibrations, because the system stores vibrational energy. Resonant phenomena occur with all types of vibrations or waves: there is mechanical resonance, acoustic resonance, electromagnetic resonance, Nuclear Magnetic Resonance (NMR), Electron Spin Resonance (ESR) and resonance of quantum wave functions…**
- ***Optics:*** **creation of coherent light by optical resonance in a laser cavity.**
- ***Astronomy:*** **orbital resonance as exemplified by some moons of the solar system's gas giants.**

SG201.3.4 The Harmonic Finality of the Universe

"Entrainment is universal in nature. It is a physical phenomenon, but it is also more than that, because it informs us about the tendency of everything that vibrates (everything in the universe is a wave function) to dance together, to lock in. It informs us about the tendency of the universe to share rhythms, that is, to vibrate in harmony…

Entering in harmonic relationships is the goal not only of music. It is the goal of atoms and molecules, of planetary orbits, of cells and hearts, of brain waves and movements, of flocks of bird and schools of fish and… of human beings.

All of them (the cosmos, the entire creation) have HARMONY AS THEIR FINAL GOAL."

J. E. Berendt. *The World is Sound: Nada Brahma*. 1983.

As Berendt & Fritjof Capra note: from the myriad of possible vibrational signatures, the universe chooses with overwhelming preference those that make HARMONIC SENSE.

All wisdom traditions say: the teleological Omega Point is Oneness, the Source of Harmony.
The universe creates & transmits harmony through the resonant musical cascades of the Overtone Series and, within it, through the even more perfect chords of the Golden Ratio & Fibonacci Series…

WHAT A GIFT TO SEE AGAIN THE EXQUISITE HARMONY OF THE WORLD!
HOW DO I/WE FULLY RE-ENTER & CO-CREATE COSMIC HARMONY?

SG201.3.5.1 Nada Brahma (1)

All sacred traditions teach that *sound* (*tone vibration)* is ontologically prior to material existence: the cosmos is vibrationally toned before it is made visible. The material world is the consequence of causal sounds - not the other way around. Correspondingly, our sensory apparatus for hearing has a much wider window of perception than our apparatus for seeing.

The Hindu tradition has brought this cosmogonic description to a full spiritual credo - and practice (with the *mantra* chanting). Yes, the universe SINGS but, even more, the universe IS song: NADA BRAHMA!

And we can co-create it by co-toning it!

Nada is Sanskrit for '*sound*' & '*roaring sound*'.
Brahma(n) (Sanskrit root *bri* = to grow) is the *Cosmic Source*, the prime mover and inner consciousness of the cosmos.

"Brahman is the absolute.
Everything that exists is Brahman or the Sacred Word…
It is without condition and without properties.
It is the world-soul containing all single souls,
as the ocean contains all drops of water…
Brahman is life, Brahman is joy…" **Upanishads**

"Do you hear the rushing of the river?
- Yes.
- This is the way!"
This zen *mondo* illustrates what happens when *nadi* becomes *nada*:
the rushing of the spine river becomes the cosmic rushing of *Nada Brahma.*

SG201.3.5.2 Nada Brahma (2) Siddhartha

"Siddhartha stayed with the ferryman and learned how to look after the boat…
He once asked the ferryman: 'Have you also learned that secret from the river: that there is no such thing as time?'
'Yes, Siddhartha', he said, 'Is this what you mean? That the river is everywhere at the same time, at the source and at the mouth, at the waterfall, at the ferry, at the current, in the ocean and in the mountains, everywhere, and that the present only exists for it, not the shadow of the past, nor the shadow of the future?'
'That is it', said Siddhartha, 'and when I learned that, I reviewed my life and it was also a river, and Siddhartha the boy, Siddhartha the mature man and Siddhartha the old man were only separated by shadows, not through reality. Siddhartha's previous lives were also not in the past, and his death and his return to Brahma are not in the future. Nothing was, nothing will be, everything has reality and presence' …
And once again when the river swelled during the rainy season and roared loudly, Siddhartha said: 'Is is not true, my friend, that the river has very many voices?'
'It is so' nodded Vasudeva, 'the voices of all living creatures are in its voice.'
'And do you know', continued Siddhartha, 'what word it pronounces when one is successful in hearing all its ten thousand voices at the same time?'
Vasudeva laughed joyously. He bent towards Siddhartha and whispered the holy OM in his ear. And this was just what Siddhartha had heard."

Hermann Hesse. ***Siddhartha.***

Siddhārtha Gautama Buddha.

Statue of the Buddha from Sarnath, 4th century CE.

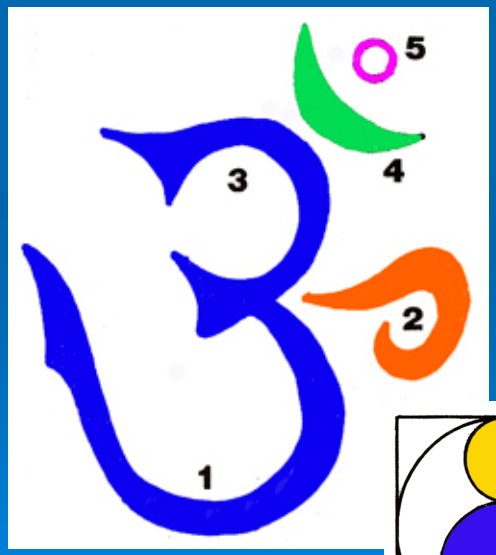
SG201.3.5.3 Nada Brahma (3) OM (1)

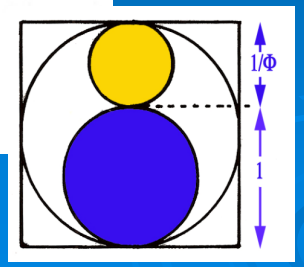
Symbolism of the Sacred Sound OM

The *Mandukya Upanishad* (400 - 200 BCE) is dedicated to the the cosmology of OM. This '*cosmic root syllable*' is described as the '*bow*' which fires the '*arrow*' of the Self (Atman) at the '*target*' of the Absolute (Brahman). In the *Maitrayaniya Upanishad*, OM is the '*sound of the soundless Absolute*'. OM stands for both Change and Changelessness and invites us to the vibration of the Journey Home, up the sound current of creation.

In the Hindu tradition, OM is the Seed-Sound that preceded the universe (*bija mantra*). It is the root sound (*mula mantra*), the cosmic pulse vibration that holds together all the atoms/quanta of creation. OM is the Mother of Mantras (*mantra matrika*): the first of all the creative spells spoken by the Great Goddess to birth the universe into being.

The visual Symbol





<u>OM has 5 components merged in one unit:</u>

1. **Lower loop: material world. *Waking state*.**
2. **Small loop on right: mental world. *Dream State*.**
3. **Upper loop: unconscious world. *Deep sleep*.**
4. **Semi-circle or Crescent: it is wide open, like an offering bowl raised to the Infinite (the point) and a bridge between the physical & spiritual aspects of consciousness.**
5. **The Point or Dot: this represents Absolute Consciousness. That which is illuminating and revealing all the rest. Merging with the Dot is *turiya*, the fourth state, i.e. illumination.**

Note the crescent + dot as symbols of the Moon + Sun.

← Note the similarity between OM and the *Arbelos*.
The *Arbelos* embodies the PHI ratio in its 2 circles.

SG201.3.5.4 Nada Brahma (4)
OM (2)

The Sound Symbol

OM is composed of four tones: 3 phonetic elements (A-U-M) and a soundless fourth sound:

A represents the fire and light of the cosmic lingam. The sound of the Heart through the open mouth. *Waking state*.

U is the middle sound made between the opening and closing of the mouth. It represents the womb of nature and the cosmic waters. *Dream state*.

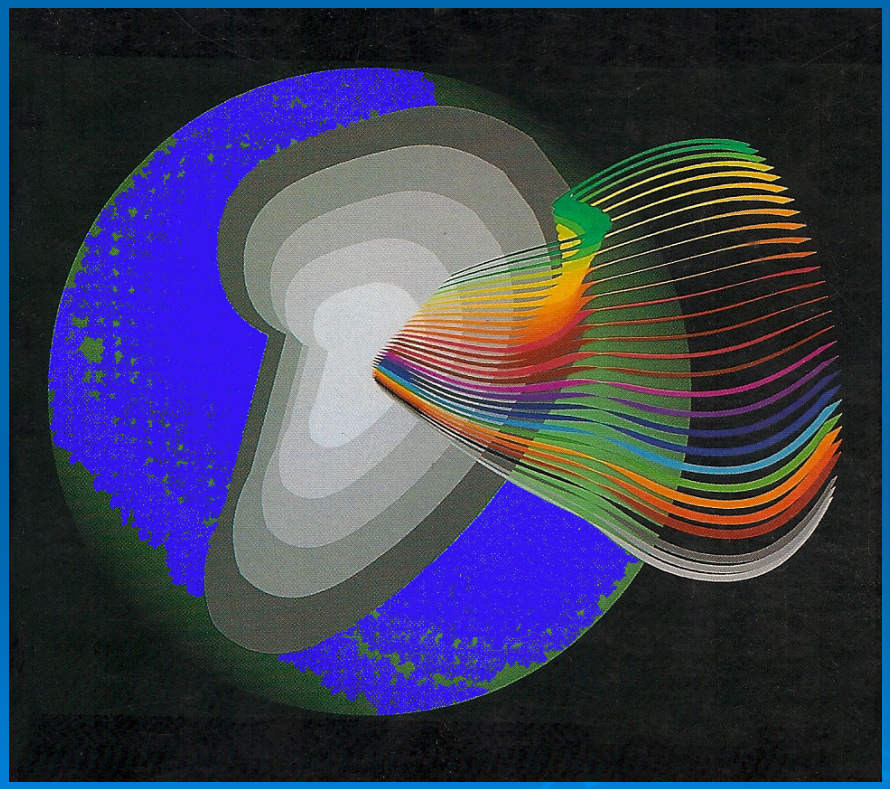
M is the sound made with the lips shut. It represents the union of the apparent opposites (fire & water). It completes the sounding of the physical creation and emerges out of the body of the symbol (the 3 loops) into the crescent. *Deep sleep state*.

The 4th sound is soundless (the Silence or Void) and can only be visually pointed to as the Dot above the crescent. *State of turiya*. It represents Absolute Spirit. Consummation of OM's power.

The Sri Yantra is said to be the visual representation of the sound OM.

SG201.3.5.5 Nada Brahma (5) The Third Ear

All great musicians have created their best work from inner revelatory experiences touching them through their "*inner ear*" [◆SG201.6]. Some modality of clairaudience is, consciously or not, the "guiding voice" of all master musician artists, just like some modality of clairvoyance is the "guiding light" of all masters visual artists.



↑ Cover image of *The Third Ear* by J. E. Berendt. 1988. (Colored)

Clairaudience (more casually called telepathy), a form of extra-sensory perception, is the experience of receiving auditory information (sounds, music, soundscapes, words, conversations, insights, advices from inner guides, languages, sonic frequencies…) through the "3rd Ear" or "inner mental ear" from what seems like a higher or inner / dimension, oftentimes beyond the boundaries of space/time ("non-locally"). Popularly, some aspects of clairaudience are referred to as the "little voice inside".

Traditionally, the Third Ear is the companion sense to the Third Eye. In the yogic teachings, the throat *chakra* is the seat of clairaudience. It is traditionally said that the *Sound Current* sustaining the cosmos (Nada Brahma) and the *Music of the Spheres* are audible in a clairaudient manner.

SG201.3.5.6 Nada Brahma (6) The Universe Within

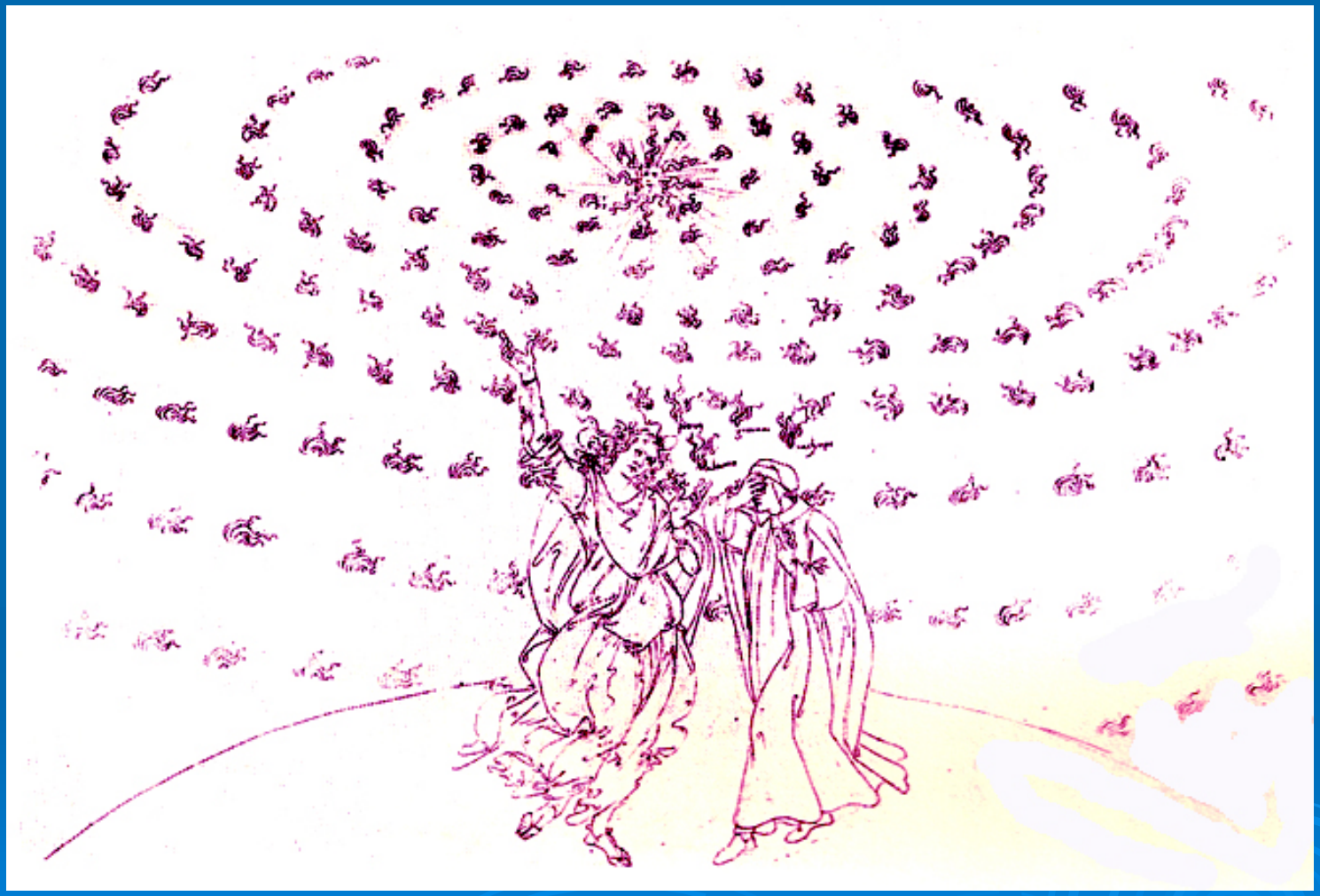


Image: *The Rainbow Book*. Ed. F. Lanier Graham. 1979.

↑ Beatrice revealing to Dante the harmony of the "*Universe Inside Us*".
Drawing for *The Paradise* by Sandro Botticelli . 15th century.

SG201.3.6.1 The Music of the Spheres (1)

Traditionally called "*Musica Universalis*", the Music of the Spheres is an ancient understanding of the cosmos that is now being revived through scientific validation.
In the history of the western culture, this concept originated in Egypt and was transmitted to us by the Pythagorean School. The *Music of the Spheres* literally designates certain proportions in the movements of celestial bodies - the Sun, Moon, and planets - as forms of harmonic musical chords. In a larger cosmological sense, it also points to the underlying Harmony of the universe, in all realms.
This 'music' is not directly audible by the physical senses (although accessible by inner psychic/spiritual perception) but is understandable through a harmonic, mathematical and sacred geometric approach.
Prior to the Renaissance, the Sun, Moon and planets were thought to revolve around Earth in their proper '*spheres*'. The 3 branches of medieval music were presented by Boethius (480-525) in his book *De Musica*:

- ***musica universalis* (the music of the universe; also called *musica mundana*, the music of the world).**
- ***musica humana* (the internal music of the human body)**
- ***musica instrumentalis* (sounds made by singers and instrumentalists)**

The most thorough description of the *Music of the Spheres* can be found in Dante's *Divine Comedy*. Johannes Kepler was the first modern to gather astronomical data of the solar system and correlate them with musical intervals, in a scientific way.

In 2006, an experiment conducted by Greg Fox divided the orbital periods of the planets in half again and again until they were literally audible. The resultant piece was "*Carmen of the Spheres*". The principle of octaves in music states that, whenever a sound-wave is doubled or halved in frequency, it yields a super-octave or sub-octave pitch that is always perfectly consonant with the original one. This can be applied (through very large octave shifts) to any periodic cycle, such as the orbits of celestial bodies, to render an audible analogue. [◆SG201.6] (*Wikipedia*).

Some oriental traditions consider the Music of the Spheres to be the *Nada Brahma* or *shabda* (Sanskrit = sound) - the sound current of the Life Stream that can be heard by the inner ear.

SG201.3.6.2 The Music of the Spheres (2) Kepler's *Mysterium*

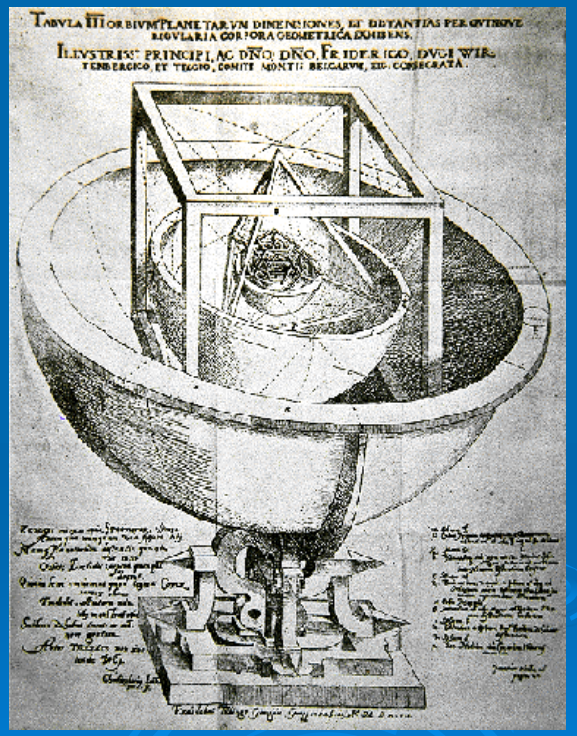
In view of the current re-evaluation of Kepler's work, it is now known that his most famous discoveries (the planetary laws) were made as a side benefit of pursuing an entirely different goal. Kepler was driven by a passion: finding evidence for the HARMONY OF THE WORLD, handed down by traditions from remote antiquity and hailed as a unified knowledge of the cosmos. Contrary to many humanist scholars of his time, who mixed their search with various levels of speculation, Kepler approached his subject with scientific precision and responsibility.

The main thesis of *Mysterium Cosmographicum* (*The Sacred Mystery of the Cosmos* - 1596) is a geometric construction of World Harmony by which the 5 Platonic Solids are fitted in between the spheres of the planets. Kepler, at that time, had not yet discovered the elliptical form of planetary orbits.

> ***"The geometrical things have provided the Creator with the model for decorating the whole world."***
> Kepler. *Harmonices Mundi*

← Diagram of the geocentric trajectory of Mars through several periods of apparent retrograde motion.
Astronomia nova. 1609.

Close-up →
of the inner section of Kepler's model.



↑ Kepler's model of the solar system, based on nested Platonic Solids.

SG201.3.6.3 Music of the Spheres (3) Kepler's *Harmonices* (1)

After a lifetime of gathering and studying astronomical data, Kepler was finally able to demonstrate his thesis by using musical laws and music theory in his *Harmonices Mundi Liber V*.

In this masterpiece of research, published in 1619, Kepler relates the *aphelion* and *perihelion* arcs of the planets to one another i.e. to the angles, measured from the sun, that are formed in 24 hours by the planets while moving at the two extremes of their orbits: the closest (*perihelion*) and furthest (*aphelion*) points from the sun.

Here is the momentous discovery of Kepler: he realized that comparison of the pairs of orbital data displayed simple proportions that are well-known musical intervals.

[◆SG301]

Saturn	Aphelion	a	a:b	=	4:5	(major 3rd)
	Perihelion	b	a:d	=	1:3	(12th)
			c:d	=	5:6	(minor 3rd)
Jupiter	Aphelion	c	b:c	=	1:2	(octave)
	Perihelion	d	c:f	=	1:8	(3 octaves)
			e:f	=	2:3	(5th)
Mars	Aphelion	e	d:e	=	5:24	(minor 3rd + 2 octaves)
	Perihelion	f	e:h	=	5:12	(minor 3rd + octave)
Earth	Aphelion	g	g:h	=	15:16	(diatonic semitone)
	Perihelion	h	f:g	=	2:3	(5th)
			g:k	=	3:5	(major 6th)
Venus	Aphelion	i	i:k	=	24:25	(chromatic semitone)
	Perihelion	k	h:i	=	5:8	(minor 6th)
			i:m	=	1:4	(2 octaves)
Mercury	Aphelion	l	l:m	=	5:12	(minor 3rd + octave)
	Perihelion	m	k:l	=	3:5	(major 6th)

These ratios have since been confirmed (see next page).

Kepler's re-discovery that musical intervals describe the structure of the solar system is in tune with ancient wisdom AND contemporary post-quantum research in the frequency ratios uncovered by cutting-edge science in physics, biology, chemistry…

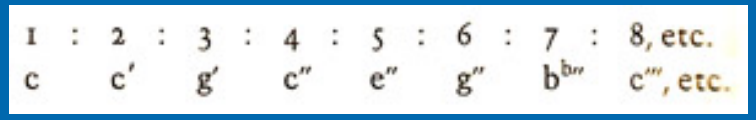
There is a Sacred Geometry sourcing the cosmos.

SG201.3.6.4 Music of the Spheres (4) Kepler's *Harmonices* (2)

The obvious question, when studying Kepler's thesis, is to whether today's knowledge validates it. After a hiatus of a few hundred years, Kepler's theories and proofs of the vibrational quantum/musical nature of the cosmos are coming to a match with cutting edge science.

• Contemporary astronomical research validates Kepler's main measurements in terms of harmonic ratios intervals. Many researchers & scientists (H. Warm, Harris, Conner, Martineau…) are putting together a whole new picture of the phi-based musical harmonies at play in the cosmos. [◆SG301]

• The *Overtone Series* (discovered by Marin Mersenne after Kepler's time) prioritizes the same main intervals that Kepler established. Let's recall that the overtones (see chapter 2) are whole-number multiples of the fundamental frequency, or their reciprocals.



← The Overtone Series with Series # on top and music chords below.

When reducing Kepler's ratios into one octave, we find that, out of 32 given intervals, 30 belong to the major triad (C, E and G).

• Recent research has shown that the physiological disposition of human hearing is structured upon the traditional foundations of music: perception of interval proportions and major/minor, adjustment of consonance & dissonance, octave and 12-fold progression… We also know now that psychological and subconscious perceptions complements this HARMONIC PERCEPTION OF REALITY and can correct deviations from "harmony" (Euler's discovery of "*correctional hearing*"). This correlates with the new medical understanding of the rhythmic Golden Ratio ordering in the human body-mind, organs and energy field.

The ratios harmonizing the human system are the same ratios that harmonize the solar system, as shown by Kepler. "*Musica Universalis*" is being heard again as human consciousness evolves.

SG201.3.7.1 Sacred Geometry & Music (1)

Using our traditional monochord, we can verify that the most pleasant musical chords are expressing sacred geometry ratios: they average to PHI, the Golden Ratio (1.618…)

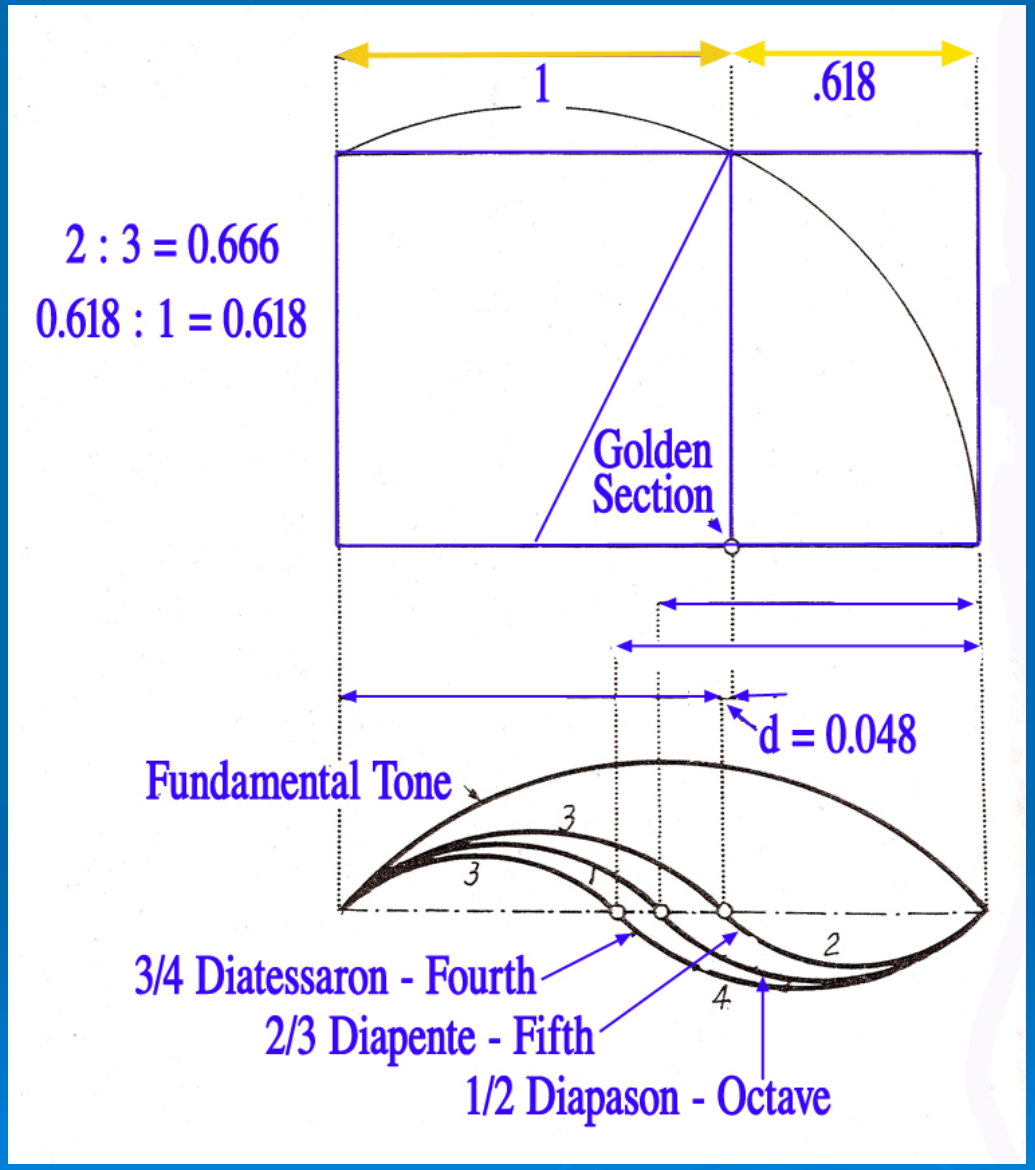
On a total length of 100 cm for the string of the monochord tuned to C, we measure the length differences (a, b, c, d, e, f) for the main harmonic chords and compute their means (a + b)/a, (b + c)/b etc…:

Octave	a	1/2 - 1/4	50 - 25 = 25 cm	(a + b)/a = 1.666
Fifth	b	2/3 - 1/2	66.66 - 50	(b + c)/b = 1.5
Fourth	c	3/4 - 2/3	75 - 66.66 = 8.34	(c + d)/c = 1.599
Major Third	d	4/5 - 3/4	80 - 75 = 5	(d + e)/d = 1.666
Minor Third	e	5/6 - 4/5	83.33 - 80 = 3.33	(e + f)/e = 1.714
	f	6/7 - 5/6	85.71 - 83.332 = 2.38	

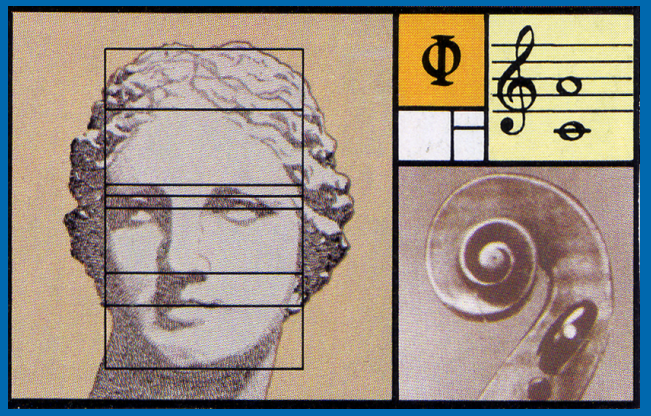
Averaging the 5 first values:

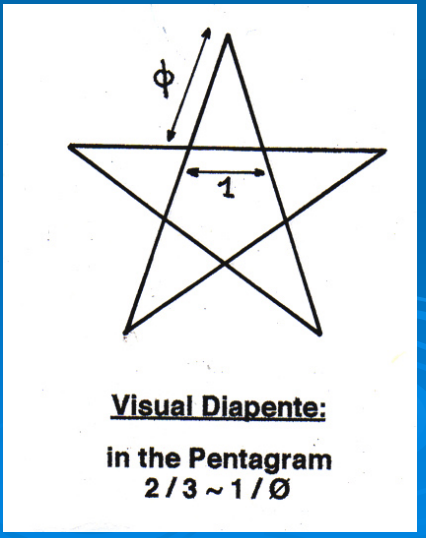
1.666 + 1.5 + 1.599 + 1.666 + 1.714 = 8.145/5 = 1.629 ~ PHI

SG201.3.7.2 Sacred Geometry & Music (2)



Note: the small difference between the fifth's 2:3 = 0.666 ratio and the exact ratio of the Golden Section, 0.618, is 0.048, marked "d".



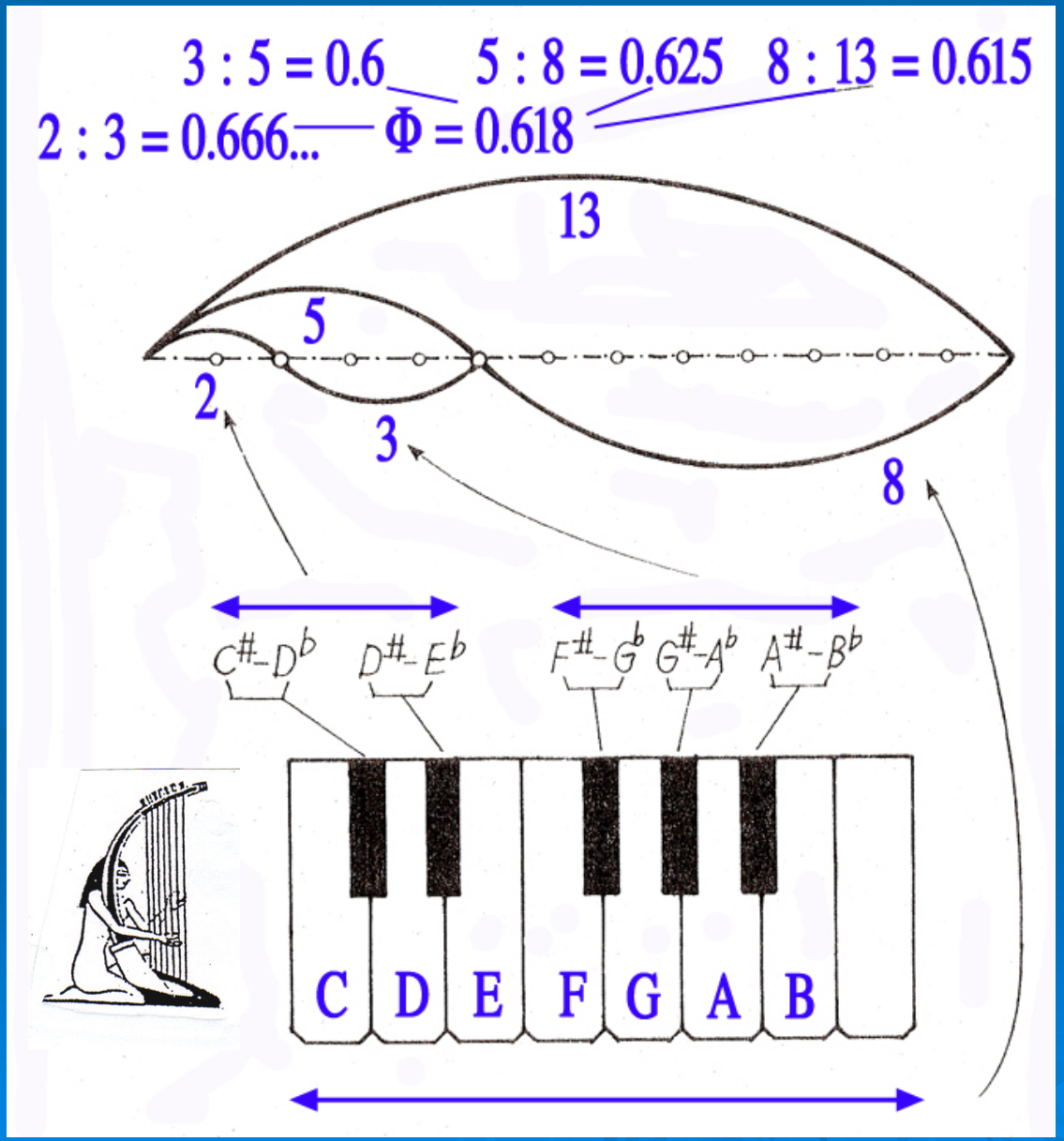


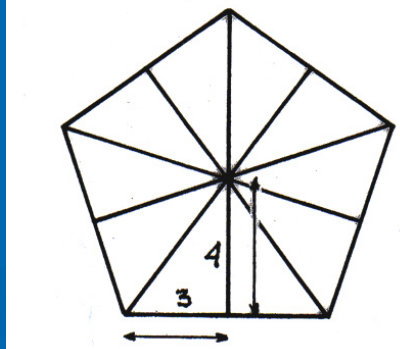
Visual Diapente:

in the Pentagram
2 / 3 ~ 1 / Ø

SG201.3.7.3

Sacred Geometry & Music (3)

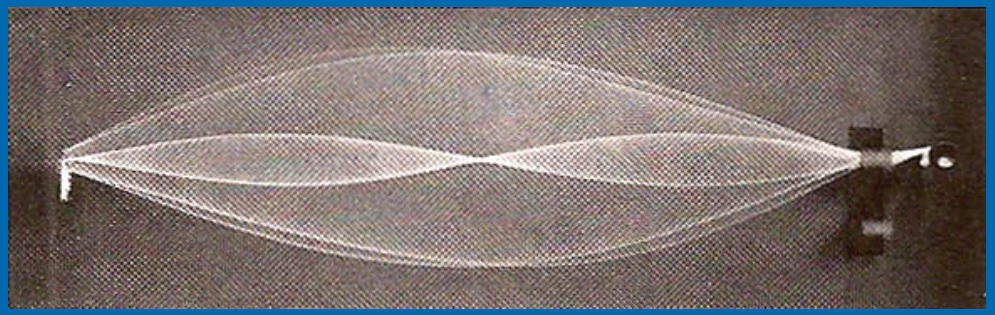




Visual Diatessaron:

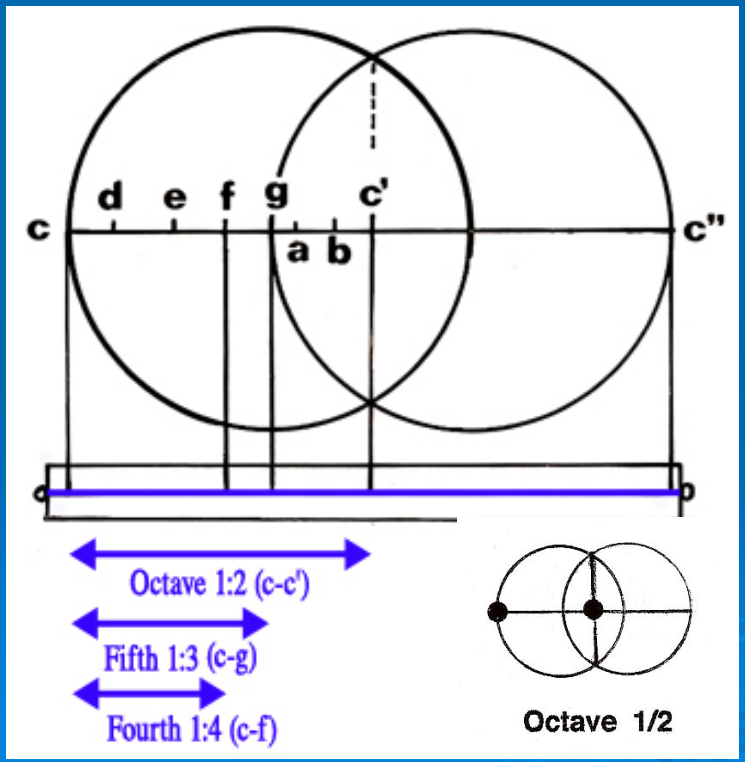
Two sides of the 3-4-5 Triangle in the pentagon are 3 /4.

SG201.3.8.1 The Vesica in Music (1)

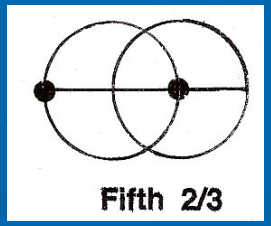


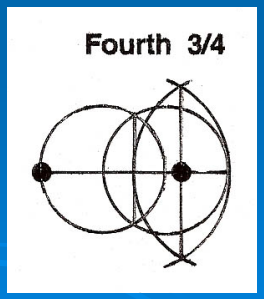
↑ The vibrating string on a monochord takes the shape of a Vesica. Plucking the string half-way produces the higher octave + 2 Vesiculas.

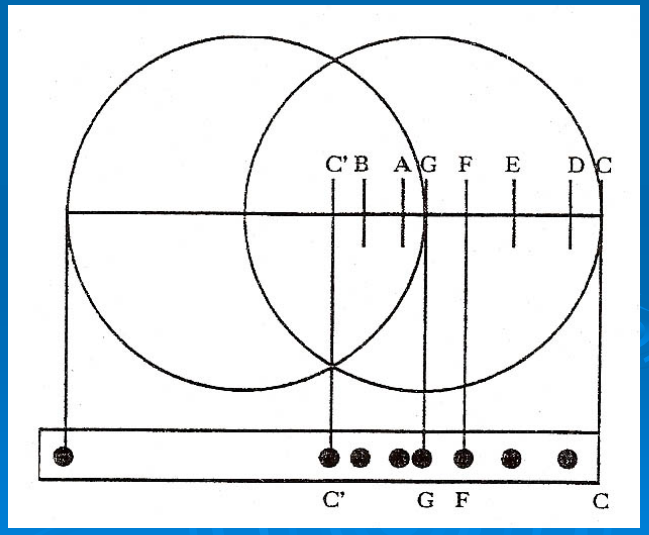
The Egyptian hieroglyph ↑ for "*mouth*" is a Vesica shape.



Harmonic musical ratios can be located on a music instrument (holes on wind instruments and positions on monochord or string instruments) by using the geometry of the Vesica Piscis.







[After Michael Schneider. "*A Beginners's Guide to Constructing the Universe*" (1994) and "*Activity Book*" (2003)]

SG201.3.8.2 The Vesica in Music (2)

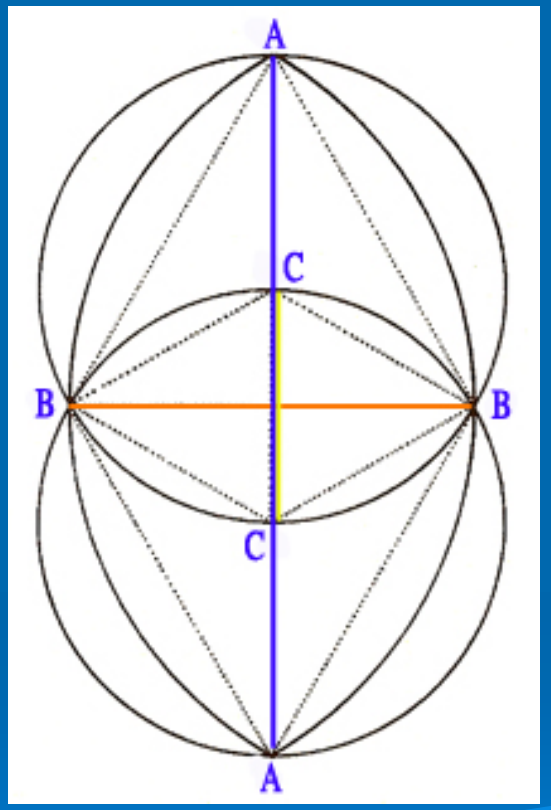
In 1897, Bristish researcher William Sterling published a book entitled *The Canon*. This was the first attempt, in modern times, to resurrect the ancient science of *gematria* which brings in correspondence the letters of the alphabet and the series of integers. [◆SG306]

Sterling describes *gematria* as a symbolic language of ancient cosmology constituting the immutable standard or *canon* on which ancient sacred cultures (Egyptian, Greek…) were based. This numerical canon of harmonics was maintained by the priesthood and formed the foundation of all learning for the arts and for the physical & metaphysical sciences.

This canon included musical and geometrical ratios. The primary numbers of Greek *gematria* were related to one another through the ratios of Sacred Geometry and musical intervals.

As David Fideler explains in his *Jesus Christ Sun of God,* a remarkable study of ancient cosmology: *"Names of the major divinities and mythological figures were consciously codified in relation to the natural ratios of geometry to equal specific numerological values."*

A beautiful example presented by Sterling is the *gematria* of Apollo, Zeus and Hermes linked to the √ 3 and the Vesica Piscis figure. ➔

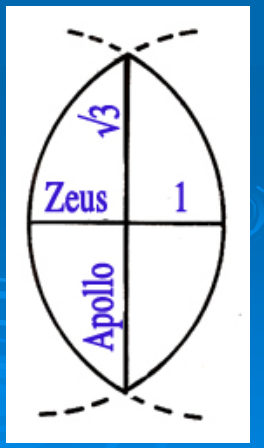


AA = Ἀπόλλων = Apollo = 1061
BB = Ζεύς = Zeus = 612
CC = Ἑρμῆς = Hermes = 353

1061 / 612 = 1.732

612 / 353 = 1.733

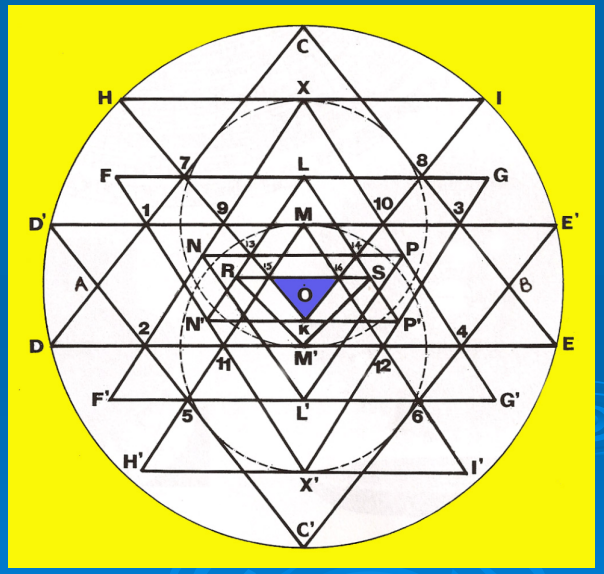
√ 3 = 1.732 = long axis of the Vesica Piscis [◆SG108]



SG201.3.9.1 Music in Mandalas & Yantras

The Sri-Yantra (Mother-Yantra) is a Mandala journey in 9 stages:

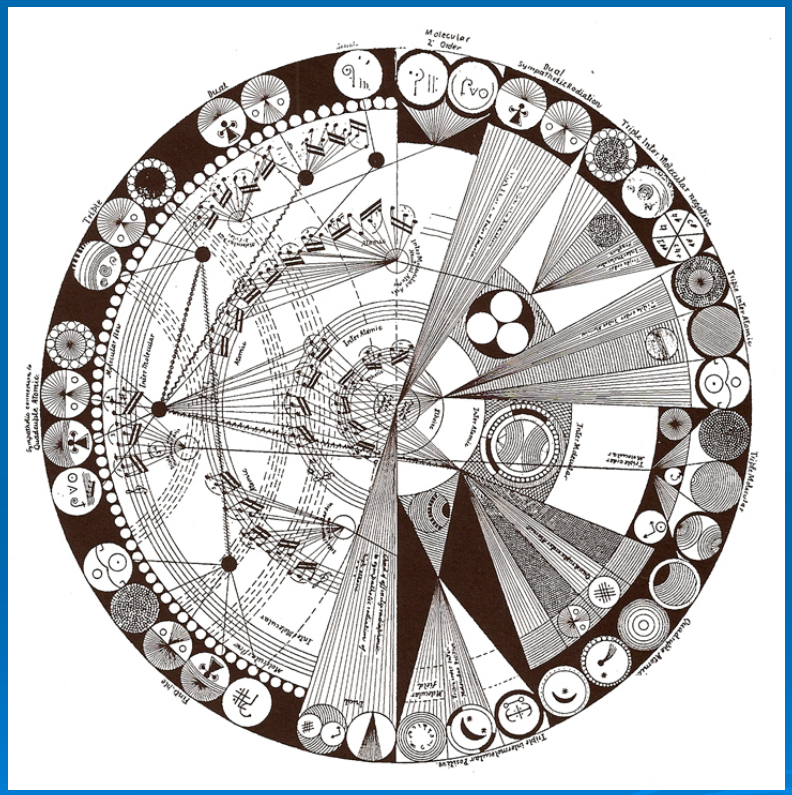
ONE square outer yard, "shivered".
TWO lotus circles.
SIX triangle circuits, formed by 5 downward-pointing female triangles and 4 upward-pointing male triangles.
ONE Center, the ultimate Bindu.



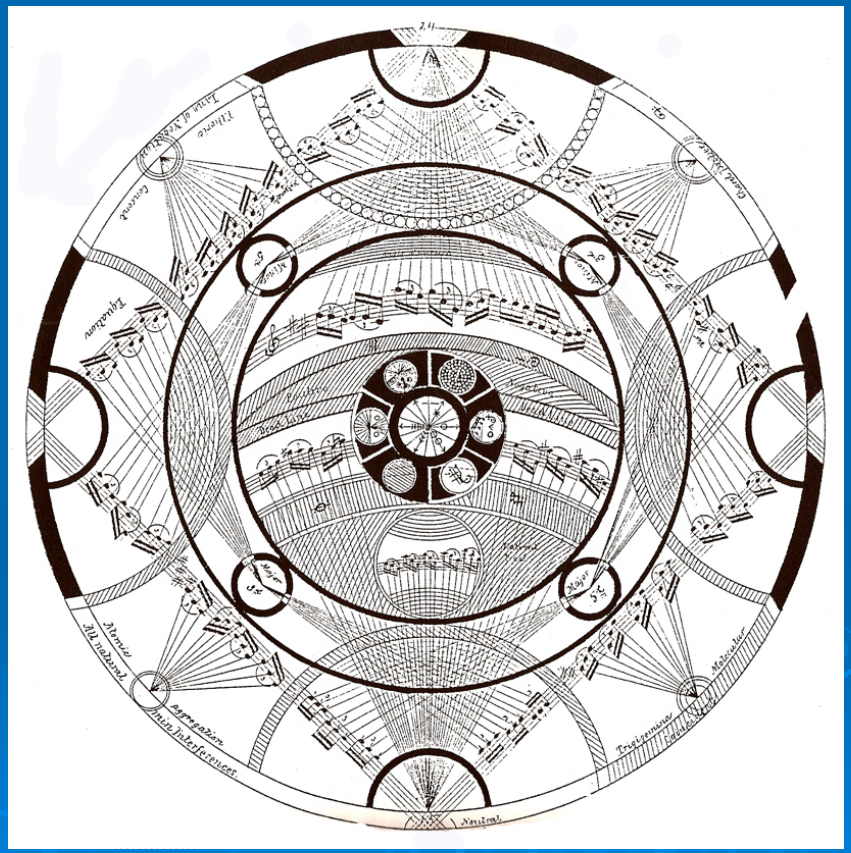
← ↑ The Sri Yantra and its Phi construction

SG201.3.9.3 Music & Mandalas (2) John Keely

In 1872, John E. W. Keely (1827 - 1898), an American inventor, announced that he had discovered a principle for power production based on the musical vibrations of tuning forks.
Of interest to us is his assertion that music could resonate with atoms, molecules or with the *ether* (which has now made a come back as "*Quantum Foam*" and "*Zero-Point Plenum*"). [◆SG202.3]
Below are two of Keely's musical *mandala* charts.



↑"*Different orders of etheric chords as associated with the Molecular, Atomic and Inter-etheric.*" **1886.**



↑ "*Quadruple settings for full Etheric circuits and the chords for Neutral Centre.*" **1880.**

SG201.3.10 The Divine Lyre in Western Culture

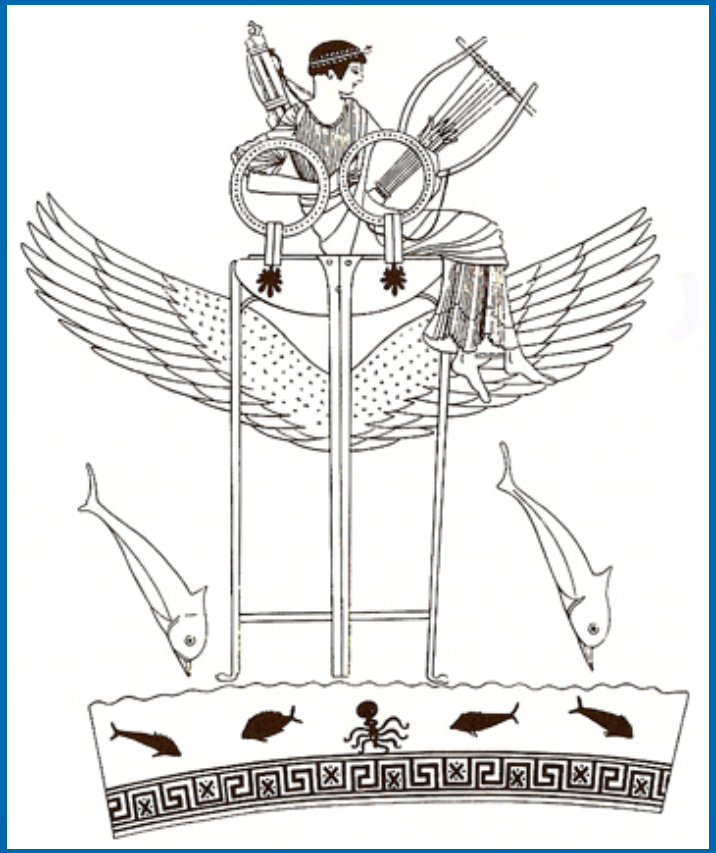
The symbol and instrument of cosmic harmony, the traditional *lyre* links heaven and earth by a mystical ladder of harmonic ratios.
The *lyre* is the paragon instrument in the tradition of western music and is associated with the following mythical heroes:

Hermes. According to legend, the *lyre* was invented by Hermes (Roman *Mercury*), son of Zeus and god of the *caduceus* staff. Hermes stretched the guts of a bull seven times across a tortoise shell. This was the *lyre* Apollo played.

Apollo. Son of Zeus and half-brother of Hermes & Artemis (Moon Goddess), Apollo is the Sun-god concerned with prophecy, music, medicine, poetry and was the patron of the 9 Muses. Following a deal with Hermes, Apollo became the sole owner of the *lyre*.
The words "*lyric*" and "*lyrical*" are derived from Apollo's lyre.

Orpheus. The son of the Muse Calliope by Apollo, Orpheus is credited to have played the lyre in such an enchanting manner that he could, at will, calm the most violent storms, still a river and charm plants, animals, humans & gods.
The "*Orphic Mysteries*" developed around his teachings. The Orphic bards were said to legislate through music alone and to strictly uphold the traditional music scales.

Pythagoras, of course, was a revered music healer & teacher.



↑ Apollo, the God of Harmony, is the personification of the Golden Mean.

"ASCENDING THE LYRE". According to Nicomachus of Gerasa (2nd century AE), the Pythagorean tuning was *"descending"* through the planetary harmonics, from Saturn to the Moon. The Greek lyre was strung with vertical strings, the deepest tone (Moon) nearest the player's head and the highest tone (Saturn) further away. A scale was played upward: thus the 7 tones would *"descend"* from heaven as the player would *"ascend"* from earth. The seven strings of the lyre were related to the 7 planets, 7 metals, 7 stars of the Pleiades… and the 7 notes of the diatonic scale. Seven is the number of Athena "*Parthenos*" (the Virgin). It is the number of magical perfection. [◆SG202.4.7]

SG201.3.11. Phi Violins of Stradivari

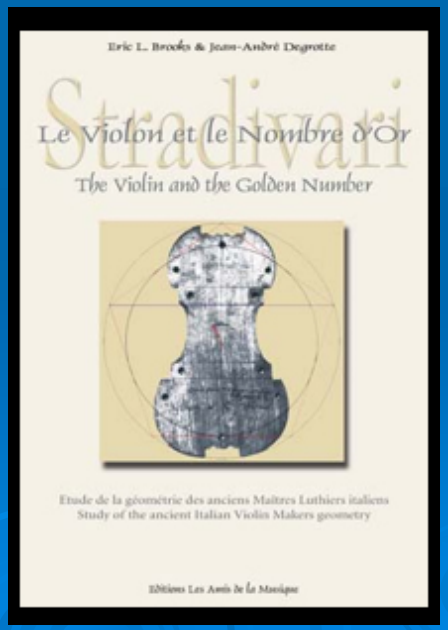
In their bilingual research book published in 2005 (*Les Amis de la Musique*, Belgium), authors Eric L. Brooks & Jean-André Degrotte propose a new step to rediscover the mode of planning for the instruments of the violin family.

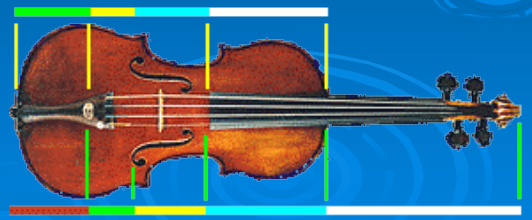
From moulds and drawings of *Stradivari* violins exhibited at the *Cremona* Museum, they proceeded to an analysis of all these documents and tried to find out if there was a unique method of planning which could report the work of Antonio Stradivari (1644 -1737), the legendary Italian violin maker.

By this process, they found the spirit, the philosophic principles and the known geometrical concepts at the time the violin appeared. As well as Stradivari did, this method, adapted to the whole violin, shows that there is a universal instrument of planning which can also supply a frame to the creation.

This universal tool is the geometry issued from the Golden Section (le "*Nombre d'Or*").

(Le Violon et le Nombre d'Or / The Violin and the Golden Number)





SG201.3.12 New Harmonic Instruments

Even fret instruments can be made "harmonic".
Guitar adjusted for Just Intonation intervals
by Jacques Dudon. //aeh.free.fr

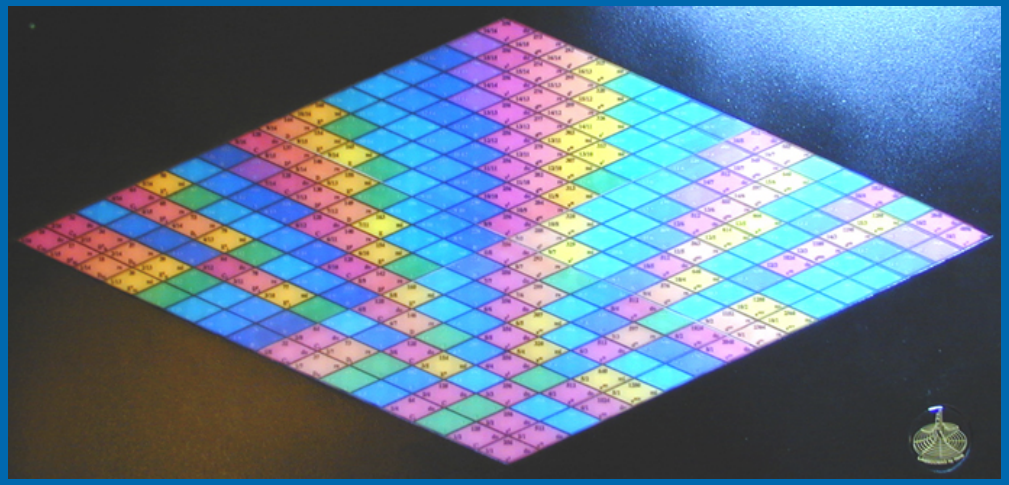
← Yuri Landman's Moodswinger.

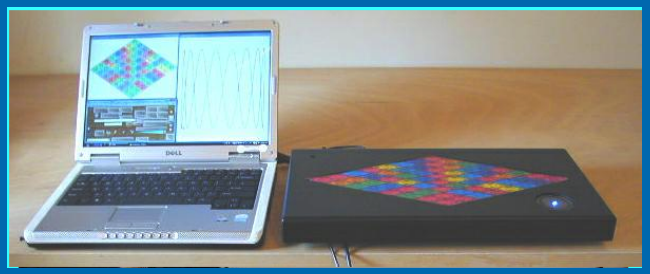
This fretless instrument is a microtonal harmonic neo-zithar using a *3rd bridge* to create *extended playing*. The 3rd bridge divides the strings into two segments with different pitches. Depending on where the string is played, a bell-like harmonic second tone is created.
The tuning of this instrument is a circle of fourths: E-A-D-G-C-F-A#-D#-G#-C#-F#-B, arranged in 3 clusters of 4 strings each.
Because of this tuning all five neighboring strings form a harmonic pentatonic scale and all seven neighboring strings form a major scale, available in every key.

//en.wikipedia.org/wiki/Yuri_Landman

↑ Buzz Kimball builds his instruments in the workshop of his barn.
www.nonoctave.com
Above, examples of the many instruments in his collection: samisen. 22 srutis electric sitar, a fretless "Plenum" guitar and a Just Intonation guitar tuned in fifths.

SG201.3.13 The Lambdoma Keyboard





↑ The 4-quadrant Pythagorean *Lambdoma Keyboard* is the result of Barbara Hero's life long study of the *Lambdoma Matrix*, an ancient grid of whole-numbered ratios attributed to Pythagoras and defining the natural relationships of music - as opposed to the man-made tempered scale (See Chapter 1).

The 256 color-coded keys / MIDI version Lambdoma Keyboard allows for: the creation of Just Intonation Scale music, the display in real time of *Lissajous* sound geometric figures (2D + 3D), the exploration of personal keynote sound frequencies, customized sound therapy as well as exciting classroom demonstrations in schools.

This new paradigm instrument opens up new levels of harmonic awareness in adults, kids and children.

The multi-faceted work of Barbara Hero will be presented in ◆SG308.

"The Pythagorean Lambdoma Harmonic Keyboard (PLHK) has the unique capability of sounding any musical interval in a matrix of harmonic frequencies in the audible range. Its diamond-shaped matrix holds 64 keys in one quadrant.

A total of 256 keys in any microtonal keynote may be played. Each keynote produces harmonic stereo intervals relating to the player's chosen keynote. Overlays of the three other quadrants in colors and frequencies of the musical notes (in a C scale) are included.
Since another set of overlays of the intervals are based upon geometrical ratios, the shapes of the musical intervals may be seen as the keys are pushed."

www.lambdoma.com

SG201.4 - Chapter 4 Musical Scales & Just Intonation

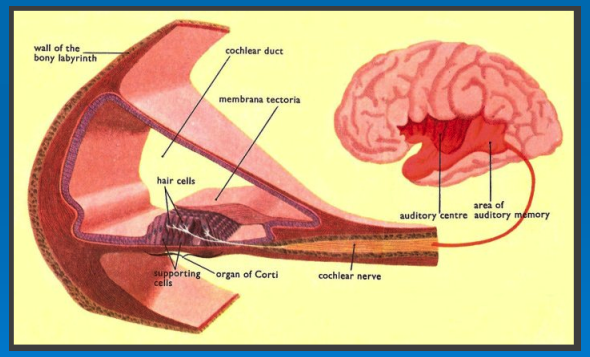
SG201.4.1.1 Physiology of Hearing (1)

In the sophisticated process of human hearing, a sound reaching the outer ear (*pinna*) is conveyed into a funnel-shaped passage to be compressed & amplified into the tapered auditory canal.

At the far end of the canal, the sound waves reach the eardrum and cause it to vibrate rhythmically. This rhythm is carried by the membrane of the eardrum to the 3 ossicles in the middle ear (*hammer*, *anvil* & *stirrup*).

The 3 ossicles function like a system of levers to double and treble the pressure of the sound waves. The sound waves then arrive at a little oval window (25 times smaller than the eardrum) which has the effect of increasing their pressure another 20 to 30 times.

In this way, the sound pressure is increased by about 150 to 200 times during its journey to the inner ear.

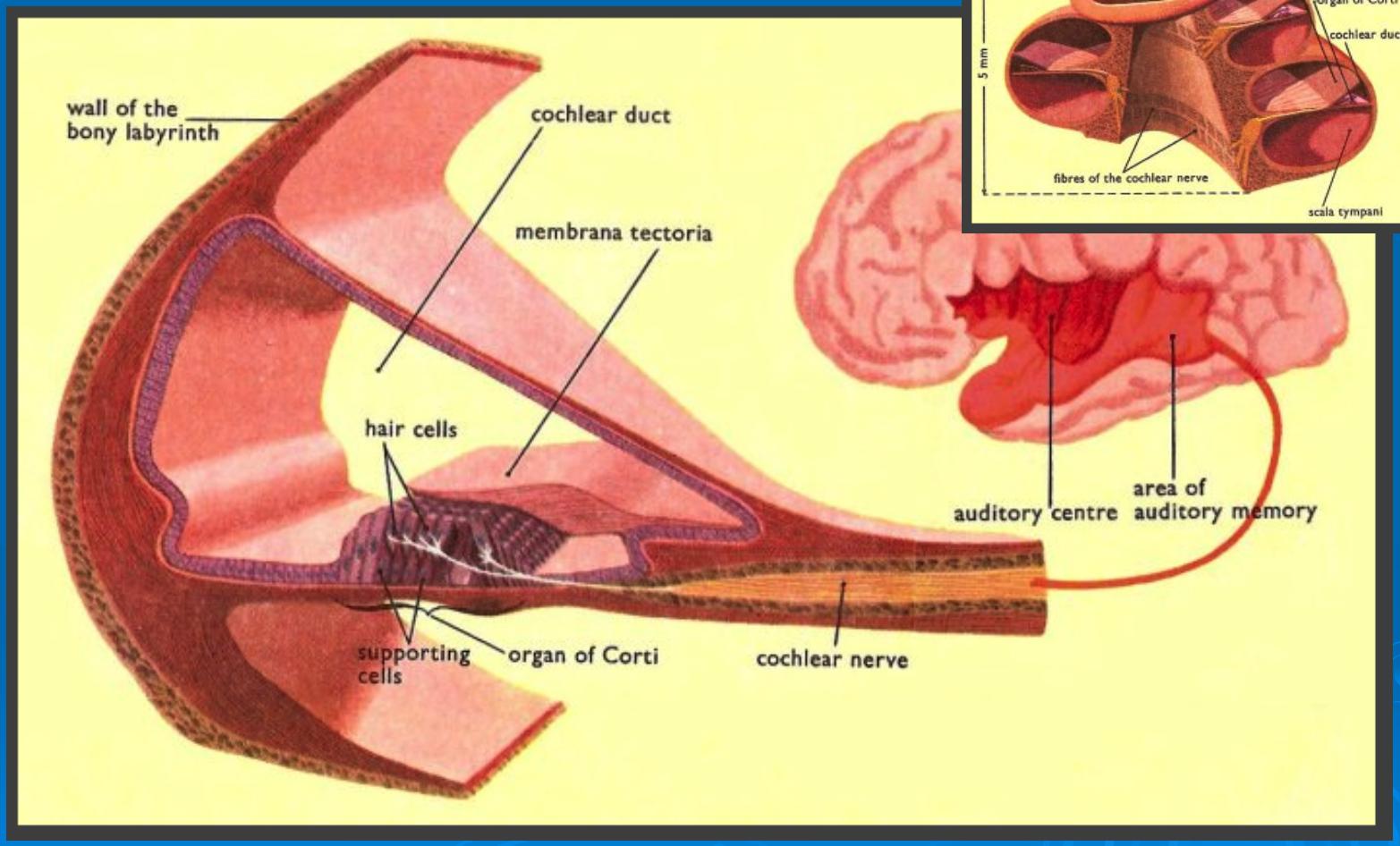


↑ The Organ of Corti looks like A harp with a keyboard. (See next slide for larger size)

The inner ear consists of the *cochlea* and the *semi-circular canal*. The system which transforms sounds into neural signals is the *organ of Corti*.
The organ of Corti is located on the basilary membrane of the cochlea and looks like a harp with a keyboard. Sound waves make thousands of small and very thin hairs (*cilia*) vibrate, whereby the differing length of these hairs is responsible for the reaction to specific frequencies, i.e. the sound pattern is sorted out according to the pitches involved.

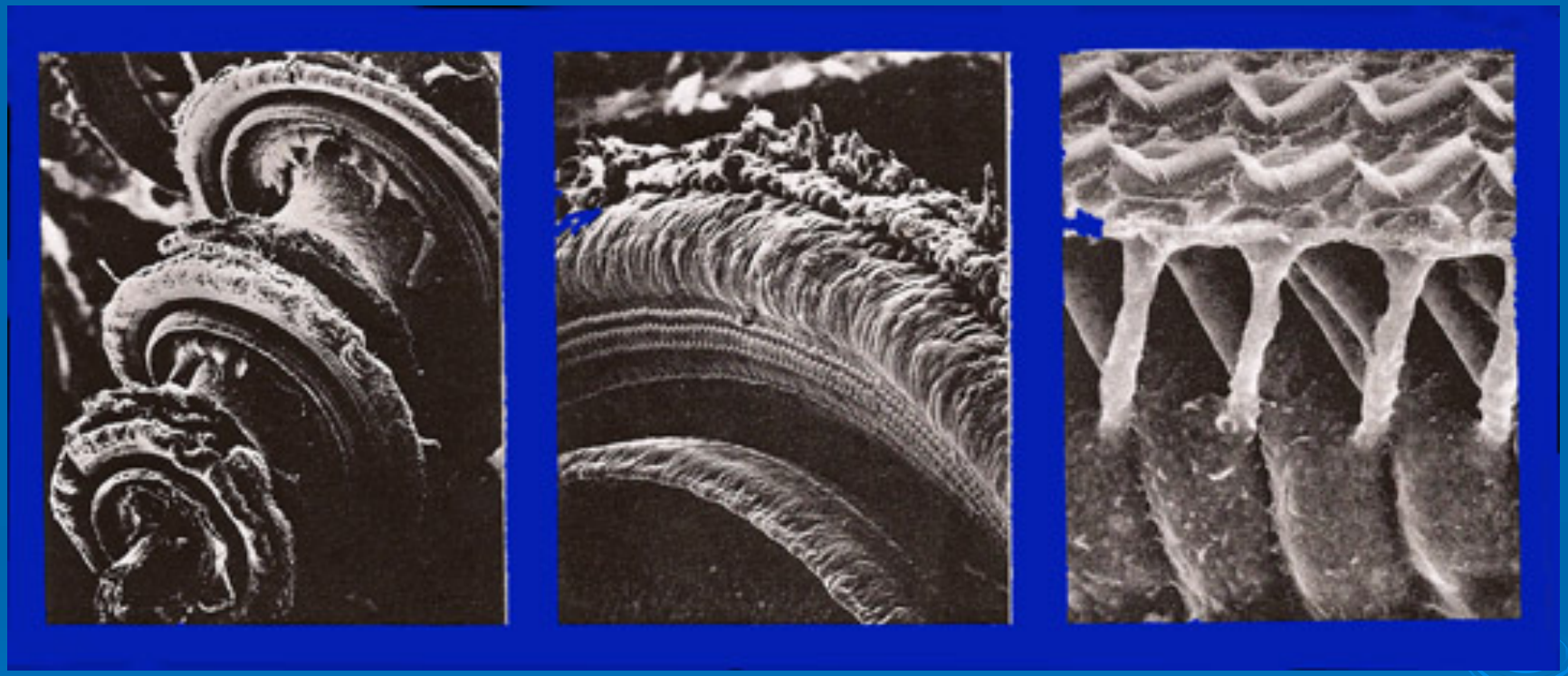
The oscillations of the cilia are scanned by nerve cells and conveyed via neurons to the cerebral cortex.

SG201.4.1.2 Physiology of Hearing (2)



↑ Cross section of cochlear duct showing part of the organ of Corti. www.daviddarling.info

SG201.4.1.3 Physiology of Hearing (3)



↑ 3 views of the cochlea, a logarithmic spiral, with increasing magnification.

Note, on the right image, The minute rows of hair cells (*cilia*).

SG201.4.2.1 Resonance & Dissonance (1)

'Resonance' and 'Dissonance' have been understood and heard differently in different musical traditions, cultures, playing styles, and time periods. Here is their brief history, in the western musical tradition:

- **Pythagoras defined a hierarchy of consonances based on how small the numbers expressing the ratio. On the other end of the spectrum, 20th-century composer and theorist Paul Hindemith's system has a hierarchy with the same results as Pythagoras's, but defined by *fiat* (arbitrary decision) rather than by interval ratios, to better accommodate equal temperament, all of whose intervals (except the octave) would be dissonant using acoustical methods.**

- **In the Middle Ages, only the octave and perfect fifth were considered consonant harmonically.**

- **In early Renaissance music, intervals such as the perfect fourth were considered dissonances that must be immediately resolved. The *regola delle terze e seste* ("rule of thirds and sixths") required that imperfect consonances should resolve to a perfect one by a half step progression in one voice and a whole step progression in another.**

- **By the end of the 15th century, imperfect consonances were no longer 'tension sonorities' but 'independent sonorities', according to Gerbert, *'although older scholars once would forbid all sequences of more than three or four imperfect consonances, we who are more modern allow them.'***

- **In 16th-century usage, perfect fifths and octaves, and major and minor thirds and sixths were considered harmonically consonant, and all other intervals dissonant.**

In the common practice period, it makes more sense to speak of consonant and dissonant chords, and certain intervals previously thought to be dissonant (such as minor sevenths) became acceptable in certain contexts. However, 16th-century practice continued to be taught to beginning musicians throughout this period.

SG201.4.2.2 Resonance & Dissonance (2)

• **In the common practice period (**i.e. 1600-1900, the period, broadly called "Classical Music", spanning the Baroque, Classical, and Romantic eras) **all dissonances were required to be prepared and then resolved, giving way or returning to a consonance. There was also a distinction between melodic and harmonic dissonance. Dissonant melodic intervals then included the tritone and all augmented and diminished intervals. Dissonant harmonic intervals included:**

➔ **minor second and major seventh**
➔ **augmented fourth and diminished fifth (enharmonically equivalent, tritone)**

• **Hermann von Helmholtz (1821–1894) defined a harmonically consonant interval as one in which the two pitches have an overtone in common (specifically excluding the seventh harmonic). This essentially defines all seconds and sevenths as dissonant, while perfect fourths and fifths, and major and minor thirds and sixths, are consonant.**

• **Lucy tuning (1990), uses a system of *ScaleCoding*, whereby intervals which are closer on the spiral of fourths and fifths are considered to be more consonant than those which are separated by a greater number of steps of fourths and fifth.**

• **David Cope (1997) suggests the concept of interval strength, in which an interval's strength, consonance, or stability is determined by its approximation to a lower and stronger, or higher and weaker, position in the harmonic series.**

• **In atonal music all intervals are considered equally consonant melodically and harmonically.**

Thus, Western musical history can be seen as starting with a quite limited definition of consonance and progressing towards an ever wider definition.
Early in history, only intervals low in the overtone series were considered consonant. As time progressed, intervals ever higher on the overtone series were considered as such. The final result of this was the so-called "emancipation of the dissonance" (the words of Arnold Schoenberg) by some 20th-century composers.

SG201.4.3 About Musical Scales & Tuning Systems

A musical scale is a set of pitches used in describing music. Typically a scale has an interval of repetition, which is normally the octave: for any pitch in the scale, there is also an equivalent pitch an octave above and an octave below it.

The most important scale in the Western tradition is the diatonic scale, but the scales used and proposed in various historical eras & parts of the world have been many and richly inventive. Except for the Pythagorean Scale, tuning systems require some compromise of the pure harmonic principles.

Scales may broadly be classified as following:

• Pythagorean tuning - based only on the perfect consonances, the (perfect) octave, perfect fifth, and perfect fourth. Thus the major third is considered not a third but a *ditone* ("*two tones*"), and is 81:64 = $(9:8)^2$, rather than the independent and harmonic just 5:4, directly below. A whole tone is a secondary interval, being derived from two perfect fifths, $(3:2)^2/2 = 9:8$.

• Just Intonation - the ratios between the frequencies for all degrees of the scale are either ratios of small integers, or obtained by a succession of such ratios. If we take the ratios constituting a scale in just intonation, there will be a largest prime number to be found among their prime factorizations. This is called the *prime limit* of the scale. A scale which uses only the primes 2, 3 and 5 is called a *5-limit scale*; in such a scale, all tones are regular number harmonics of a single fundamental frequency.

• Tempered - the scale represents an adjustment, or 'tempering', of just intonation.

• Practice-based - the scale simply reflects musical practice, as for instance various measurements of the tuning of a gamelan might do.

(*Wikipedia*)

SG201.4.4.1 What is Just Intonation?

JUST INTONATION is any system of tuning in which all of the intervals can be represented by ratios of whole numbers, preferably *small* whole numbers.

As explained on the website of the Just Intonation Network: *"Just Intonation is not a particular scale, nor is it tied to any particular musical style. It is, rather, a set of principles which can be used to create a virtually infinite variety of intervals, scales, and chords… Ultimately, it is a method for navigating through the boundless reaches of the pitch continuum—a method that transcends the musical practices of any particular culture."*

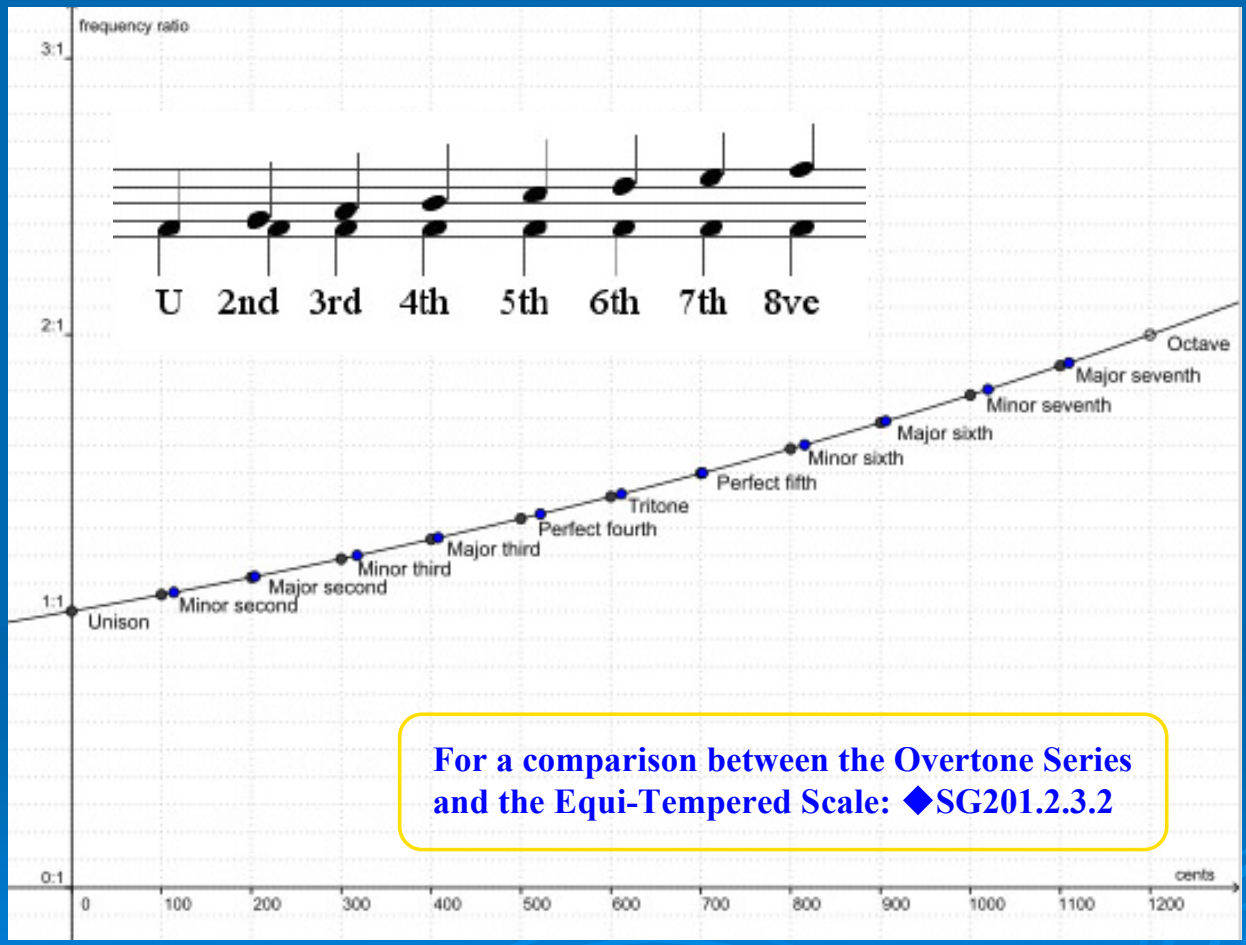
Brief History

During the 17th - 18th centuries, when Western music and instruments were rapidly evolving, musical instruments were inadequate to play the intricacies of Just Intonation. As a result, various compromises (or *temperaments)* were used. The 12-tone *Equal Temperament* was ultimately adopted because it provided the greatest facility for transposition and modulation with the smallest number of tones, and because it made all of the intervals of a given type equally out of tune, thus avoiding the contrast between in-tune and out-of-tune intervals that characterized some earlier temperaments.

"Equal temperament was not adopted because it sounded better (it didn't then, and it still doesn't, despite 150 years of cultural conditioning) or because composers and theorists were unaware of Just Intonation. The adoption of 12-tone Equal Temperament was strictly a matter of expediency. Equal Temperament allowed composers to explore increasingly complex harmonies and modulations. But this benefit was short-lived. By the beginning of this century, all of the meaningful harmonic combinations in the equally-tempered scale had been thoroughly explored and exploited, and many composers believed that consonance, tonality, and even pitch had been exhausted as organizing principles.
What was really exhausted was merely the limited resources of the tempered scale. By substituting 12 equally-spaced tones for a universe of subtle intervallic relationships, the composers and theorists of the 18th and 19th centuries effectively painted western music into a corner from which it has not yet succeeded in extricating itself."

www.justintonation.net

SG201.4.4.2 Just Intonation & Equal Temperament



For a comparison between the Overtone Series and the Equi-Tempered Scale: ◆SG201.2.3.2

← Comparison chart of frequency ratios to interval values (in cents) between the Equi-Tempered (in black) and the Just Intonation / Pythagorean (in blue) scales.

The Equi-Tempered scale is off on most of the harmonic intervals.

(1 octave = 1200 cents).

(Wikipedia)

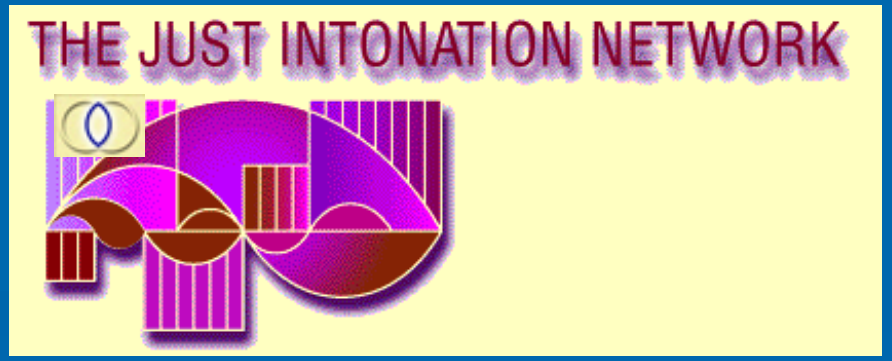
SG201.4.4.3 The Just Intonation Movement

As the 21st century progresses and the western musicians meet global music and start to recognize the value of harmonic resources and the richness of World Music in terms of harmonic scales, Just Intonation will be an increasingly important factor in shaping the future of music.

Another factor bringing Just Intonation to the forefront is the appearance of affordable electronic instruments with programmable tuning capabilities making it possible for just about any musician to explore the many new frontiers of Just Intonation.

It is now a matter of education to spread the awareness of intonation principles and their musical applications. It is to encourage this development that the Just Intonation Network was founded.

The JUST INTONATION NETWORK is a non-profit group fostering communication among composers, musicians, instrument designers, and theorists working with Just Intonation. Founded in 1984, the Network (JIN) is an international organization, with a regular journal *"1/1"*, (*" one-one"*).



In France, the "*Atelier d'Exploration Harmonique*", founded in 1983 by Jacques Dudon, a prolific instrument inventor [◆SG201.5.11] and harmonic musician, is an educational hub for "Harmonic Music" defined as "*giving back to sounds & rhythms their original world richness by offering again an infinite palette of intervals and intonation systems*".

//aeh.free.fr/

Note: Harmonic music, like most traditional world music, is necessarily a *microtonal* music i.e. music which contains intervals smaller than the conventional contemporary Western semitone. Practically, it is equivalent to Just Intonation as the term implies music containing any tuning that differs from the western 12-tone equal temperament.

Fibo	f	Temp f	Note	Chord	A = 432	Oct +	Oct -
1/1	440	440	A	Root	432	216	864
2/1	880	880	A	Octave	864	432	1728
2/3	293.33	293.66	D	4th	288	144	576
2/5	176	174.62	F	Aug 5th	172.8	86.432	345.6
3/2	660	659.26	E	5th	648	324	1296
3/5	264	261.63	C	Min 3rd	259.2	129.64	518.4
3/8	165	164.82	E	5th	162	81	324
5/2	1,100	1,108.72	C#	3rd	1080	540	2160
5/3	733,33	740.00	F#	6th	720	360	1440
5/8	275	277.18	C#	3rd	270	135	540
8/3	1,173.33	1,174.64	D	4th	1152	576	2304
8/5	704	698.46	F	Aug 5th	691.2	345.6	1382.4

SG201.4.5.1 The "A = 432" Scale (1)

← Table of the Fibonacci ratios giving the key musical frequencies.

Col 2: exact frequencies
Col 3: tempered frequencies
Col 4: Note
Col 5: Chord
Col 6: frequencies for A = 432
Col 7: higher octave
Col 8: lower octave

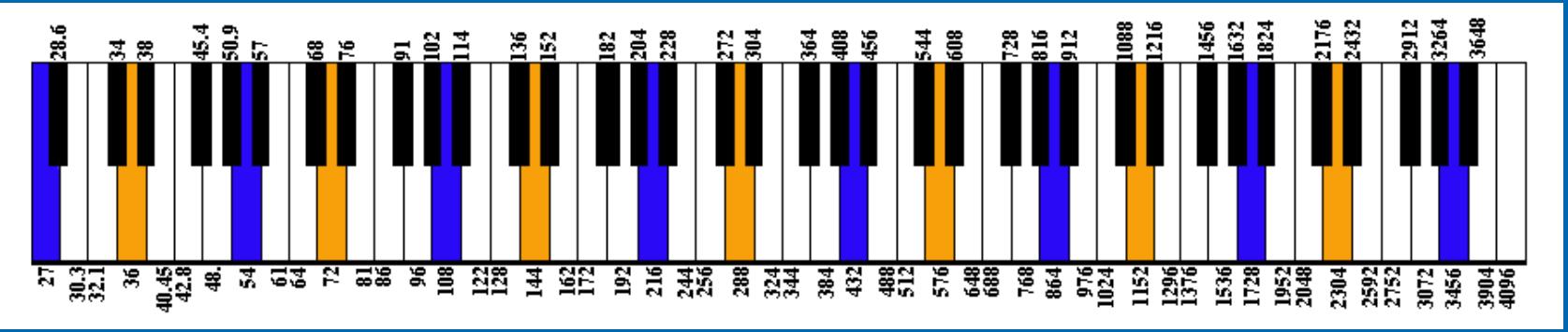
The A = 432 standard has been suggested as a tuning closer to natural rhythms. The A432 scale includes many 'canonic' numbers found in sacred numerology/geometry and sacred sites. So are the G432 or F432 scale.

Chart after Gary Meisner. www.goldennumber.net

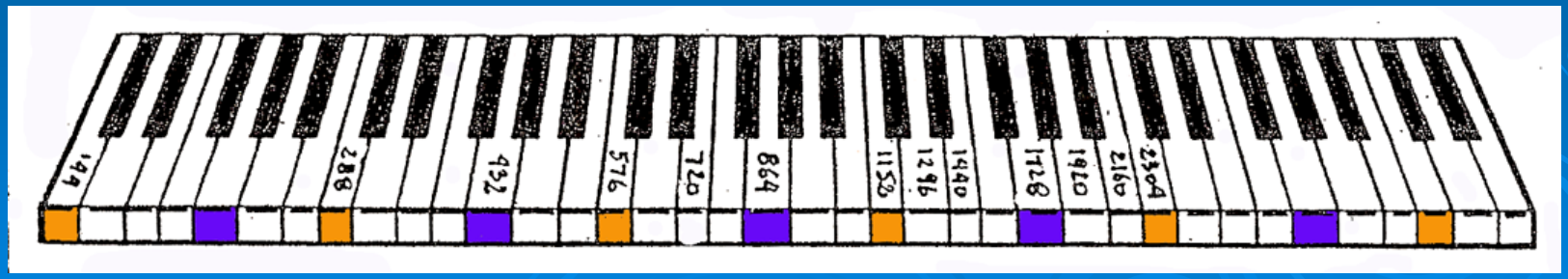
SG201.4.5.2 The "432" Scales (2)

There are many possible scales based on a "432" standard: one can use the twelfth root of 2 (1.059463094) following the tempered scale system and apply it to any note as the fundamental: mostly A, G or F. Or one can use Pythagorean ratios and intervals with various degrees of just intonation which are based on the series of overtones. Below are two examples.

In all cases, many of the numbers derived are highly significant in terms of ancient reckoning calendars, measurement systems, mythological tales, sacred sites… Basically, the 432 scale tuning points to a Sacred Geometry matrix that displays the same mathematics of growth that life follows: the values oscillate around or average to PHI. [◆SG202.6.9]



A432 tuning (tempered) on a piano keyboard. The A octaves are in Blue. The D octaves in Orange.



G432 tuning based on the Overtone Series (Natural Harmonic Scale).

SG201.4.6 The Rising of the Standard Pitch

The *pitch* is the perceived fundamental frequency of a sound or note. It is one of the three major auditory attributes of sounds along with loudness and timbre. When the actual fundamental frequency can be precisely determined through physical measurement, it may differ from the perceived pitch because of the overtones or harmonics of the sound.

The standard musical pitch has widely fluctuated in the history of western music. However there has been a clear tendency to "pitch inflation": the standard "A" pitch has risen from around 400 Hz, in the 17th century, to the now "normal" 440 Hz.

In 1917, the note A = 440 Hz was decreed the standard concert pitch by the American Federation of Musicians. It was then accepted by the US government as its standard. And, in 1939, A = 440 Hz was adopted as an international standard, the so-called *"standard concert pitch".*

Few people realize that this was the imposition of an artificial decision by a few that now heavily bears upon the collective consciousness of the global culture as western music, in its electronic/digital formats, is reaching out to the entire world. We are living in a music culture that is doubly off: first by using a "tempered" or conveniently flattened music scale and second by using a standard pitch that has been raised to an artificial level. "Western" music is now in dissonance with the natural rhythms of the cosmos and the earth, of nature and of the human body's physiology.

1699 - A404 Paris Opera
1711 - A423.5 John Shore
1751 - A422.5 Handel's own fork
1780 - A421 Stines for Mozart
1811 - A427 Paris Grand Opera
1831 - A431 Helmholz pitch
1859 - A435 French Pitch
1885 - A436.5 Vienna Opera
1896 - A439 Philharmonic Pitch

"My experience is that, as overall pitch moves upwards, the feeling of music becomes more of a head experience, while as overall pitch is lower, the feeling of music becomes more of a heart experience.
As pitch moves up, music and rhythmic elements tend to become more frantic".

Patrick Thilmany, Music researcher

SG201.4.7.1 The Solfeggio Scale (1)

Joseph S. Puleo & Leonard G. Horowitz, in their 1999 book *Healing Codes*, uncovered evidence of a missing "S*olfeggio*" musical scale. According to them, this set of six sound frequencies was hidden by the Church in the "Bible Apocrypha", in order to des-empower the masses. The missing notes were part of the original Gregorian Chanting and were imparting spiritual blessings when sung in harmony.

As a "*secret tone scale*", the Solfeggio tones are vibrating at the "*exact frequencies required to transform spirit to matter and matter to spirit*", using the vibrational power of 3 - 6 - 9 (See next page). For example, the 3rd note, frequency 528, relates to the note MI on the scale and derives from the phrase "*MI-ra gestorum*" (Latin = "*miracle*"). Interestingly, this is the exact frequency used by genetic biochemists to repair broken DNA – the genetic blueprint upon which life is based!

Note	Ancient Latin Name	Translation	Frequency
UT	Utqueant laxis	Liberating guilt and fear	396 Hz
RE	Resonare fibris	Undoing situations and facilitating change	417 Hz
MI	Mira gestorum	Transformation and Miracles (DNA repair)	528 Hz
FA	Famuli tuorum	Connecting/Relationships	639 Hz
SOL	Solve pollute	Solutions/Expression	741 Hz
LA	Labii reatum	Awakening Intuition	852 Hz

Listen to the 6 Solfeggio frequencies

www.biowaves.com

The Solfeggio sequence of notes is now recognized as an extremely unique series of sound frequencies that include harmonic sequences similar to those found in the "*Music of the Spheres*". The Solfeggio sequence displays interrelated, mathematically symmetrical numbers with reoccurring ratios. It looks like a "code".

Examples: 639 / 396 = 1.61363636… 852 / 528 = 1.61363636…

(More symmetries are shown further…)

SG201.4.7.2 The Solfeggio Scale (2)
3, 6 and 9

Applying Digital Reduction (◆SG202) to the six *Solfeggio* frequencies yields the root numbers 3, 6 & 9.

Ut = 396 = 9	**Fa = 639 = 9**
Re = 417 = 3	**Sol = 741 = 3**
Mi = 528 = 6	**La = 852 = 6**

John Keely, a pioneer in Harmonics [◆SG201.3.9.3], wrote that the vibrations of "*thirds, sixths, and ninths were extraordinarily powerful.*"

In fact, he proved that the "*vibratory antagonistic third" was "thousands of times"* more forceful in separating hydrogen from oxygen in water than heat.

In his "*Formula of Aqueous Disintegration*" he wrote that, "*in molecular dissociation or disintegration of both simple and compound elements, whether gaseous or solid, a stream of vibratory antagonistic thirds, sixths, or ninths, on their chord mass will compel progressive subdivisions. In the disintegration of water the instrument is set on thirds, sixths, and ninths, to get the best effects.*"

[On the "Pulse of 3 - 6 - 9", see ◆SG202.6]

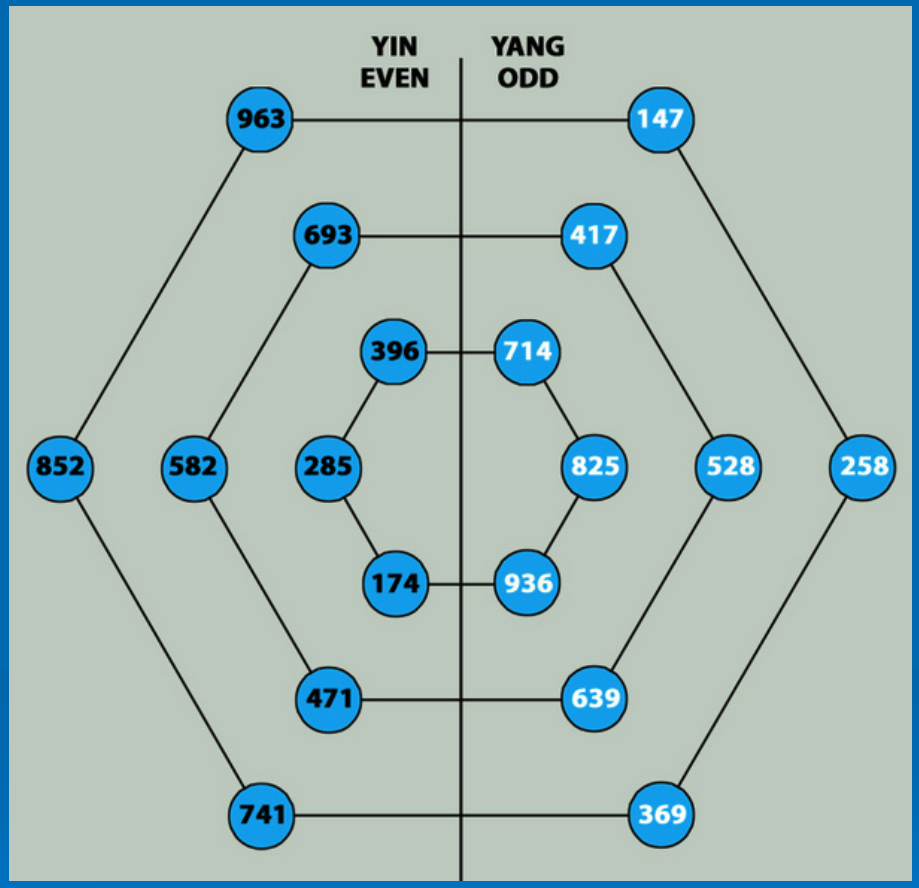
"If you only knew the magnificence of the 3, 6 and 9, then you would have a key to the universe."
(Nikola Tesla).

↑ The Solfeggio frequencies are permutations of the 9 integers.

37	78	29	70	21	62	13	54	5
6	38	79	30	71	22	63	14	46
47	7	39	80	31	72	23	55	15
16	48	8	40	81	32	64	24	56
57	17	49	9	41	73	33	65	25
26	58	18	50	1	42	74	34	66
67	27	59	10	51	2	43	75	35
36	68	19	60	11	52	3	44	76
77	28	69	20	61	12	53	4	45

↑ A coincidence?
The magic constant (sum) for the 9 x 9 Magic Square of the Moon = 369.

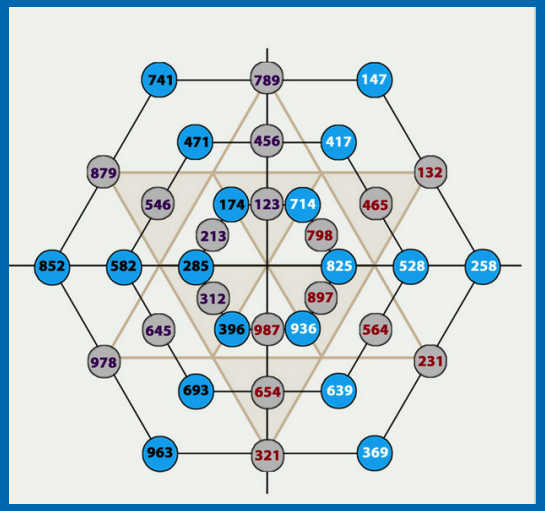
SG201.4.7.3 The Solfeggio Scale (3) Expansions



Mirror symmetric expansion of the Solfeggio frequencies. (Abrahadabra Institute).

"Each hexa-ring of six tones adds up to 3330…
Any L/R polar pair adds up to 1110...
The total of all 18 tones equals 9990...
444, 555, 666 also make 'mean radial' appearances…"

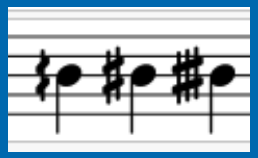
www.abrahadabra.com



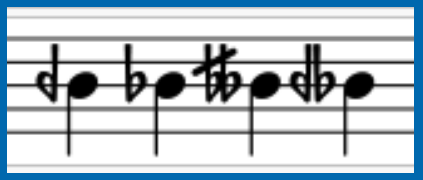
↑ **Expansion to 36**

↑ **"Solfeggio" Tuning Forks**

SG201.4.8 Harmonics as Microtones



↑ Half sharp / Sharp / Sharp-and-a-half



↑ Half flat / Flat / Flat-and-a-half (2 variants)

Microtones, being smaller than a semi-tone, multiply the harmonic possibilities.

The following systems are considered to be microtonal: a diatonic scale in any meantone tuning (a modified Pythagorean tuning); the traditional Carnatic system of *22 śruti*; much Indonesian gamelan music; Thai, Burmese, and African music using seven tones in each (approximate) octave; and blues and/or rock music which makes extensive use of *blue notes*.

All music using just intonation, meantone temperament, or other alternative tunings is microtonal. Microtones carry the resonant cascade of harmonics.

Note	C	D ♭	D ♭	D	D	E ♭	E ♭	E	E	F	F	F♯
Ratio	$\frac{1}{1}$	$\frac{256}{243}$	$\frac{16}{15}$	$\frac{10}{9}$	$\frac{9}{8}$	$\frac{32}{27}$	$\frac{6}{5}$	$\frac{5}{4}$	$\frac{81}{64}$	$\frac{27}{20}$	$\frac{4}{3}$	$\frac{45}{32}$
Cents	0.00	90.22	111.73	182.40	203.91	294.13	315.64	386.31	407.82	519.55	498.04	590.22

Note	F♯	G	A ♭	A ♭	A	A	B ♭	B ♭	B	B	C
Ratio	$\frac{64}{45}$	$\frac{3}{2}$	$\frac{128}{81}$	$\frac{8}{5}$	$\frac{5}{3}$	$\frac{27}{16}$	$\frac{16}{9}$	$\frac{9}{5}$	$\frac{15}{8}$	$\frac{243}{128}$	$\frac{2}{1}$
Cents	609.78	701.96	792.18	813.69	884.36	905.87	996.09	1017.60	1088.27	1109.78	1200.00

↑ An example of a microtonal scale: the Indian 22 Srutis. (*Wikipedia*)
Ancient Vedic music texts explain "22" as being "*beyond the Sun and the Moon*".

SG201.4.9 Table of Interval Systems

Common diatonic name	Comparable just interval	equal temperament	just intonation
perfect unison	1:1 ●	0	0
minor second	16:15	100	112
major second	9:8	200	204
minor third	6:5	300	316
major third	5:4	400	386
perfect fourth	4:3 ●	500	498
augmented fourth diminished fifth	45:32 64:45	600	590 610
perfect fifth	3:2 ●	700	702
minor sixth	8:5	800	814
major sixth	5:3	900	884
minor seventh	16:9	1000	996
major seventh	15:8	1100	1088
perfect octave	2:1 ●	1200	1200

↑ The blue dots mark the main harmonic chords.

← This table shows the musical intervals for the main chords of the diatonic scale.

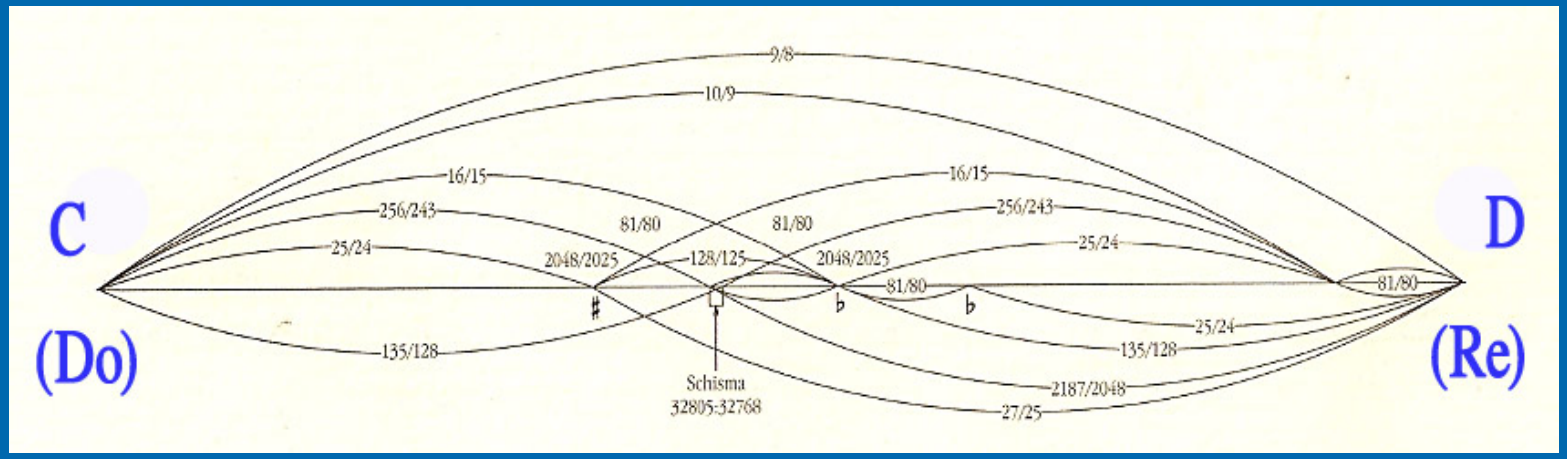
The most harmonic intervals & chords are marked with a blue dot. They are the ratios of the lowest whole numbers (1-2-3-4): 1:1 (unison), 2:1 (octave), 3:2 (Fifth) and 4:3 (fourth).

Column #3 gives the exact 1/12th division of the equal temperament system of 1200 "cents".

Column #4 gives the "just intonation" tuning for the interval ratio.

Note that the equal temperament is "detuned" with reference to just intonation, sometimes a little, sometimes a lot.

SG201.4.10 The Music Field: Infinite Harmonics



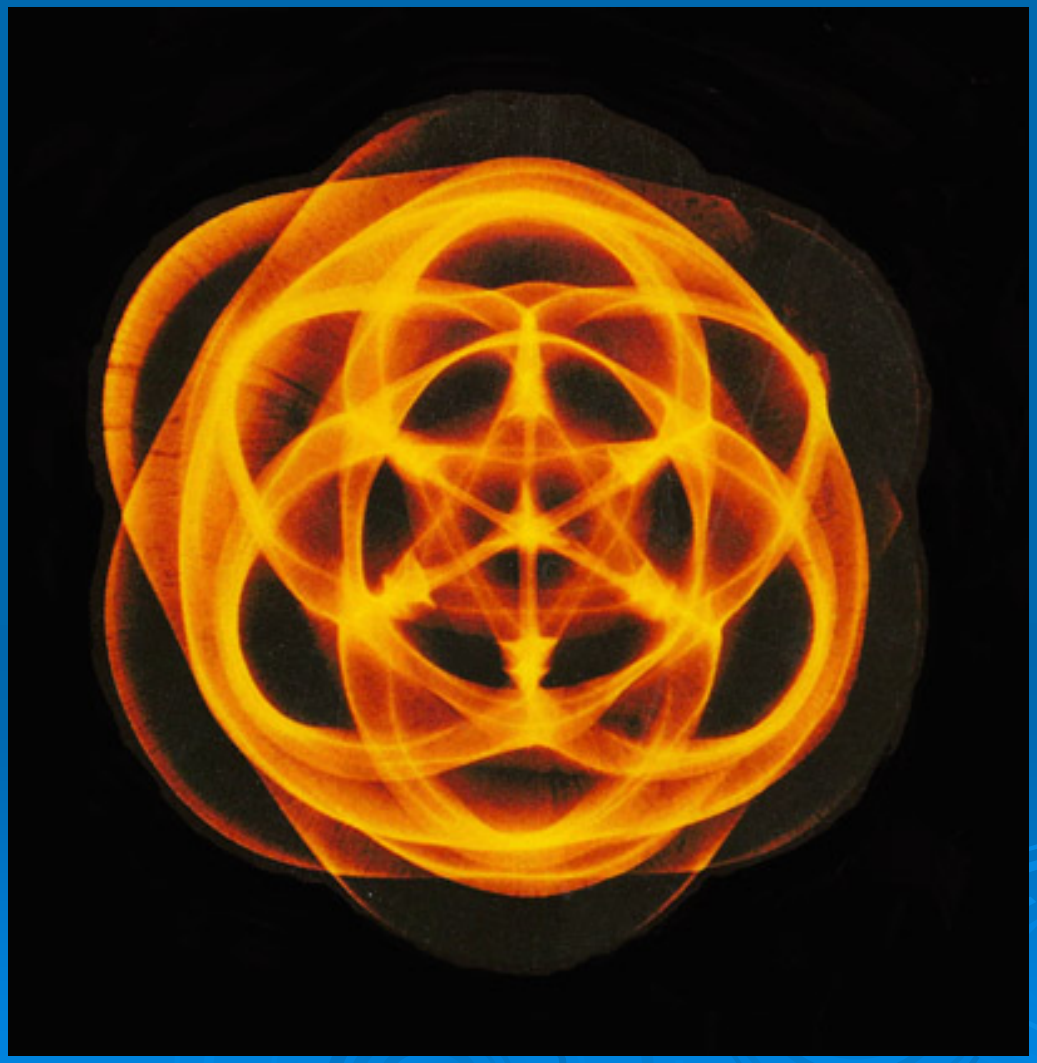
↑ **Diagram showing some of the harmonic ratios and potential microtones in the resonant music field between "C" and "D". (Anthony Ashton. *Harmonograph*. Wooden Books. 2003)**

The Western description of "*flats*" being the "*sharps*" of the previous notes is a gross lie that steals from us most of the universe. We are denied the subtle sonic textures of Nada Brahma! This is heavenly raw food!

Just like the Zero Point Quantum Plenum is thriving with immense vortex energy, the Cosmic Music Field is thriving with endless spirals of harmonic ratios…

The New Paradigm shouts:
Look between the musical notes,
Look between apparently solid objects.
Look beyond your body-suit octave:
in this "void" resides the dynamic dance of creation.

SG201.5 - Chapter 5 Cymatics, Yesterday & Today

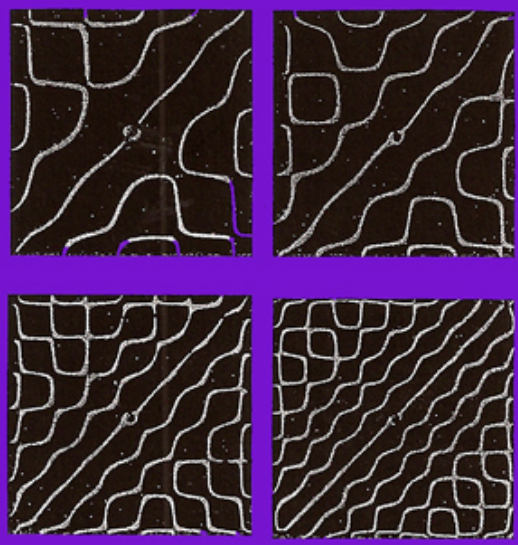


SG201.5.1 Cymatics - Introduction

Cymatics (Greek *kuma* = wave) is the study of wave-forms in fluid materials, as they are created and modulated by sound frequencies.

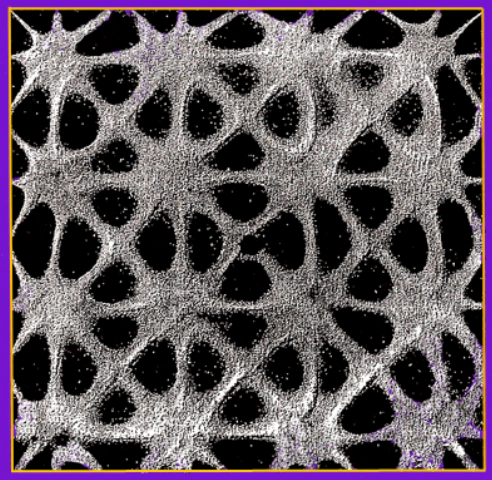
The word was coined by Swiss 'Renaissance Man' artists-scientist Dr. Hans Jenny (1904-1972) who carried extensive and well documented research into these phenomena. He published the results of his investigations along with his own insights in two books: *Cymatics I* (1967) and *Cymatics II* (1972).

The relationship between frequencies and forms is a fascinating subject because it can demonstrate visually the dynamic process of Sacred Geometry - specially in the domain of pure geometric music ratios.



Quartz sand vibrated by a crystal oscillator. The pattern becomes more elaborate as the sound frequencies rise higher:

1,690 Hz 2,500 Hz
4,820 Hz 77,800 Hz



↑ Cymatic "sonorous figure".
Frequency 6,700 Hz.
Nodal lines of sand pile up like dunes.

Images credit:
Hans Jenny. *Cymatics.*
Macromedia. 2001.

Specific materials subjected to specific frequencies will assume specific shapes. A given form can only be created by a given frequency. Physical forms respond directly to frequencies - and so does the entire fabric of physical "reality".

Lawrence Blair in his *Rhythms of Vision* (1975) notes: "*The intriguing point about Cymatics is that 'inorganic' matter vibrated simply with sounds produces 'organic' shapes, both moving and static.*"

http://www.cymaticsource.com/

SG201.5.2.1 Cymatics - Early History (1)

• The origins of Cymatics can be traced back at least 1000 years to African tribes who used the taut skin of drums sprinkled with small grains to divine future events. The effects of sand on a vibrating drum-head have probably been known for millennia.

• Leonardo Da Vinci (1452-1519) noticed that vibrating a wooden table on which dust lay created various shapes.
'I say then that when a table is struck in different places the dust that is upon it is reduced to various shapes of mounds and tiny hillocks. The dust descends from the hypotenuse of these hillocks, enters beneath their base and raises itself again around the axis of the point of the hillock.'

• Galileo Galilei (1564-1642) described scraping a brass plate with a chisel and noticed a *'long row of fine streaks, parallel and equidistant from one another*,' presumably caused by the brass filings dancing on the surface of the plate and finding safe haven in a series of parallel nodal striations.

• Robert Hooke (1635-1703) was an English scientist of Oxford University who made contributions to many scientific fields including mathematics, optics, mechanics and astronomy. Hook devised a simple apparatus in 1680 consisting of a glass plate covered with flour that he 'played' with a violin bow.

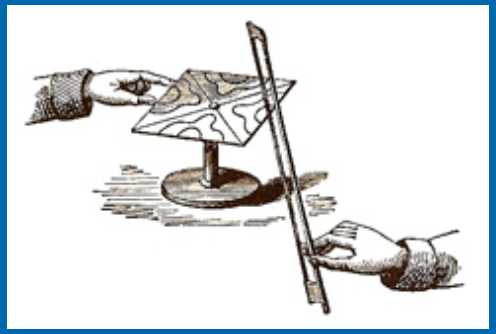
(For reference: 1756, the year Mozart was born - 1827, the year Beethoven died).

• 1787 - German physicist Ernst Chladni found that if a violin bow vibrated a plate sprinkled with fine sand definite visual patterns would appear in the sand. Chladni held the plate between his fingers to set up a node around which symmetrical wave patterns were created.

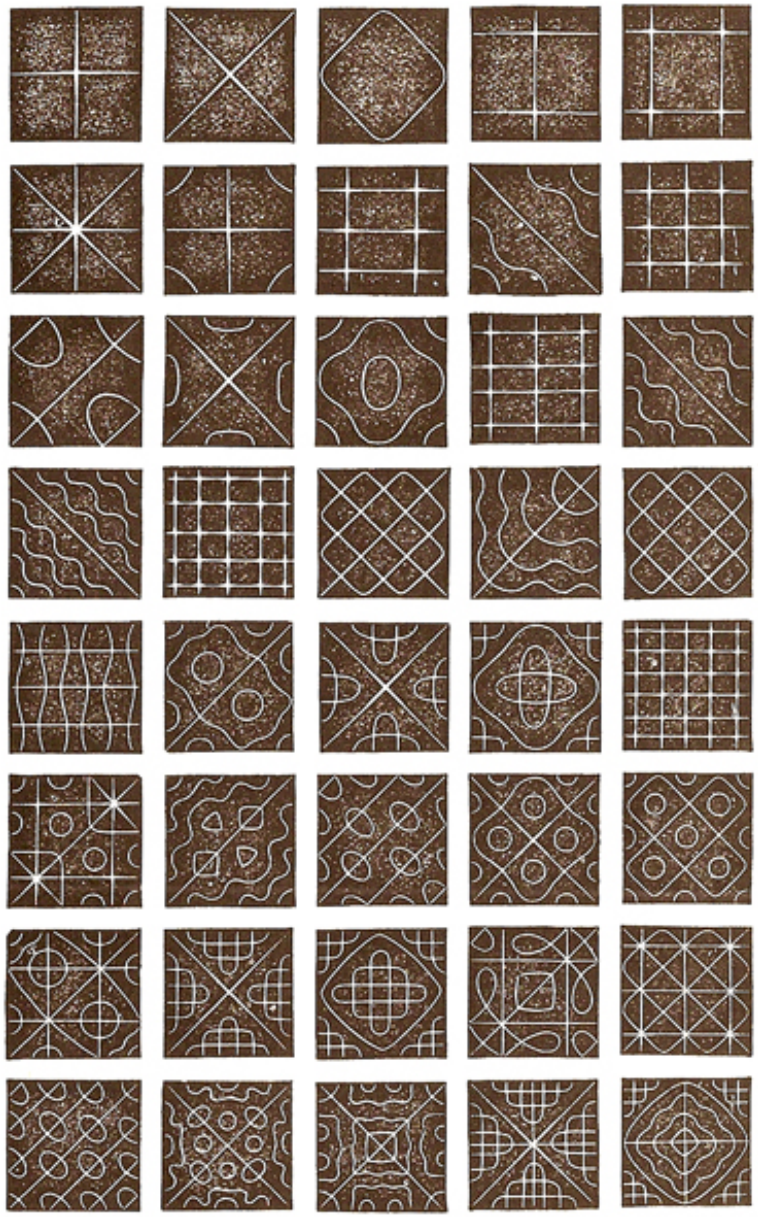
Harmonic notes would create clear geometries
while disharmonic notes would produce fuzzy patterns or just some chaos.

Chladni even discovered that his sand particles formed shapes in response to a violin played in the next room.

SG201.5.2.2 Cymatics - Early History (2) Chladni

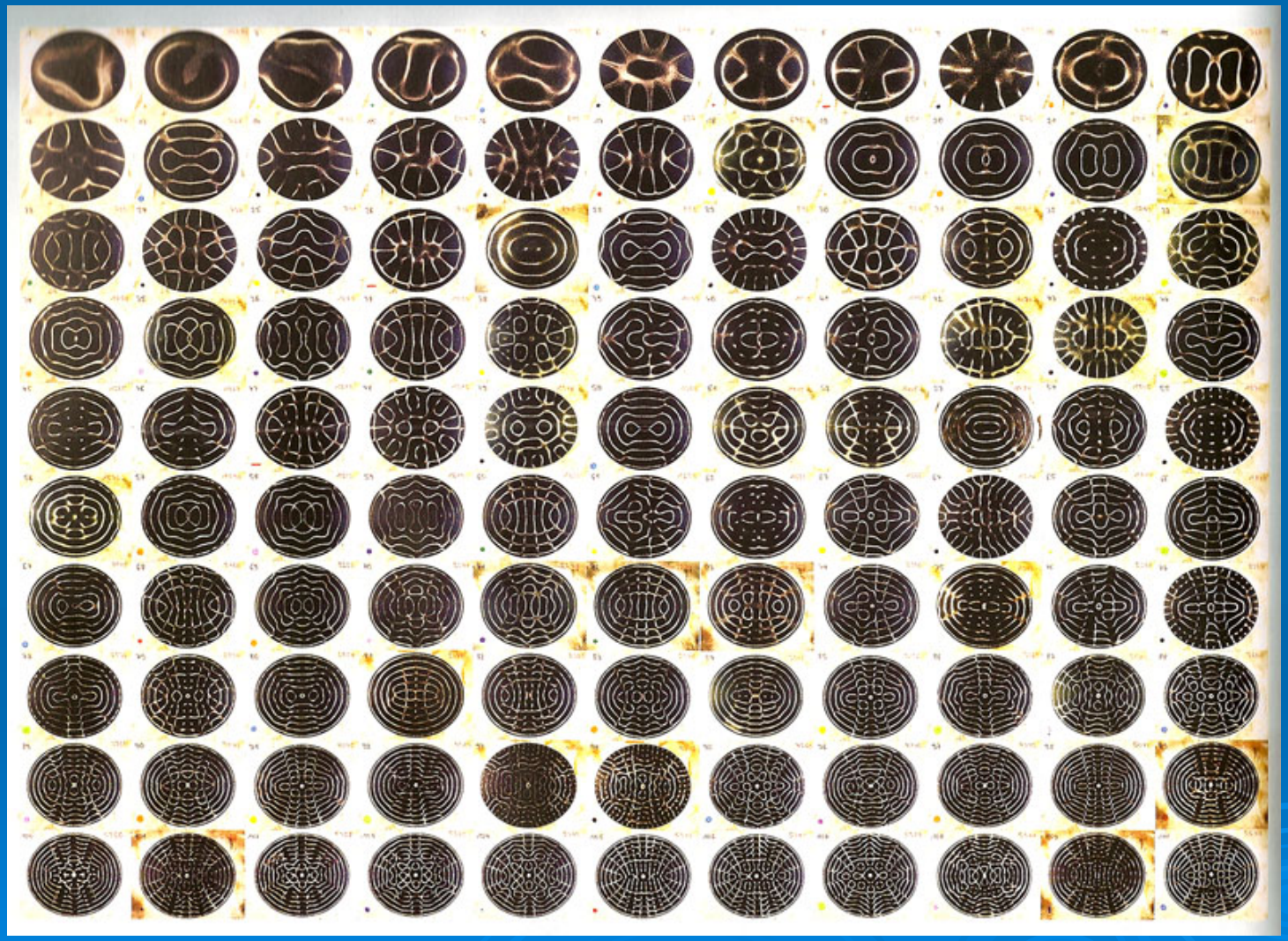


↑ The set up used by Chladni: square plate and violin bow



← A set of *"Chladni Figures"*.

SG201.5.2.3 Cymatics - Early History (3) Chladni (2)



Lauterwasser. *Images Sonores d'Eau*. Medicis. Paris. 2002.

↑ Contemporary Chladni figures. 100 - 20,000 Hz.

SG201.5.2.4
Cymatics - Early History (4)

• 1800s. Professor Seydley Taylor used his "*phoneidoscope*" to produce images of sounds through soap bubble films. Whirls of colored figures would respond to sustained notes voiced into the device.

• 1827 - Sir Charles Wheatstone invented a "*philosophical toy*" he named the "*kaleidophone*". With this device (fixed on one end), a surprising number of harmonic patterns can be recorded.

• 1844 - Professor Blackburn invented the "*harmonograph*", an instrument drawing complex & fascinating pictures of musical harmonies.
The harmonograph uses a pendulum apparatus.

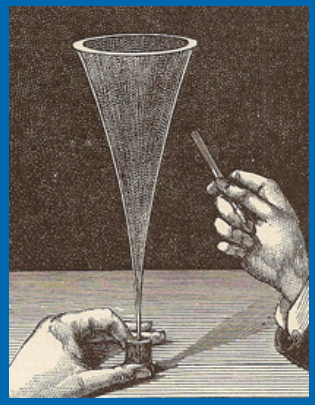
• 19th century. English physicists Michael Faraday and Lord Raleigh were fascinated by nodal phenomena. Faraday's diary records many experiments in which he studied the effects of vibrations ("*crispations*") on water, oil and fine grains.
Lord Raleigh's major treatise, *'Theory of Sound*,' in two volumes, includes a chapter on the '*Vibrations of Plates*'.

• 1857 - J. A. Lissajous invented a graph system of curves for harmonic motion.

• 1875 - Sir Thomas Bazley created harmonic patterns.

• 1880s - Margaret Watts-Hughes, a singer, invented the "*eidophone*", a device consisting of a hollow base with a membrane stretched across it and a mouthpiece. As she sang, lycopodium powder on the membrane would suddenly come to life creating various geometries, organic shapes and flower-like patterns.

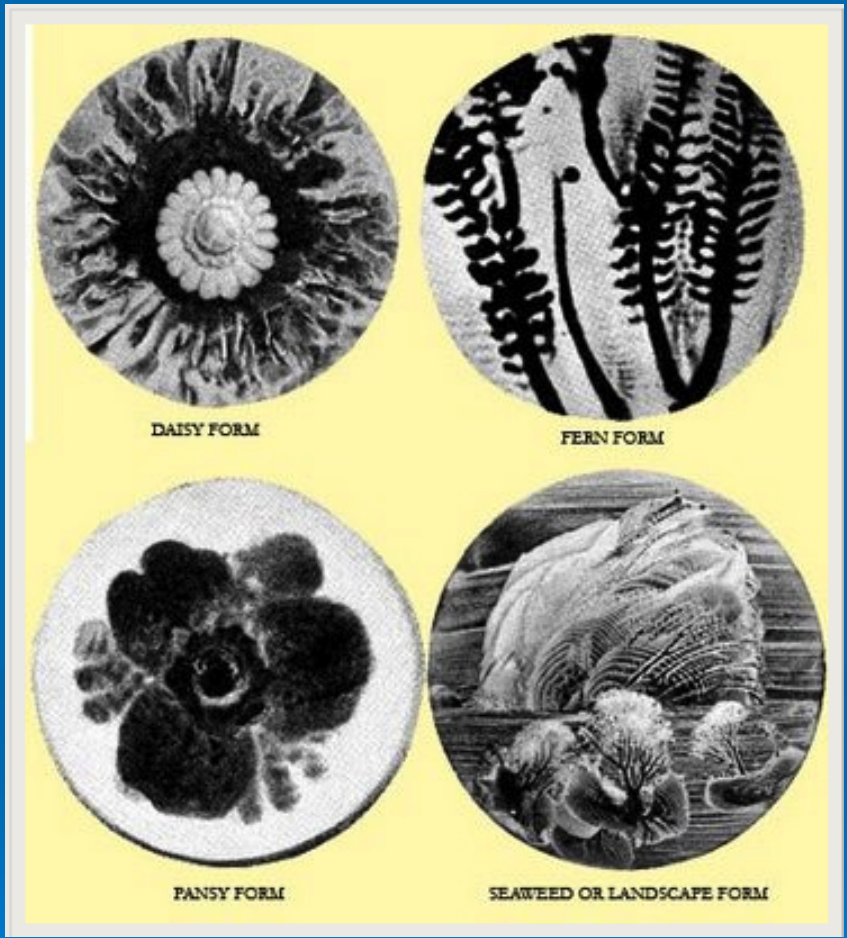
• 1950s - Hans Jenny, a Swiss scientist and artist, coined the term "*cymatics*". His landmark book "*Kymatik-Wellen und Schwingungen*" was published in 1967 to share his in-depth study of the world of rhythmic vibrations.
He used crystal oscillators in his experiments. Jenny also invented a "*tonoscope*" which transformed sounds into their visual representations on a screen.



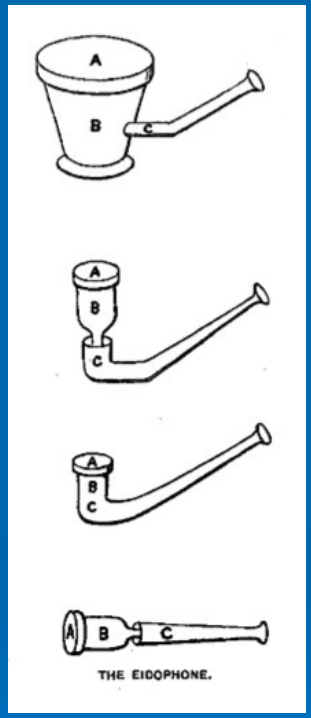
The Kaleidophone

Harmonograph

SG201.5.2.5 Cymatics - Early History (5) The Eidophone

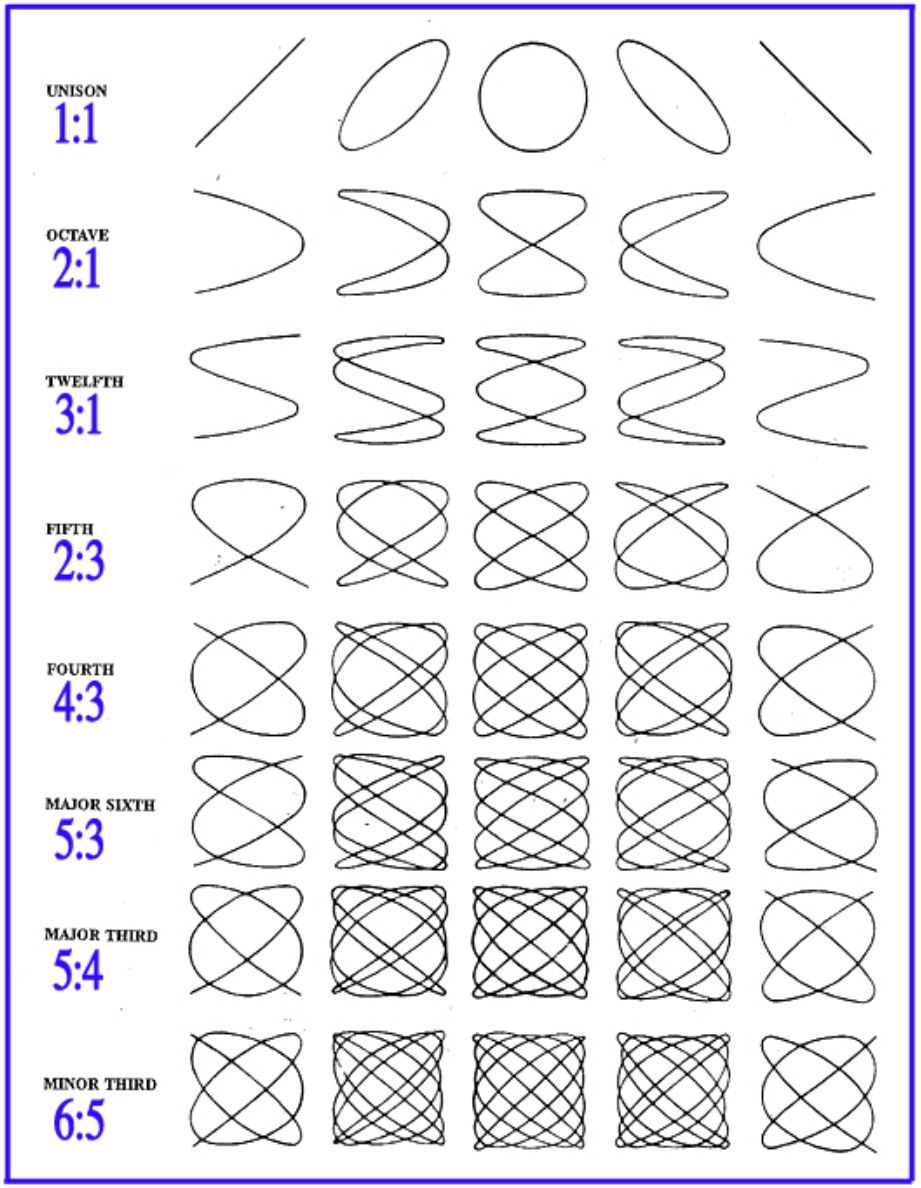


↑ Some of the original figures created by Margaret Watts-Hughes through her Eidophone.



← The original Eidophone device.

↑ Eidophone's voice figures



SG201.5.2.6 Early Cymatics - The Lissajous Figures

In mathematics, a Lissajous curve or Bowditch curve, is the graph of the system of parametric equations which describes complex harmonic motion. This family of curves was investigated by Nathaniel Bowditch in 1815, and later in more detail by Jules Antoine Lissajous in 1857.

Prior to computer graphics, Lissajous curves were typically generated using an oscilloscope. Two phase-shifted sinusoid inputs are applied to the oscilloscope in X-Y mode and the phase relationship between the signals is presented as a Lissajous figure.

Lissajous curves can also be traced mechanically by means of a harmonograph.

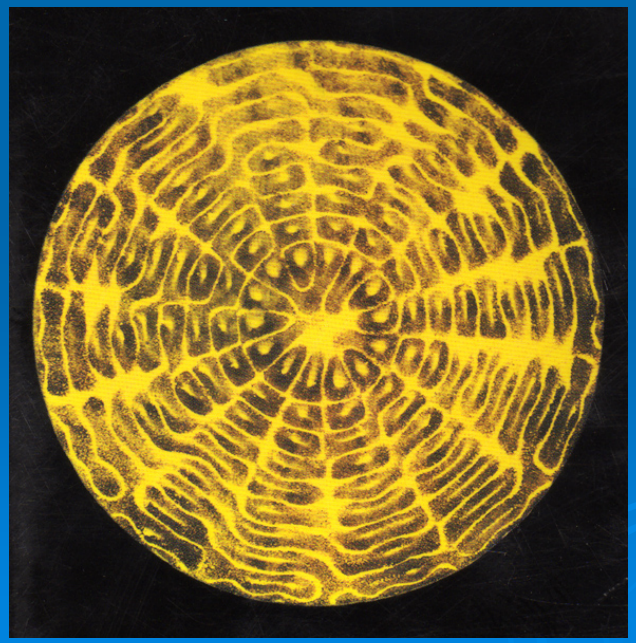
← Lissajous figure for the octave on an oscilloscope.

SG201.5.3.1 Cymatics - Hans Jenny (1)

Hans Jenny (1904-1972) was a 20th century Renaissance Man, a "whole brain" person.

Although his training and primary profession was that of a family physician in Switzerland (hence the scientific "left brain" methodology in his research), his right brain and keen eyes were trained in the Goethean way of observing nature (specially animals) and searching for the hidden cosmic principles of life in all fields of knowledge, from organ playing to ornithology.

When he was 14 years old, Jenny was fascinated by the *Goethaneum*, the sacred geometry structure built by Rudolph Steiner, the founder of Anthroposophy.



Pursuing his study of Steiner's spiritual wisdom, Jenny was already lecturing about Anthroposophy before he had even completed medical school.

His pioneering experimentation with a whole new field of science (*"Cymatics"*) stemmed from Jenny's eagerness to open the eyes of others to the underlying periodic phenomena and harmonic principles in nature.

Nowadays, *Cymatics* is attracting a passionate interest from artists, mystics, quantum physicists, mathematicians, musicians and sound healers.

"Dr. Jenny's cymatic images are truly awe-inspiring, not only for their visual beauty in portraying the inherent res-ponsiveness of matter to sound (vibration) but because they inspire a deep re-cognition that we, too, are part and parcel of this same complex and intricate vibrational matrix - the music of the spheres!"

Macromedia

SG201.5.3.2 Cymatics - Hans Jenny (2)

A Triadic cosmology & Whole Systems view

"Wherever we look in nature, animate or inanimate, we see widespread evidence of periodic systems. These systems show a continuously repeated change from one set of conditions to another, opposite set." **Hans Jenny.**

Jenny describes these polar phenomena in the context of a three-part unity: the primordial generative power is in the vibration which sustains phenomena with its harmonic periodicity between two poles. One polarity is form, the pattern of shape. The other polarity is motion, the dynamic process.
These three fields - vibration and periodicity as the ground field, and form and motion as the two poles - constitute an indivisible whole. Jenny was a forerunner of Systems Theory: he always sought to understand the whole and the relationship of the parts to the whole (Golden Ratio), knowing that the whole is greater than the sum of its parts. ***"If we comprehend the wholeness of vibration or oscillation, and grasp the totalities in which it manifests, then we have caught hold of reality."***

In the closing chapter of his book *Cymatics*, Jenny states:

> ***"In our research we move towards a creative world, towards a world-creating power… We ARE in reality, this mystery; in it we BECOME; it is not that man simply IS, he is BECOMING all the time with an ever fuller and fuller consciousness."***

www.cymaticsource.com

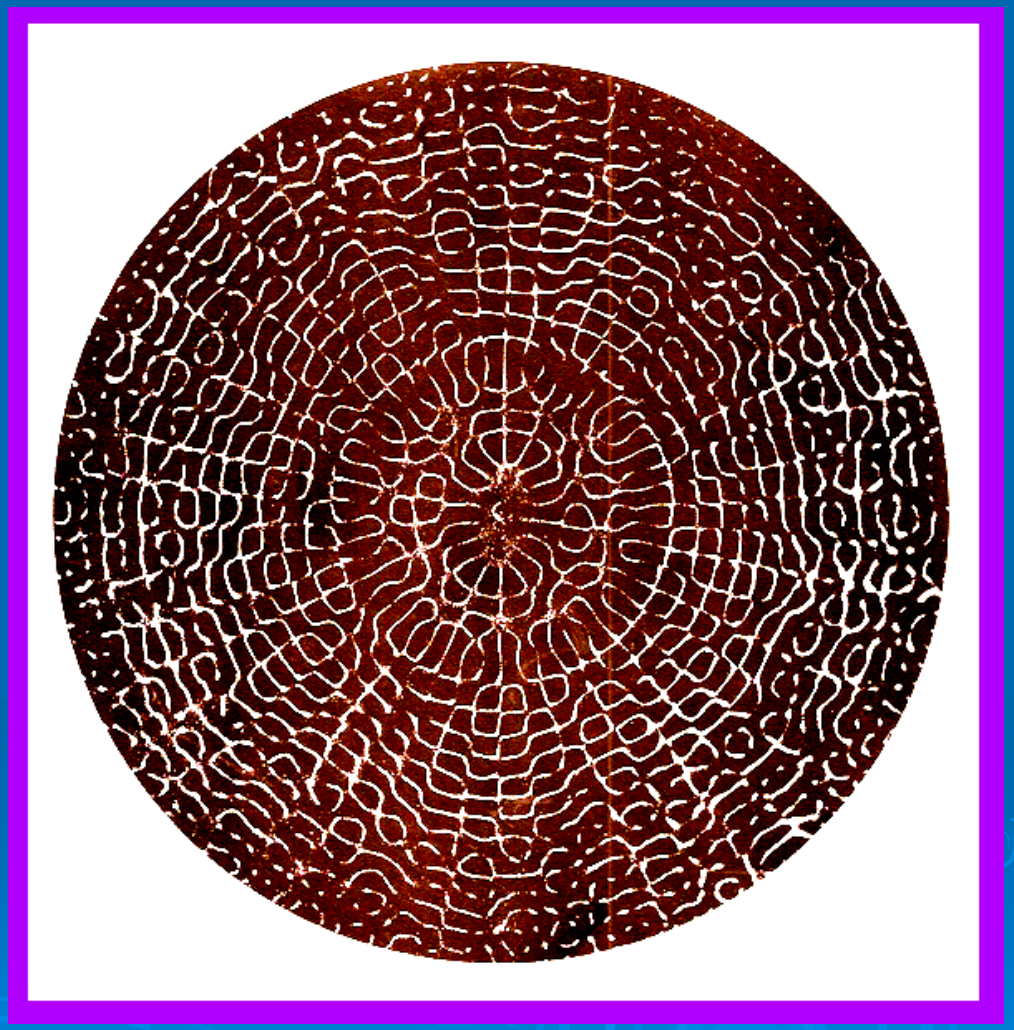
← Hans Jenny was also a prolific artist: he created over 2,000 animal "portraits". Capturing the soul of "*man's mysterious companions on the earth*", Jenny tunes into the animals "*to let them express themselves*" - just like he let sounds express themselves into cymatic images.

"I love him… He is a mystic, like me". **Marc Chagall**

SG201.5.4.1 Cymatics - Examples (1)

**As the frequency goes up,
the patterns become more complex,
displaying more fields,
richer in harmonics.**

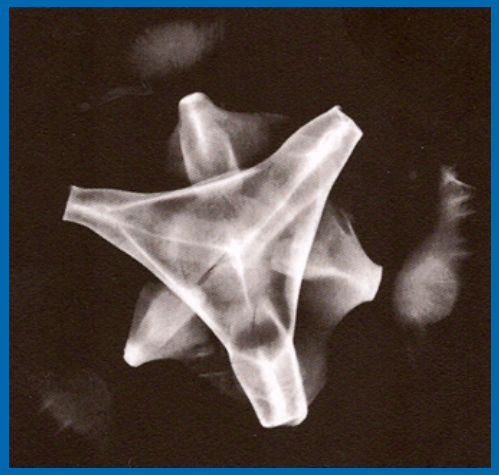
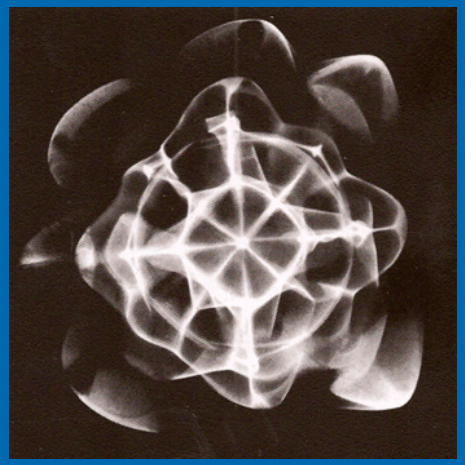
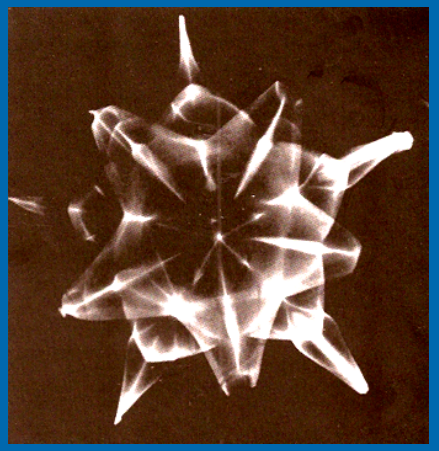
**↑ Plate = 50 cm
Frequency = 6,250 Hz.**

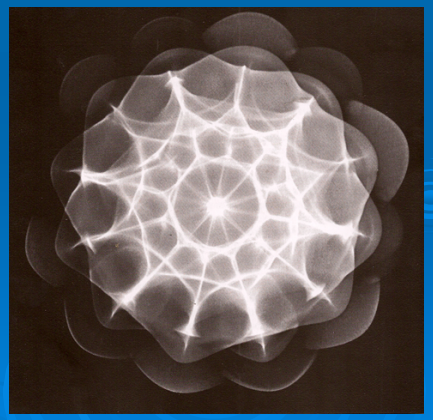


**↑ Plate = 50 cm.
Frequency = 16,000 Hz**

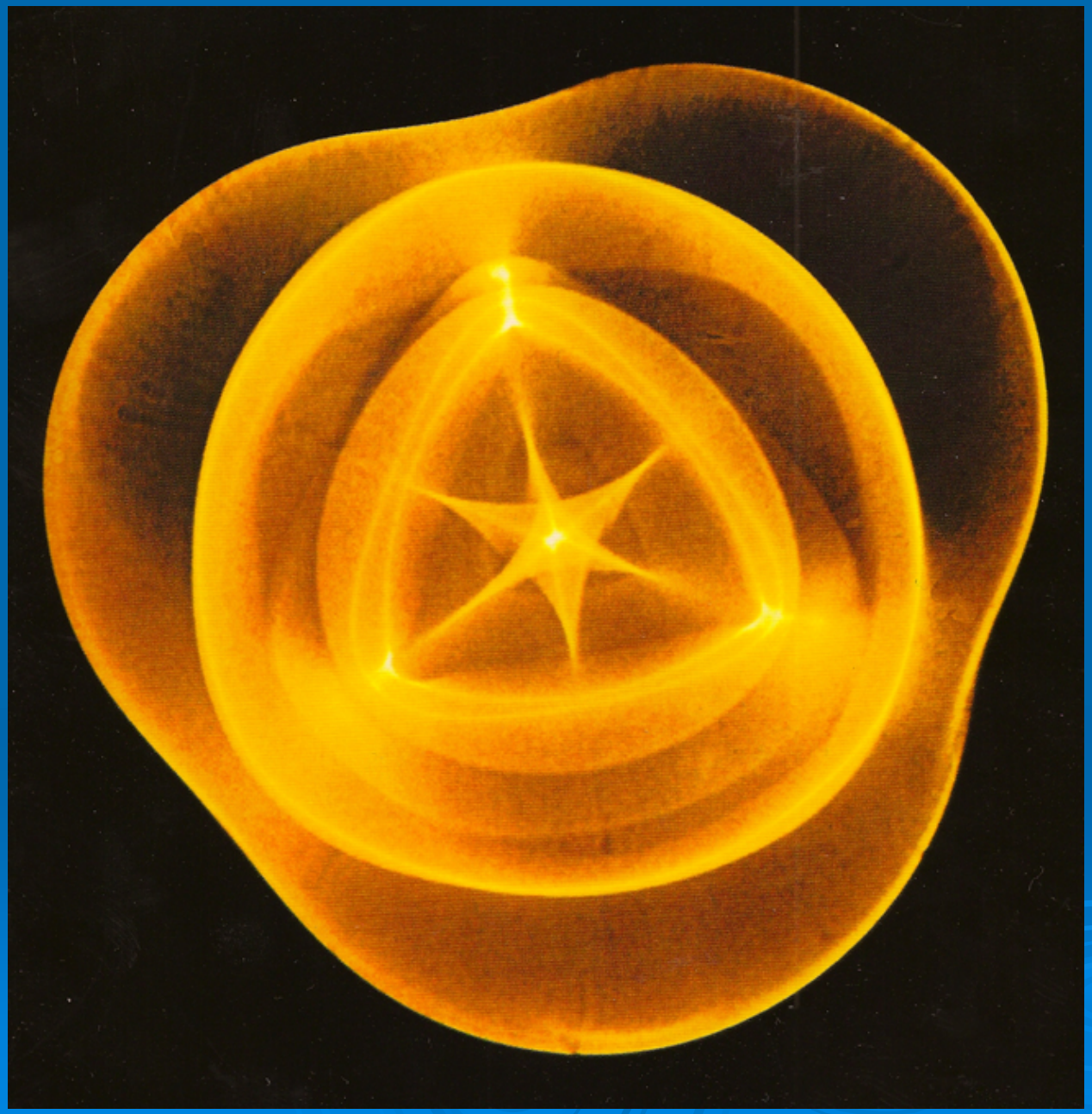
SG201.5.4.2 Cymatics - Examples (2)

Sounds frequencies create patterns that have mathematical order & symmetries and show exact geometries. Sometimes a whole series of structural patterns can be obtained by keeping the exciting tone (frequency) unchanged and varying the volume (amplitude). Below: symmetries 3, 4, 5, 6, 10 and 12. **(Images. Hans Jenny. *Cymatics.* 1967, Basel. 2001, Macromedia).**

SG201.5.4.3 Cymatics - Examples (3)



←

"While the tone persists, the phenomenon continues in motion as a total situation perpetually seeking wholeness."

Hans Jenny.

SG201.5.5.1 Cymatic Dynamics (1) - Chaos & Order

Remember the dance of Chaos & Cosmos described in Greek mythology? [◆SG101.2]
"Chaos" is the undifferentiated potentiality now called *Quantum Vacuum* / *Plenum*, an underlying universal field of pure harmonic/geometric codes of information. "Chaos" is only a yet-unrecognized, deeper level of order.

The evolutionary journey of human consciousness seems to be a built-in adventure of pushing the boundaries of chaos further & further away… all the way to the peak experience of many mystics: communion with pure, absolute cosmic order, beauty and harmony - the "Original Source" of Oneness.
In between, just like the new science of "Chaos Theory" is exploring the hidden symmetries of hitherto chaotic phenomena, humanity is pushed to explore disharmony & disorder (externally and inwardly) as a necessary phase of des-integration before the reconstruction phase of a new harmony, on a higher level of the evolutionary spiral.

***Cymatics* is a timely, graphic demonstration of the perfect dance between order and chaos, manifestation and potential, foreground and background.**

Dr. Jenny was able to photograph the interferences of wave patterns created in the medium as it was vibrated by pure sine wave tones. The following repeated sequence was found:

- At low frequency, a stable pattern emerges displaying simple geometry shapes. As long as the frequency (pitch) is maintained, the pattern looks static.
- Increase the frequency and the "stable" structure dissolves into chaos, an apparently very dynamic state.
- Keep increasing the frequency and, at quantum intervals / harmonic ratios, chaos changes back into order, a more intricate pattern/structure.

The remarkable aspect is: the new "higher frequency" pattern does not emerges gradually. It sort of builds up potentially and suddenly jumps into manifestation.

***"The tremendous orderliness of things".* Hans Jenny.**

//cymatica.com (School of Cymatics, Journal + You-Tube links)
//cymascope.com (Cymatics info + Cymascope research)

SG201.5.5.2 Cymatic Dynamics (2)
Background & Foreground

In *Cymatics*, the dynamics of chaos and order manifests as the dance of the foreground and the background.

The runnels of sand that we see are the "dead" spots where sand has collected, while the dynamic "life" of the frequency vibrates in between the runnels. The visible pattern is the complementary "shadow" of the "real" invisible vibration. As quantum physics points out: what appears to be solid form is actually underwoven by wave fields.

The grains of sand or lycopodium "take refuge" on the spots where the plate is not or less vibrating: there, they congregate and form visible patterns & shapes, as standing waves. In a sense, visible forms are like vibrational cemeteries or dumping grounds of slower waves waiting to be sucked again into the eye of the next larger dynamic vortex. Visible forms we call objects are actually points of repose where vibrations slow down, stand up and freeze, for a cosmic instant, before returning to their usual twirling dance.

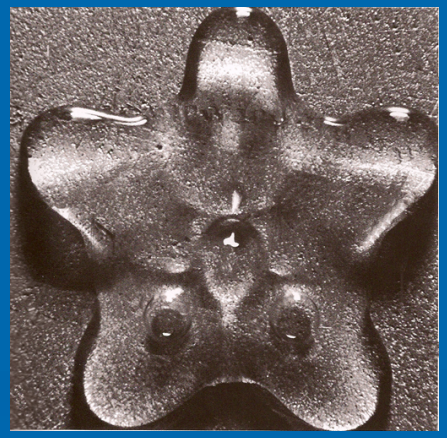
***Cymatics* is indeed a graphic and apt metaphor for the manifestation / materialization process from higher-dimensional causal patterns of creation. This dance background-foreground could describe:**

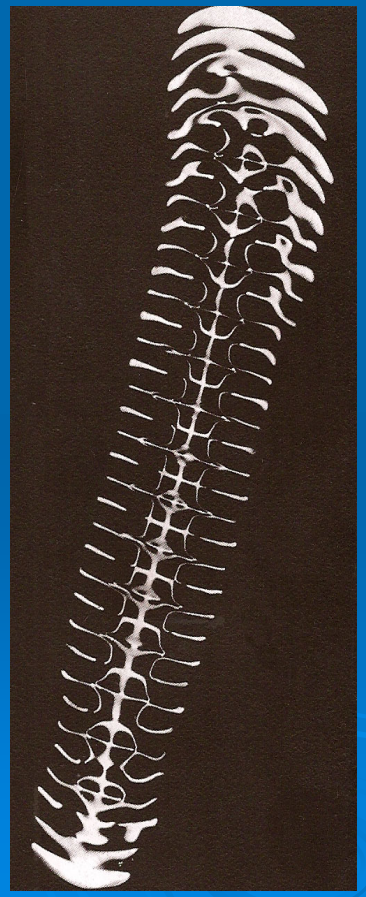
- **Incarnation as the 3D appearance of a human standing form-wave issued from the vibrational imprint of a higher-dimensional spirit being.**
- **The material "explication" of implicate morpho-genetic fields.**
- **Sacred Geometry as the harmonic patterns calling forms to exist and showing temporary stability in certain quantum ratios and rhythmic intervals, in accordance with the PHI series cascade.**

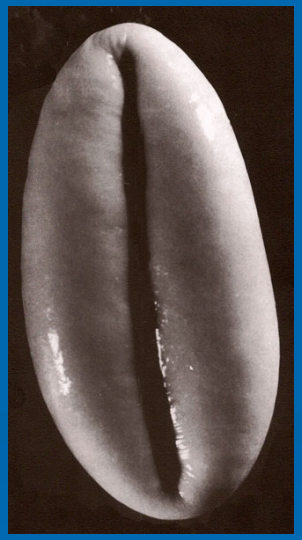
SG201.5.6 Cymatics & Nature

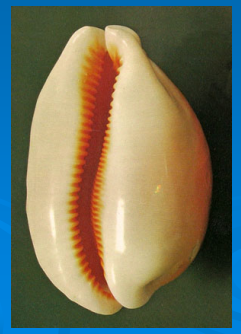
Anyone witnessing a cymatic demonstration or perusing Jenny's book *Cymatics* will soon be amazed to see the resemblance between the shapes & patterns familiar to us in physical reality and the shapes & patterns generated in the cymatic images. Below are some examples.

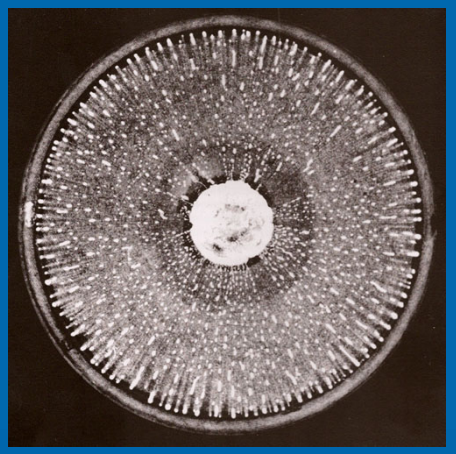
Jenny was actually convinced that biological evolution was a result of vibrations, and that their nature determined the ultimate outcome. He believed that every cell had its own frequency and that a number of cells with the same frequency created a new mega-frequency in harmony with the original and forming an organ… and so on in the order of harmonic complexity.







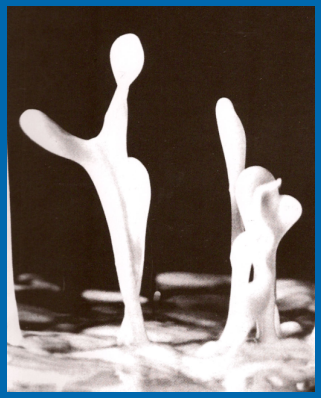


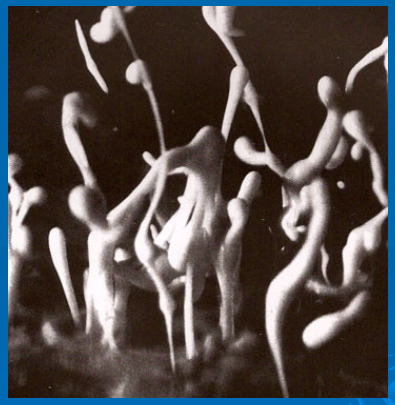


SG201.5.7 Cymatics in 3D

To fully appreciate the 3D dynamic choreographies created by sound frequencies, watch the original movies made by Dr. Hans Jenny. Cymaticsource has dvd versions.

www.cymaticsource.com





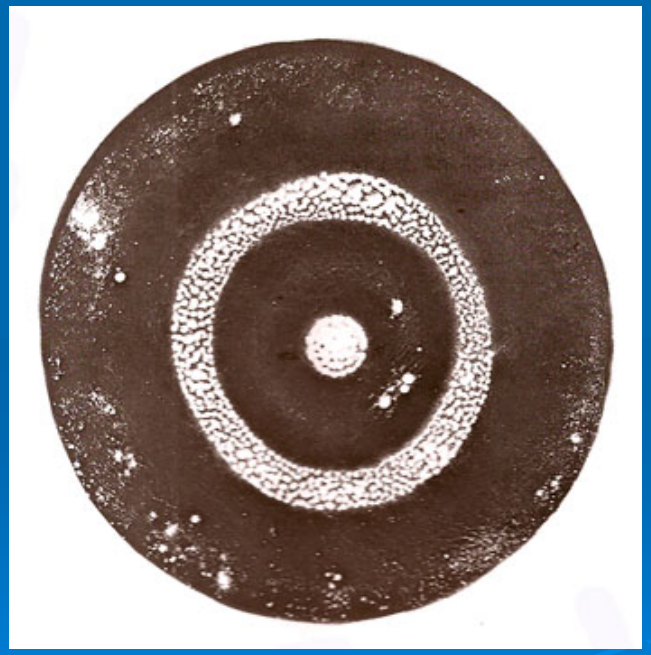
↑ *"When greater amplitudes are used, the masses of a viscous kaolin paste are flung high and ejected."* Hans Jenny

Anti-Gravity effects. An interesting phenomenon appeared when Dr. Jenny took a vibrating plate covered with liquid and tilted it. The liquid did not yield to gravitational influence and run off the vibrating plate but stayed on and went on constructing new shapes as though nothing had happened.
If, however, the oscillation was then turned off, the liquid began to run, but if Dr. Jenny was really fast and got the vibrations going again, he could get the liquid back in place on the plate. Dr. Jenny explains that this is an example of an anti-gravitational effect created by vibrations.

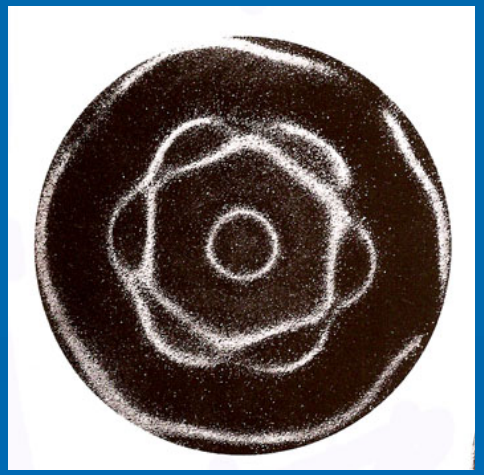
SG201.5.8.1 Cymatics - The Tonoscope (1)

In his research with the *tonoscope*, Jenny noticed that when the letters (and specially the vowels) of ancient languages like Hebrew and Sanskrit were pronounced, the sand tends to take the shape of their written symbols. Our modern languages, on the other hand, did not generate the same results, except for basic vowel-sounds like "O".

It seems that sacred languages or alphabets [◆SG306] have a direct link to the cosmic energies they represent or describe. These "glyphs" have the power to influence and transform physical reality, to manifest material reality (for example through the recitation or singing of sacred texts) and, generally speaking, to heal a person who has gone "out of tune".



↑ The vowel "O" spoken into the Tonoscope.



↑ Two other vowel shapes.
(the vowel is not specified in Jenny's book)

A lot of exciting research remains to be done along the lines of cymatic shapes expressing the spoken sounds of various languages and therefore assessing the vibrational power & harmony of words in human cultures.

SG201.5.8.2 Cymatics - The Tonoscope (2)

Here is a ”DIY” (Do-it-yourself”) simple Tonoscope.
You can find detailed instructions in the websites of the Cymatics School:
//cymatics.ning.com/ www.cymaticsounder.com //cymatica.com

↑ Example of DIY Tonoscope built at the Sedona School of Sacred Geometry.

The PVC parts can be obtained at a hardware store. The membrane is latex. When experimenting with chanting tones, sustained vowels, mantras etc…. into the tonoscope, the membrane is sprinkled with commercial white salt or fine sand.

↑ A didjeridu playing into the Tonoscope.

Nine year old Lily Peirce of the United States won a blue ribbon at a science fair on February 27th, with her cymatics project documenting her vibration experiments, and her booth titled, “Cymatics.”

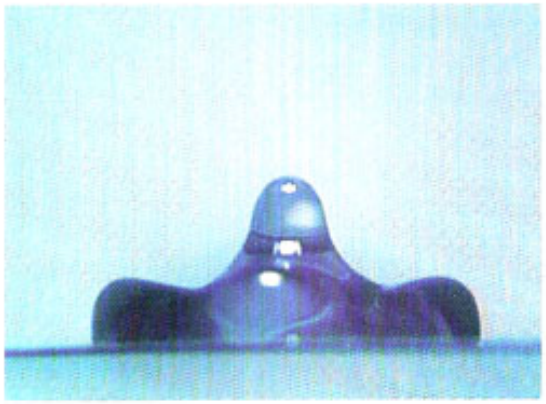
“On my iBook I used ToneGen to produce the signal to the amplifier and then to the speakers. On one speaker I had a piece of matt board attached and on the other speaker I had a bowl of water attached. My video camera and brother’s iMac was used as a monitor so the people could see my Cymascope.”

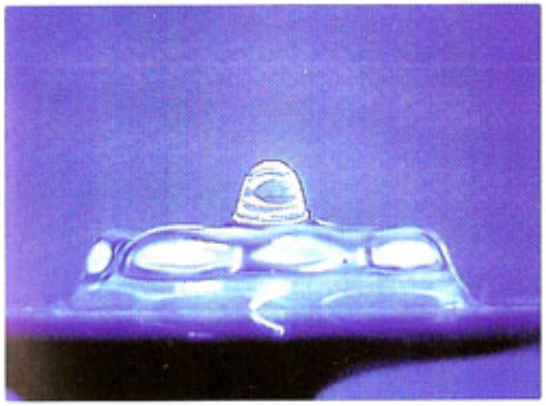
For those electronically inclined, a more technical tonoscope can be built using a piezo-electric plate (or “sounder”) that is hooked up to a sound generator.

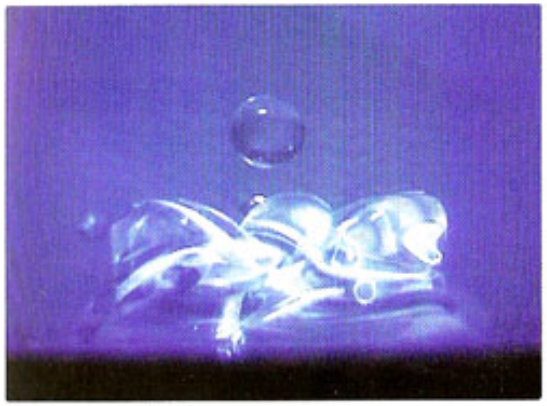
This setup makes it possible to see in exquisite details the visual patterns of specific sound frequencies, and to experiment with wide ranges of musical tones by repeating & modulating the frequencies.

↑ Pattern from an electronic tonoscope.

This site: http://www.rmcybernetics.com has a great discussion page for an electronic tonoscope.

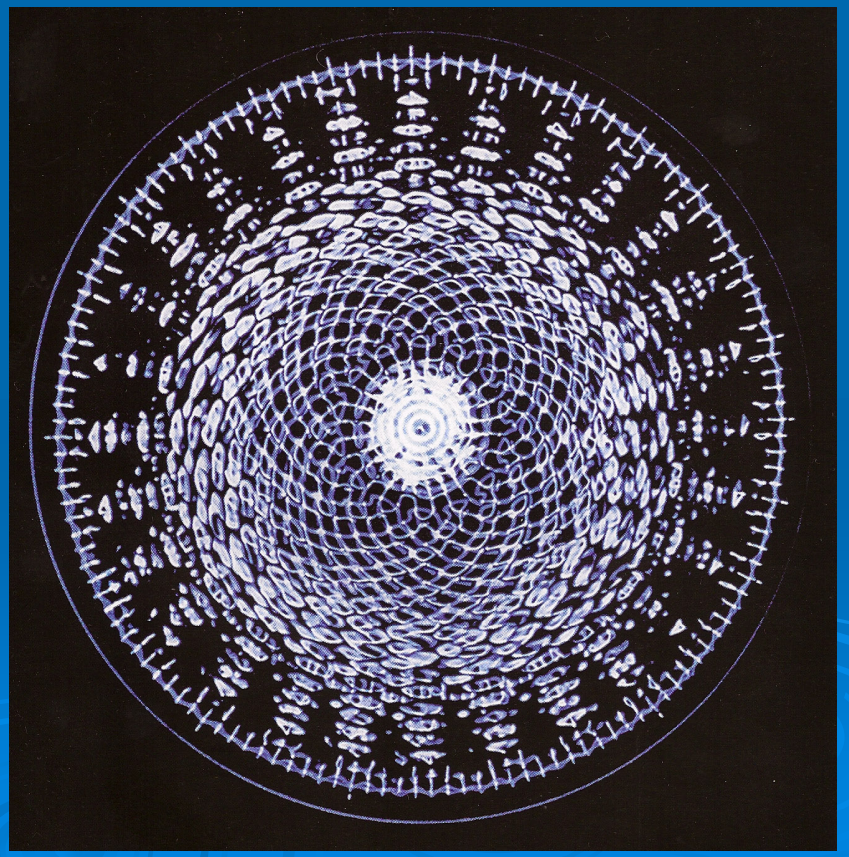






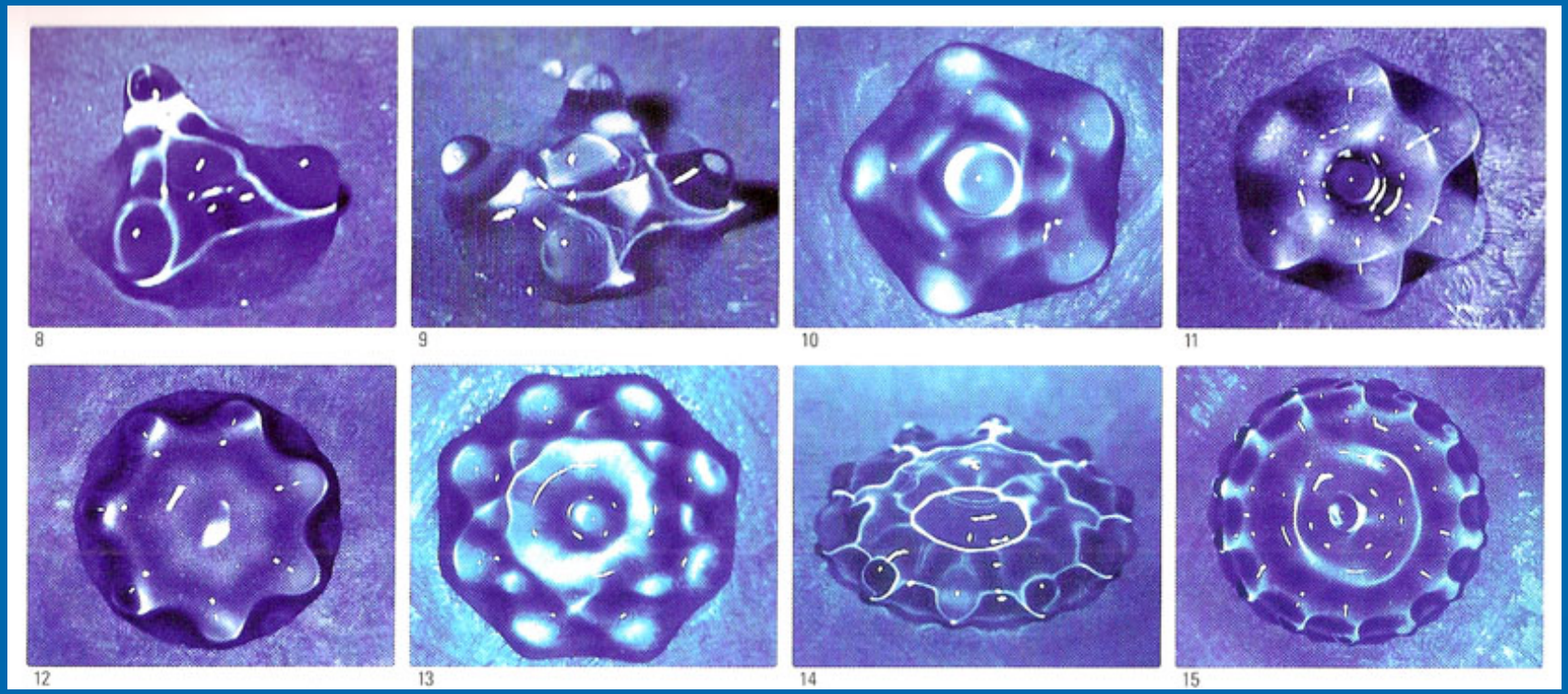
SG201.5.9.1 Water Cymatics (1)

The new development in Cymatics is the work of Alexander Lauterwasser who, following up on the tracks of Hans Jenny, experimented with the visual vibrations of water resonated by sounds frequencies.
Staring with the pulsations of a simple water drop, Lauterwasser progressively moved to small circular water containers, methodically recording the effects of modulating sound frequencies on larger water aggregates.
He published his research in Germany in 2002.



← 102.58 Hz

SG201.5.9.2 Water Cymatics (2)

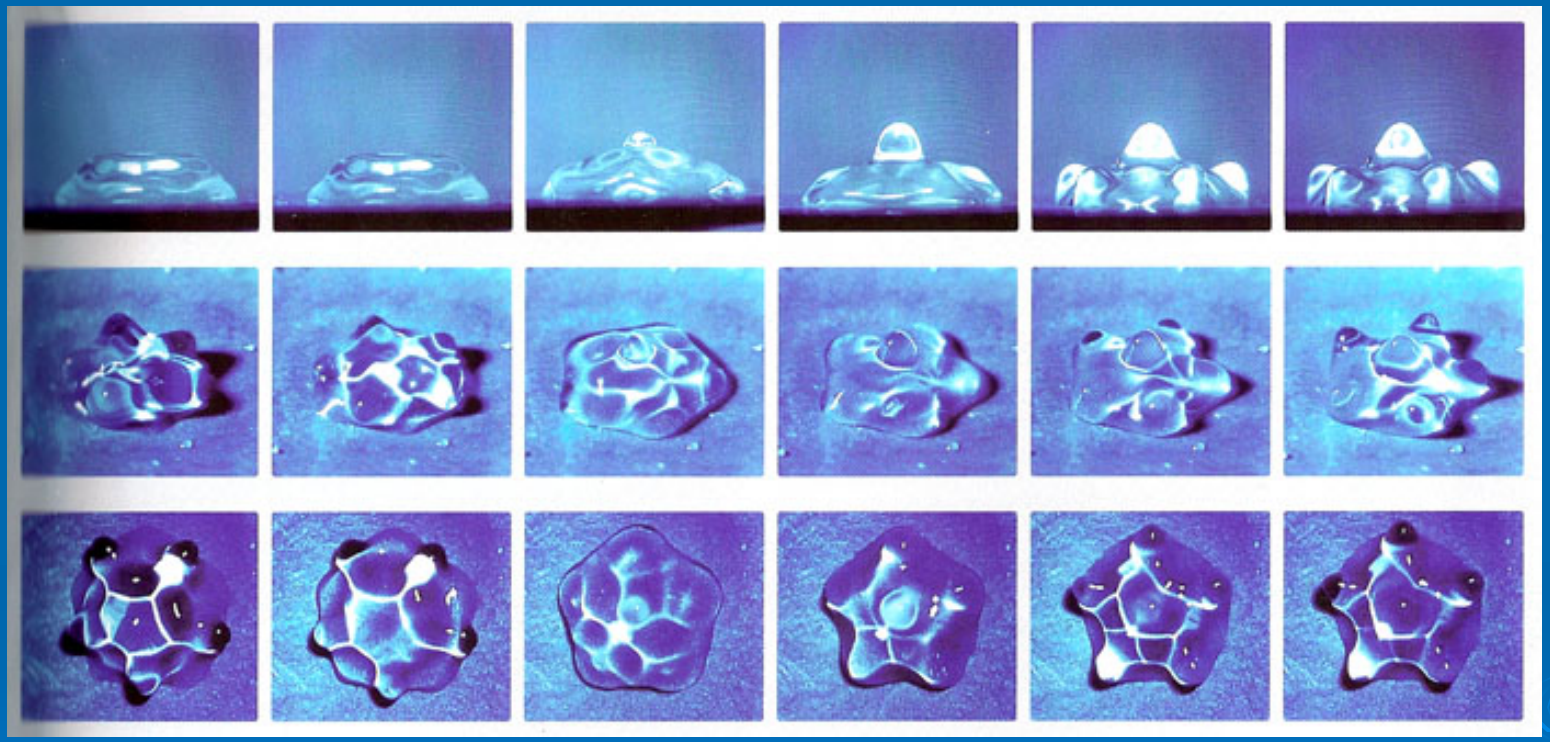


↑ Oscillatory motions are taking place and generate geometric figures structured by simple integers:
3 - 4 - 5 - 6 - 7 - 8 - 9/10 - 14

A plate with a water drop is pulsed by a vertical vibration from a frequency generator and a special sonic transformer. The drop responds to various wavelengths and frequencies that are made visible by a modulating stroboscopic lamp.

Lauterwasser. *Images Sonores d'Eau*.
Medicis. Paris. 2002.

SG201.5.9.3 Water Cymatics (3)

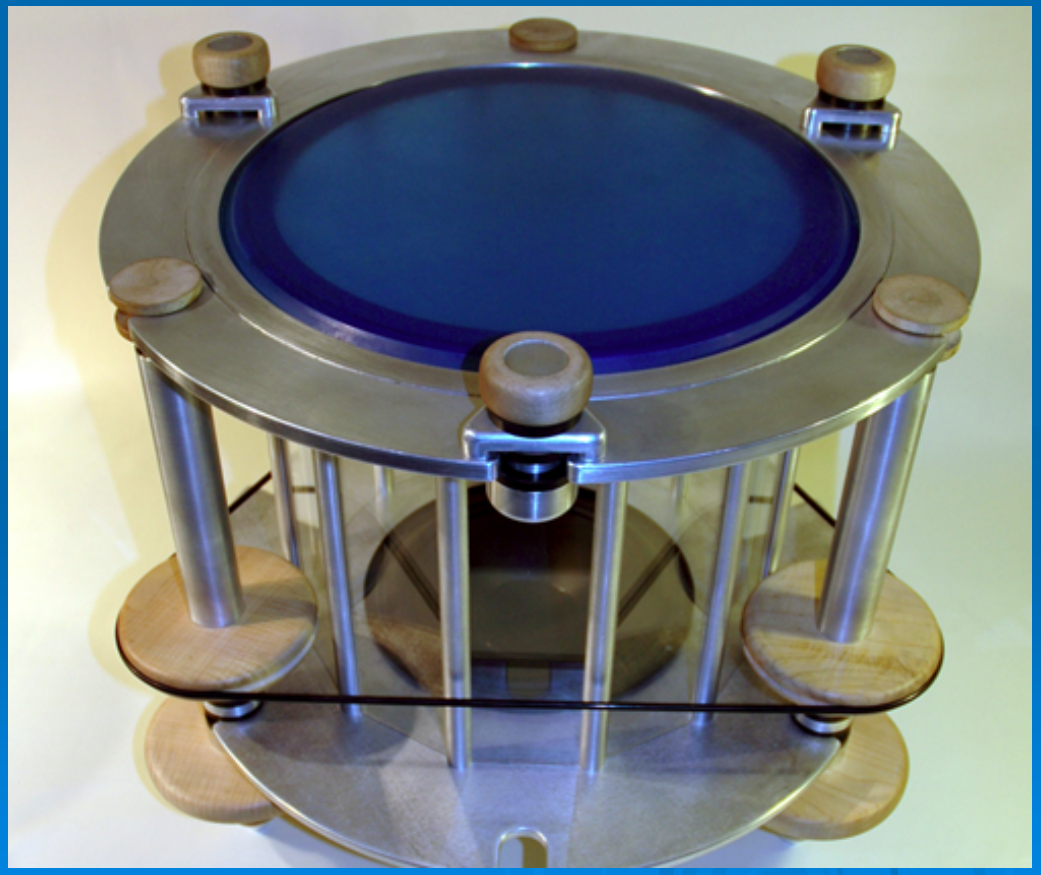


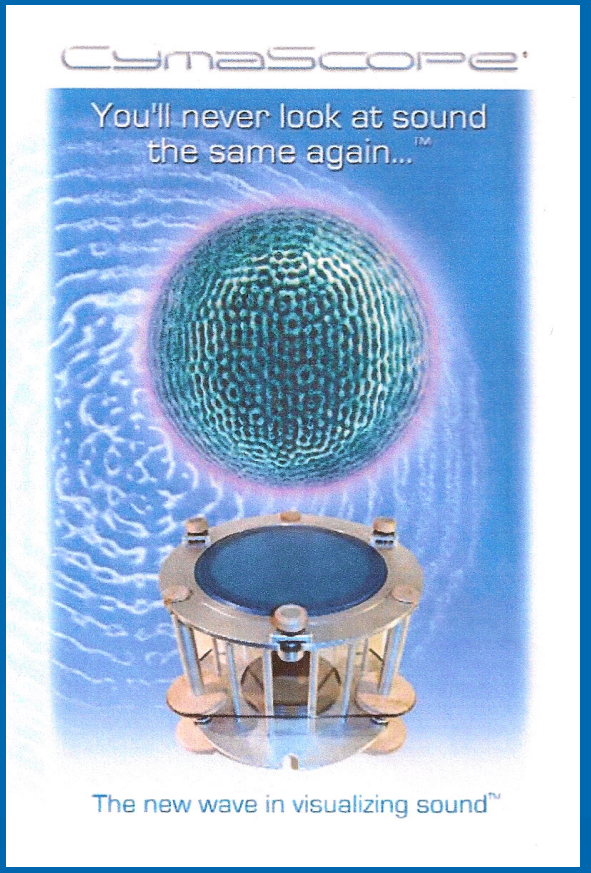
↑ Six stages of the vibrational dance of a pulsating water drop.
Side, diagonal and top views.

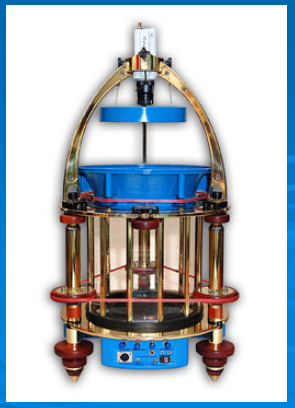
Lauterwasser. *Images Sonores d'Eau*.
Medicis. Paris. 2002.

SG201.5.10.1 CymaScope (1)

An even newer development in Cymatics is the invention of the *Cymascope*, now available to researchers. It is heralded as a "sonoscope" to rival the microscope & telescope. Co-invented by John Reid and Erik Larson, the cymascope is the first scientific instrument that can give us a visual image of sound and vibration - a cymatic image - helping us to understand our world and universe in ways previously hidden from view. www.cymascope.com







← Latest model with water interface

SG201.5.10.2 CymaScope (2)

The Cymascope displays vibrational images for any source of sound frequencies: human voice, sound generator, bird chants, pets, DNA, planet… even your personal harmonic signature.

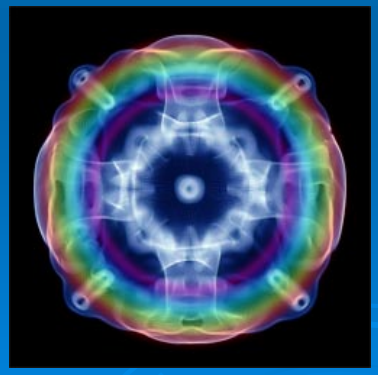
It is an exceptional tool of education & exploration of the nature of life and the dynamics of creation. Its applications are wide open: from the spherical physics of sound to speech therapy to studying the language of birds or dolphins…

//cymascope.com

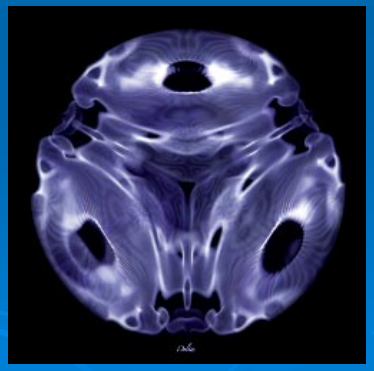
Read the fascinating account of John Reid's acoustic research in Egypt: www.cymascope.com/cyma_research/egyptology.html

The vibrational imprint of the Sarcophagus in the King's Chamber, Great Pyramid, at 117 Herz.

Alpha



Beta



Delta

Theta

BRAIN WAVES

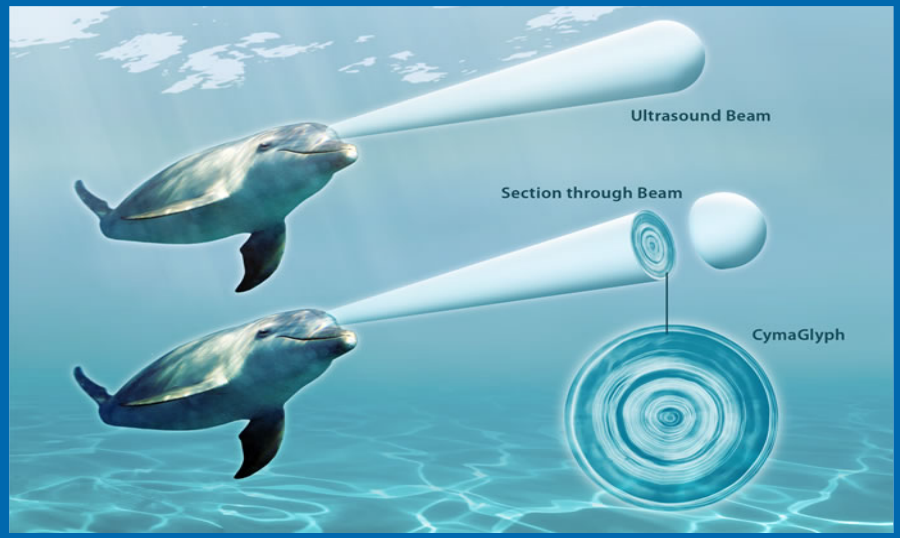
SG201.5.10.3
CymaScope (3)

In an important breakthrough in deciphering dolphin language, researchers in Great Britain and the United States have imaged the first high definition imprints that dolphin sounds make in water.

The key to this technique is the CymaScope, a new instrument that reveals detailed structures within sounds, allowing their architecture to be studied pictorially.

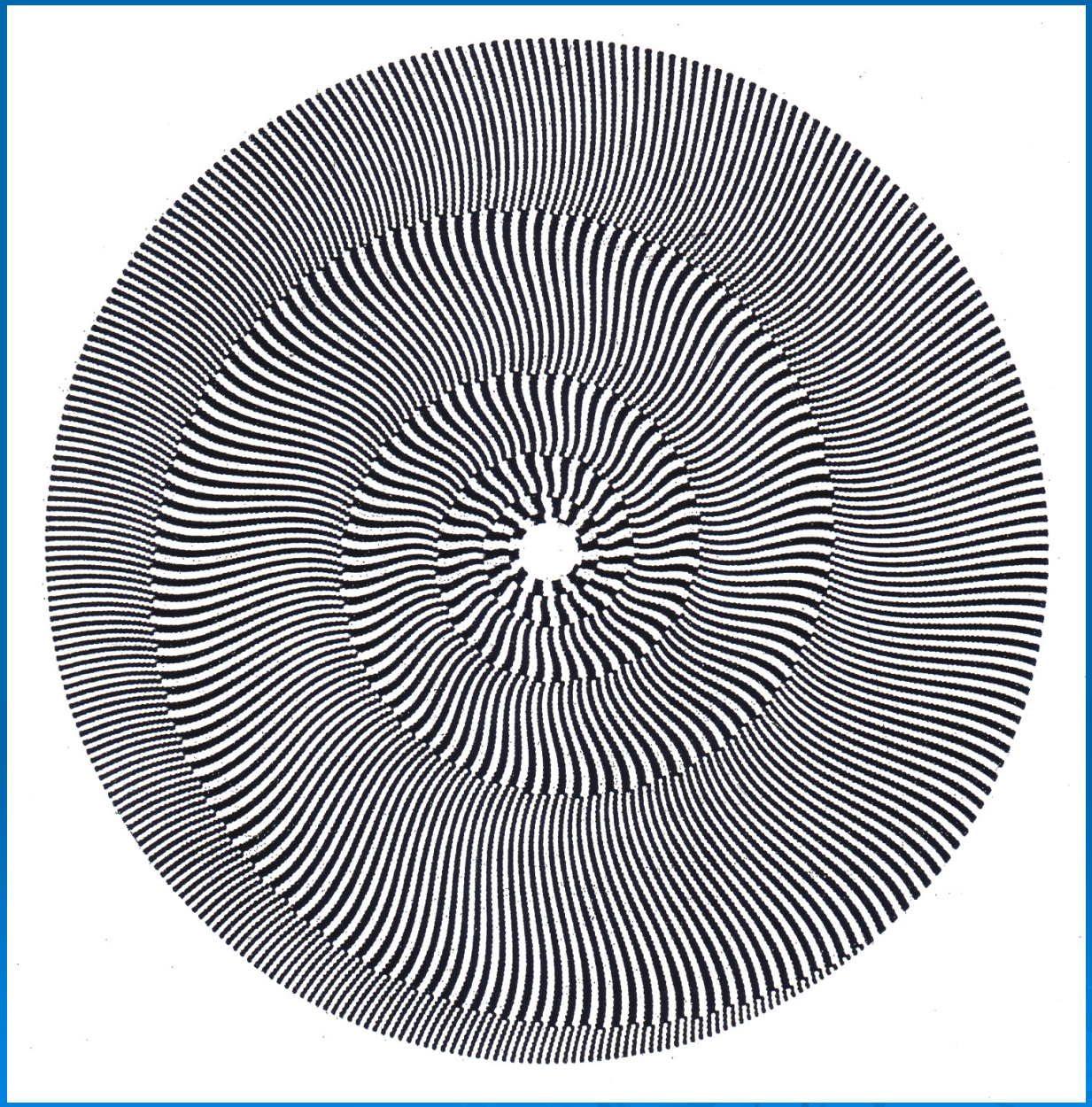
Using high definition audio recordings of dolphins, the research team, headed by English acoustics engineer, John Stuart Reid, and Florida-based dolphin researcher, Jack Kassewitz, has been able to image, for the first time, the imprint that a dolphin sound makes in water.

The resulting "*CymaGlyphs*", as they have been named, are reproducible patterns that are expected to form the basis of a lexicon of dolphin language, each pattern representing a dolphin 'picture word.'



↑ **Visualizing dimensional structures within sound**

← **Mother dolphin & baby**



SG201.5.11
Visual Music - Photosonics

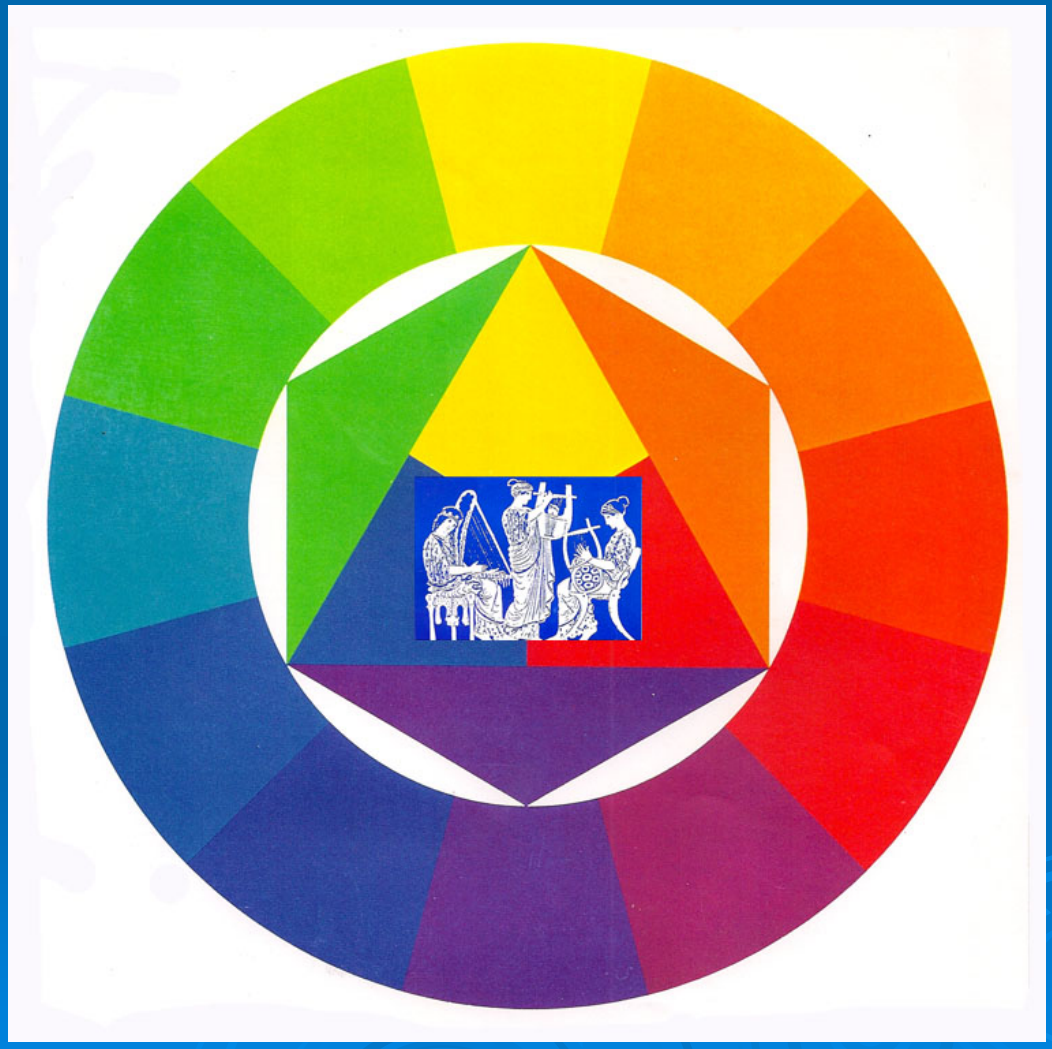
Photosonics **was invented by Jacques Dudon, a French *Just Intonation* researcher and composer, instrument builder and the founder of the AEH (Atelier d'Exploration Harmonique), in France.**

The *Photosonic* instrument produces sound from modulated light: a light source shines through spinning geometric patterns printed on acrylic discs; the resulting patterns of light are picked up by solar cells and converted into a voltage which can then be treated as a sound signal. This is music from light through the sacred geometric of music ratios.

← Photosonic Disk
(Visual music mandala).
Jacques Dudon.

//aeh.free.fr/

SG201.6 - Chapter 6 Music, Colors & Healing



SG201.6.1.1 Music & Color (1)

Music ad color are twin sisters. Both touch a deep sympathetic "chord" within the human psyche and soul. Even our language conveys this *synaesthesia*: we speak of a "chromatic scale" or a "loud color". In fact, both spiritually and scientifically, we know that light and sound are the same language of energy & frequencies, albeit manifested in two different modes or scales and perceived by two apparently "separate" senses.

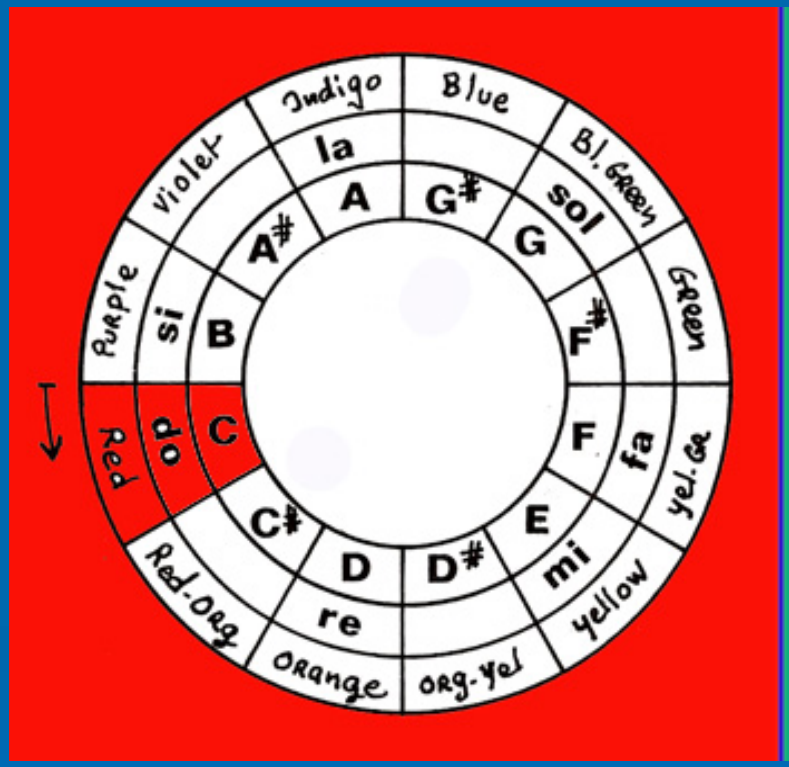
In physics, music and color are two different phenomena: colors are electro-magnetic light waves, traveling at the speed of light, vibrating (trillions of times per second) transversally to the direction of propagation, whereas sounds are pressure waves dawdling at the speed of 1100 ft per second and traveling in parallel to the direction of propagation. Add to that the various modulating factors in music (overtones, harmonics, pitch, timbre, loudness, duration…) and in color (tint, hue, intensity, size…), the variety of musical instruments and scales, the many color technologies, the myriad music traditions… the situation seems hopeless.

To cut through the amazing number of attempts made, in the course of time, to correlate the two "sisters", there are two basic ways of matching colors & musical tones:

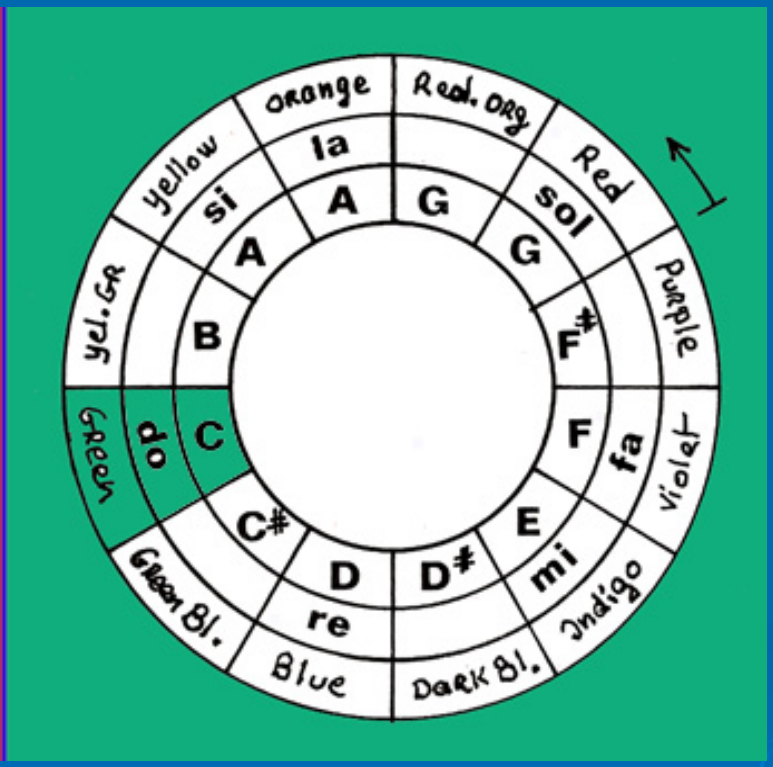
- The traditional 7 - 7 or 12 - 12 match = an ascending color-music scale based on the progression of the 7 rainbow colors (extended to 12) and 7 musical notes (extended to the 12 tones of the chromatic scale). This system is simple, understandable by everyone and allows all sorts of symbolic associations: planets, days of the week, chakras, zodiacal signs… In the traditional system, the note C is "red", D "orange" etc…

- The scientific system whereby the color light frequencies are lowered by 40 octaves (divided by 2^{40}) in order to match the sound spectrum frequencies and then rough correlations are made. This system make the note C "green", D "blue" etc…

SG201.6.1.2 Music & Color (2)



Traditional Color-Music Wheel



Scientific Color-Music Wheel

Both systems (and their many modulations) are somehow simplistic and based on conventions and assumptions. I believe they will come to be understood as complementary (like Yin and Yang) in the larger context of higher-dimensional realities and a science of cosmic harmonics. Right now, we have C both red and green, D both orange & blue… each note walks on its two feet: wave & particle, yin and yang…

Note that from red in one system (C) to red in the other system (G), we have a perfect fifth!

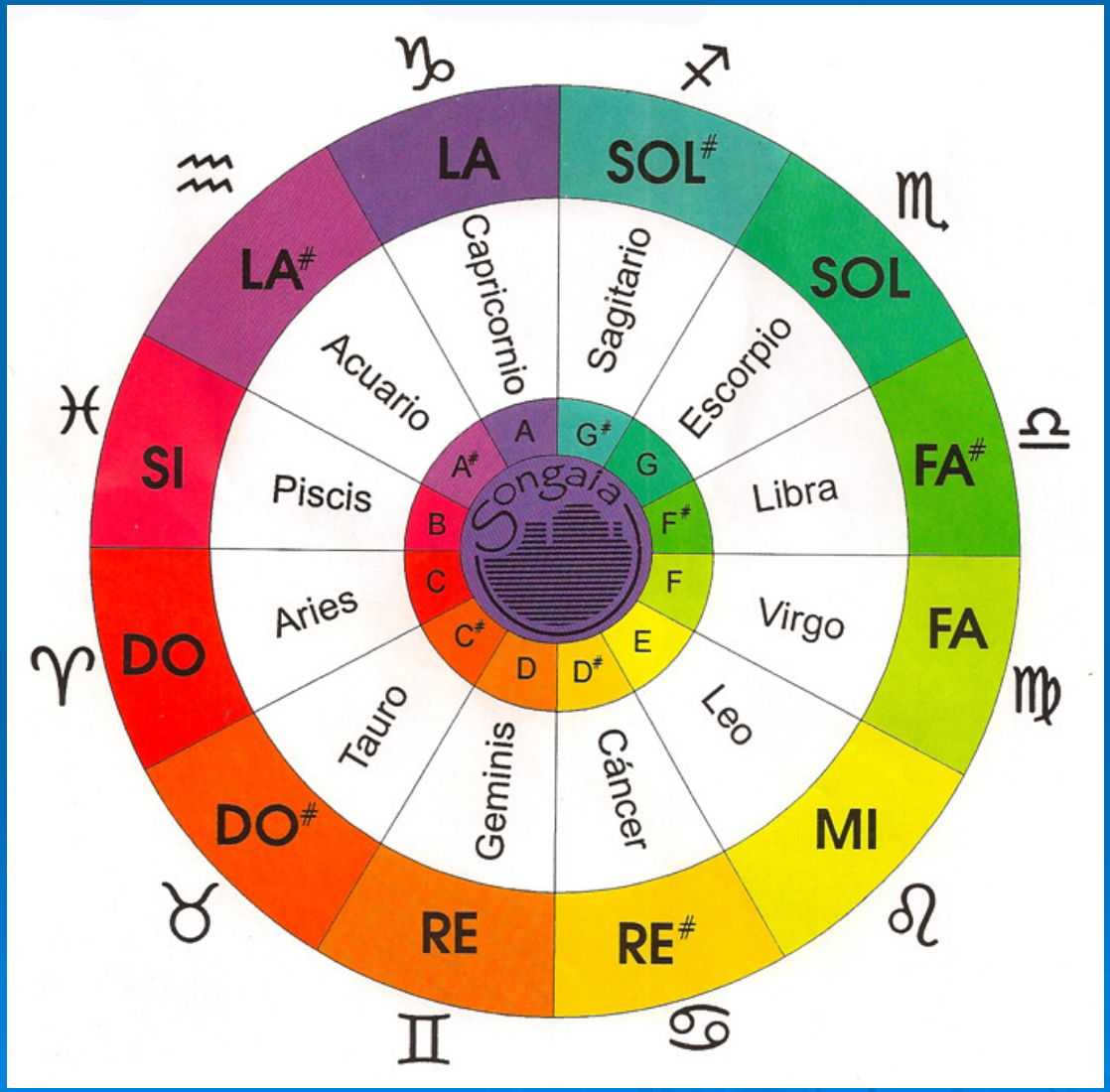
Meanwhile, follow your harmonic heart and play/dance with colors and sounds!

SG201.6.1.3 Music & Color (3) Traditional Seven

Color	*Properties of color*	*Music Interval*	*Chord*	*Planet*	*Properties of planet*	*Signs*
RED	Birth Heat /Heart	Unison DO (C)	Major	Mars *God of war*	Energy Desire	Aries Scorpio
ORANGE	Power/Glory Radiance	Whole Tone RE (D)	Minor	Sun *Apollo*	Vitality Illumination	Leo
YELLOW	Intellect Joy	Maj.Third MI (E)	Minor	Mercury *Messenger*	Mind/Logic Communication	Gemini Virgo
GREEN	Growth Healing	Fifth SOL (G)	Major	Jupiter *Jovial*	Enthusiasm Fortune	Sagittarius Pisces
BLUE	Spirit/Sky Heaven	Fourth FA (F)	Major	Saturn *Chronos*	Limitation Caution	Aquarius Capricorn
INDIGO	Intuition Search	Maj. Sixth LA (A)	Minor	Venus *Love*	Harmony The Arts	Libra Taurus
VIOLET	Transition Transmission	Maj. Seventh SI (B)	Diminished	Moon *Diana*	Feelings Subconscious	Cancer

The 7 - 7 traditional correspondences between the 7 musical notes / rainbow colors and planets, as allegories of cosmic energy principles. They can be understood as symbols of progressive stages in a cycle leading from beginning through dissolution and a final ascent to a new beginning, a new "octave".

SG201.6.1.4 Music & Color (4) Traditional Twelve



← The S*ongaia* color-music wheel, a traditional system used by sound healer and harpist Ani Williams. This color-music-astrology wheel put in direct correspondance the sequence of the 12 rainbow colors, the 12 musical notes and the 12 signs of the zodiac.

DO (C) is red and corresponds to Aries. DO# (C#) is red-orange and corresponds to Taurus etc…

www.aniwilliams.com

SG201.6.1.5 Music & Color (5) The Giant Piano

Let's create a very large piano with a keyboard extended through 44 octaves! And let's play on it, starting with the middle C octave.

When we arrive to the notes in the last highest octave of this giant keyboard, the keys will correspond with the chromatic color frequencies, the colors of light visible to the human eye. They will be the light harmonics of the middle C octave.

There are seven notes in the highest octave that are the frequencies of the 7 primary colors of the spectrum of light: the 7 colors of the rainbow!

We can even imagine the piano keyboard to be a spiral: the 44th octave will be on the next higher spiral, just above the middle C octave.

FREQUENCY (x 10^{12})	COLOR	FREQUENCY DOWN 40 OCTAVES	FREQUENCY (Chromatic)	NOTE
430	Very dark red	391.3	392	G
440	Dark red	400.4		
450	Dark red	409.5		
460	Darkish red	418.6	415	G#
470	Red	427.7		
480	Red-orange	436.8		
490	Orangish red	445.9	440	A
500	Reddish orange	455.0		
510	Light orange	464.1		
520	Yellow	473.2	466	A#
530	Greenish Yellow	482.3		
540	Yellow green	491.4		
550	Yellow green	500.5	494	B
560	Light green	509.6		
570	Green	518.7		
580	Green	527.8		
590	Green	536.9	523	C
600	Bluish green	546.0		
610	Blue green	555.1		
620	Sky blue	564.1	553	C#
630	Bluish indigo	573.2		
640	Indigo	582.3		
650	Indigo	591.4	587	D
660	Indigo	600.5		
670	Indigo violet	609.6		
680	Indigo violet	618.7	622	D#
690	Light violet	627.8		
700	Violet	636.9		
710	Violet	646.0		
720	Dark violet	655.1	659	E
730	Dark violet	664.2		
740	Dark violet	673.3		
750	Very dark violet	682.4	698	F

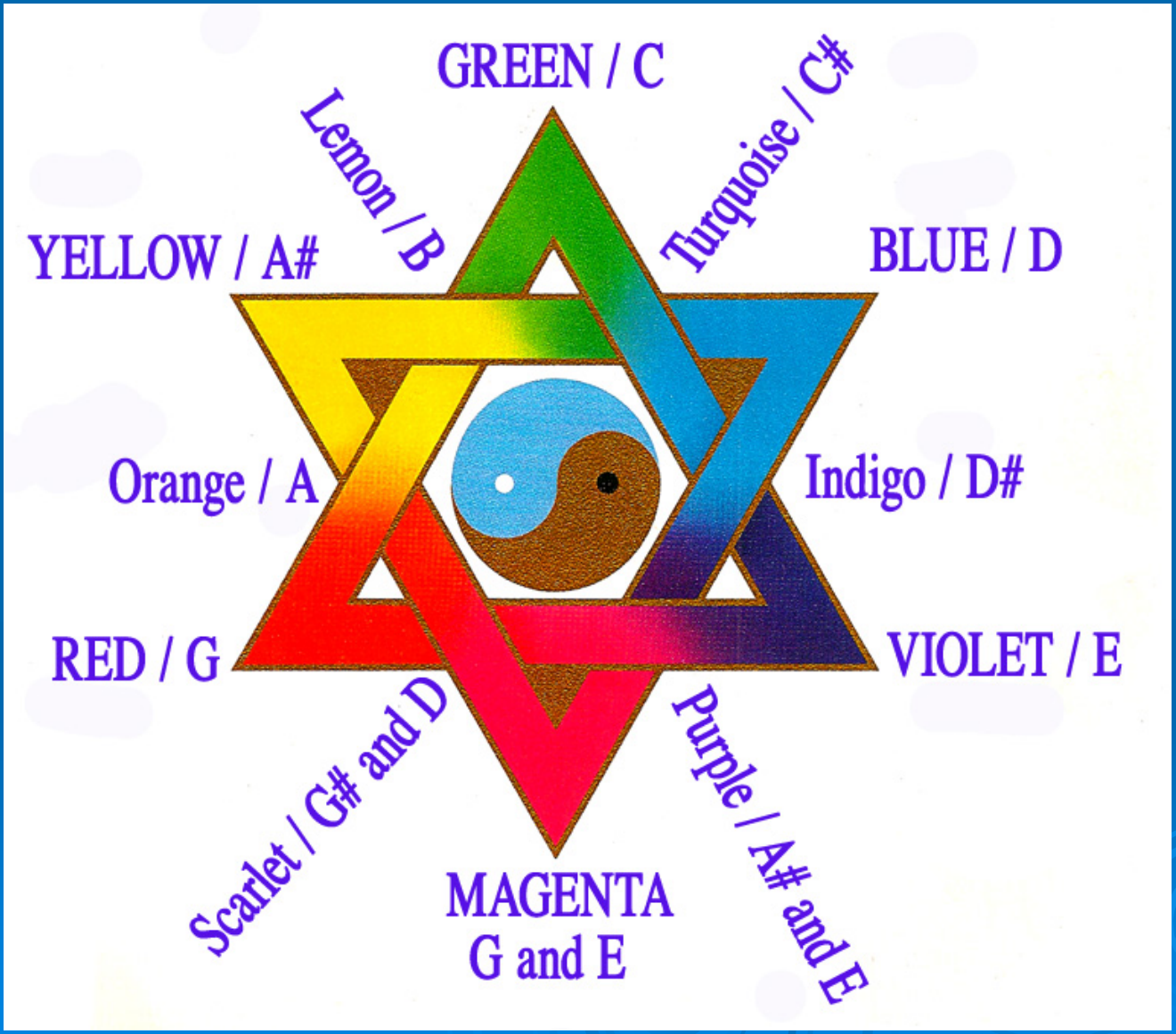
SG201.6.1.6 Music & Color (6) Scientific Scale

← Downscaling of color frequencies into audible sounds.

An exact octave harmonic of G would vibrate in the range of red light.

(F. L. Graham. *The Rainbow Book*. 1979.)

SG201.6.1.7 Music & Color (6) Spectro-Chrome



← The *Spectro-Chrome* Color therapy wheel of Dinshah Ghadiali (1873 - 1966) is a 12 - 12 correspondence system based on the scientific downscaling of light frequencies.

In the *Spectro-Chrome* system each color is associated with a family of specific elements (Red = hydrogen, Blue = oxygen etc…)

www.dinshahhealth.org

SG201.6.2 Healing as Harmony

When an area of the mind, body, or emotions becomes out of balance, it vibrates at an unhealthy frequency. It is this lack of harmony in the frequencies that can cause sickness, disease, and robs us of our physical vitality and clear mental peace. The whole field of vibrational medicine & healing is based on this understanding: re-harmonizing out-of-tune frequencies and/or providing lacking frequencies.

"The human organism is not only constructed according to harmonic principles but also functions with them…"
Gunther Hildebrandt. *Institute for Ergophysiology*, University of Marburg, Germany.

Rudolf Haase, one of the leaders of the German School of Harmonics originated by Hans Kayser, explains: "*It has been found that the rhythmics of the human organism function utterly harmonically - that is, the frequencies of pulse, breathing, blood circulation, etc… as well as their combined activities. We can observe that these rhythms are strictly coordinated, primarily in terms of the numbers one through four, which are able to form the intervals of the octave (1:2), fifth (2:3), fourth (3:4), twelfth (1:3), and double octave (1:4)…*"

Interrupting these MUSICAL RHYTHMS and their whole-number ratios brings about *dis-ease, dis-harmony*, alienation of the human system from the universal orchestra and exclusion from the Web of Life. Cancer has been observed to result from the chaotic irregularity of all harmonic rhythms.
"The cancer cell causes a withdrawal from the temporal harmony of the body functions".

"Every disease is a musical problem".
Novalis

Why is it that music education has been surgically removed from the American school system?

SG201.6.3 Music & Plants

It is well known and proven that playing classical music or Indian ragas to plants will boost their growth. Playing to seeds, seedlings and plants musical pieces with harmonic chords, coupled with feeding them organic nutrients, can work miracles.

This is exactly what Dan Carlson has done with the development of his *Sonic Bloom* system. Sonic Bloom delivers to plants rich organic nutrients applied with a misting machine along with music similar to the frequency range of bird calls made by swallows, martins, and warblers…

The music opens up the *stomata* (pores) on the plant's leaves and the nutrients are fed directly into the *stomata*.

The results are phenomenal and have been tested over 20 years and around the globe. Such is the power of Harmony!

In the American Southwest, ancient tradition speaks of Hopi farmers adept at singing "water songs" to their corn plants to help them survive the drought.

← Scanning Electron Micrographs of stomata on a grape leaf.

↑ Corn treated with Sonic Bloom

www.originalsonicbloom.com

SG201.6.4 Music & Inspiration

- **Einstein once said that Mozart's music *"was so pure that it seemed to have been ever-present in the universe, waiting to be discovered by the master."* Arthur I. Miller, in a New York Times article (1-31-2006), wrote: *"As a boy Einstein did poorly in school. Music was an outlet for his emotions. At 5, he began violin lessons but soon found the drills so trying that he threw a chair at his teacher, who ran out of the house in tears. At 13, he discovered Mozart's sonatas. The result was an almost mystical connection… (Einteins's) ideas on space and time grew in part from aesthetic discontent. It seemed to him that asymmetries in physics concealed essential beauties of nature; existing theories lacked the 'architecture' and 'inner unity' he found in the music of Bach and Mozart.***

Einstein had an inner knowledge that, beyond the grim mathematics of physics, lay the fabled "*Music of the Spheres*" which, to him, revealed a "*pre-established harmony*" exhibiting cosmic beauty.

Arthur I. Miller explains: *"In his struggles with extremely complicated mathematics that led to the general theory of relativity of 1915, Einstein often turned for inspiration to the simple beauty of Mozart's music. 'Whenever he felt that he had come to the end of the road or into a difficult situation in his work, he would take refuge in music,' recalled his older son, Hans Albert. 'That would usually resolve all his difficulties.' In the end, Einstein felt that in his own field he had, like Mozart, succeeded in unraveling the complexity of the universe."* In Beauty.

- **The case of Beethoven is astounding. A composer who was almost completely deaf at the end of his life, he was able to hear his symphonies with his inner "third" ear and see them in space: he constructed his symphonic music like an architect would build a cathedral with portal, roof, dome and great harmonic symmetries.**

- **According to Daniel Morris, in his article "*Music of the New Spheres*" (*Chemistry* Magazine, 12/1969), Mendeleev's arrangement of the elements came to him while he was listening to a performance of Schumann's Piano Quintet, Opus 44.**

SG201.6.5.1 The Resurgence of Sound Healing (1)

As we have seen earlier [SG201. Chapter 1: Ancient music], music and the musical traditions were essential to ancient civilizations. Music was a way to bridge over to the cosmos and somewhat bring the heavens on earth,, often with magical and therapeutic intentions. Past cultures used music to call upon their gods & goddesses, bring about healing and create ceremonial rites of passage into higher levels of consciousness.

In the words of Jonathan Goldman, founder of the New England Sound Healers (NESH), *"in the ancient mystery schools of Egypt, Greece and other centers of knowledge, the use of sound and music for healing was a highly developed sacred science. Sonic vibration was known to be the fundamental creative force in the universe. The use of specific tones, frequencies, intervals and chants was extremely refined and specific."*

As the wheel of human evolution turns again, we are now seeing a welcome & timely resurgence of research and applications regarding the healing potential of sounds and sonic frequencies. Edgar Cayce, the 'sleeping prophet', said that "*sound will be the future medicine*". Indeed we can see that many aspects of alternative medicine ("*vibrational medicine*") incorporate sound and specially designed music. Even conventional medicine is researching the subject and experimenting with various forms of sonic bio-entrainment.

The now accepted modalities of sound healing include: relaxation and stress-relief, altered states of consciousness, enhancement of learning and creative abilities, treatment of psychological & emotional traumas, heart beat entrainment, brain synchronization…

At the cutting edge of sound healing research, specific tones & frequencies are used to treat specific aspects of the physiology and the energy systems of human beings: organs are understood as living entities having their own frequency rate that can potentially be treated with the appropriate re-harmonizing sounds. The immunological system has been proven to be sensitive to sounds; the acupuncture meridians and the chakras all respond to sound…

This is the new beginning of an exciting time of re-orchestrating life, in tune with the universe.

SG201.6.5.2 Sound Healing (2) - New Modalities

In the fertile realm of sound healing research & applications, we will briefly mention some new modalities:

- **The French physician Dr. Alfred A. Tomatis has revolutionized medical science with the simple clinical observation that the voice can only produce what the ear hears, showing that the two organs share the same neurological loop. Tomatis believes that certain sounds can "feed" the brain and recharge the whole being. His "Electronic Ear" has been successfully treating many learning abilities. Listening is nothing less that our "Royal Route" to the divine, says Tomatis who treated an entire Benedictine abbey in France by prescribing an immediate return to their 6-8 hours of chanting a day (the new abbot had decided to eliminate all chanting from their schedule).**

- **The applications of Harmonic Chanting as a new generation is learning to chant by creating overtones.**

- **The Monroe Institute has pioneered a binaural beat frequency (Hemi-Synch) that synchronizes the left & right hemispheres of the brain. Robert Monroe, a broadcasting executive, got interested in sound frequencies after numerous out-of-body experiences, some triggered by hi-frequency sounds he heard.**

- **Many other brain entrainment sonic applications are based on the harmonic functioning of the human body: the frequencies of the pulse, breathing, blood circulation and brain waves, as well as the many functions they control, are all in harmonic synchronization. Their rhythms are coordinated in whole number ratios: 2 to 1, 3 to 2 etc… Therefore, by using sound to entrain the brain, the whole being can be affected.**

- **Songaia Voice Spectrum Analysis. The specific configurations in the voice directly reflect our physical, emotional, mental and energy patterns. They also point to healing potential by revealing the missing or stressed tones indicative of dis-harmony or dis-ease in our being. These healing tones can then be selectively listened to as "sonic supplements". www.aniwilliams.com/voice_spectrum_analysis.htm**

CymaTherapy, Tuning Forks, Toning
and scientific applications of sound will be discussed next.

SG201.6.6.1 CymaTherapy

Scientists now know that the human body is an interactive energy system programmed to keep an overall harmonic balance. The body and its parts (cells, organs and tissues) have their own vibratory nature. They have a natural, resonant frequency that can become upset or imbalanced.

As a result of a lifetime of dedicated research, starting in the 1940s and 50s, Dr. Peter Guy Manners developed the sound healing system he dubbed "CymaTherapy". Dr. Manners studied and collaborated with many outstanding scientists, including Dr. Hans Jenny (Switzerland) and Dr. Harold Saxon Burr of Yale University (U.S.). He researched the use of cymatics and biomagnetics for medical diagnosis and treatment, including the healing effects of certain sound vibrations and harmonics on the structure and chemistry of the human body as well as the importance of sound and light in our natural environment.

Dr. Manners used a portable "sound applicator" to focus the specific combinations of frequencies on parts or organs of the human body. These sound waves help to normalize imbalances and synchronize the cell's frequency back to its natural healthy state of vibrational resonance.

Dr. Manners and colleagues have put together a large catalog of frequencies (or "*commutations*"). Since each person's anatomy and energy is different, within a narrow range, single frequencies are not effective enough. The problem was overcome by using an overlay of five frequencies producing a harmonic of the tissue. Why five? Besides the many symbolic explanations, a biological one is that these frequencies seem to be related to the five main stages of the cell renewal process. But the results speak: these particular patterns of five audible sounds frequencies have been shown. Over decades of clinical studies, to effectively correspond with the given tissue throughout a broad sample of the population.

Like other holistic techniques, Cymatherapy supports the body's natural ability to heal itself and regain its original harmony or balance.

Building on prior research, Cymatherapy International has created a range of new products for precise delivery of sound frequencies associated with healthy tissue and organ systems. These instruments now combine sound and magnetics - two powerful and natural restorative agents - to enhances results.

www.cymatherapy.com

SG201.6.6.2 CymaTherapy (2)

The webzine *Spirit of Maat* (founded by Drunvalo Melchizedek) has an article on Cyma-Therapy (Vol. 1, Nb. 8) introduced by this leading story:

A Re-Soundingly Successful Experiment

"Recently, in Germany, researchers took the DNA of a 17-year-old boy, recorded its sound frequencies, and saved them. The boy was accidentally killed, but the scientists still had his DNA frequency patterns. Later, the DNA frequencies of the 17-year-old were transmitted into the body of a man in his late thirties.
And the man almost became the young boy. His skin became youthful, he became slim, his hair went back to its natural color. Today he's in his forties and he still looks like a much younger man."

Sir Peter Guy Manners, M.D.

In the course of the interview, Dr. Manners gave the following explanation for perhaps the most exciting application of Cymatics: its potential to reverse the aging process.

"When you're born, every cell multiplies. Then, at puberty, the frequency patterns of the cells change, and instead of multiplying, cell replaces cell. As we age, cells still replace each other, but the tempo slows down. Within a few years of time we will be able to prevent this slowing down of cell replacement. And this can all be done with sound. If we take a frequency sample of your DNA at age 18, and save it, then later, if we transmit this frequency to your cells, they will rejuvenate."

Asked by Spirit of Maat about his medical training, Dr. Manners said that he had started off in ordinary medicine, but that a couple years into his training he'd reached a startling realization:

"As part of my training, I and my fellow students would observe doctors in the process of treating their patients. And so we are sitting there with this doctor, and some patient comes in with a headache, and the doctor says, 'Take these two tablets.' And the patient goes off. But he comes back in a fortnight or so, a couple weeks, and he says, 'Those tablets did the trick, but now I've got a little tummy upset.' And we watch the doctor give him some different tablets, and he goes off. And then later this same patient is back again, 'Oh, those tablets were wonderful, but now I've got a bit of diarrhea, you see.'
And I realized, we started out with one patient, and now we've got three!"

← Dr. Peter Guy Manners.

SG201.6.7 Phi-ratio Tuning Forks

Nowadays, besides Tibetan Bells (*Ting Sha's*) and bowls, Peruvian Whistles and Crystal Toning Bowls, we also have the traditional tuning forks laid out on the shelf of the Sound Healer/Therapist.

An adjustable Tuning Fork

A tuning fork is an acoustic resonator in the form of a two-pronged fork with the tines forming a U-shape… It resonates at a specific constant pitch when set vibrating by striking it against an object, and emits a pure musical tone after waiting a moment to allow some high overtones to die out. The pitch of a tuning fork depends on the length of the two prongs.

Tuning forks have long been used in Sound Healing. Many healers incorporate their use in their daily sessions with Reiki, Polarity, Massage, Acupuncture, etc… Tuning forks usually come as a set of 7 or 8 adjusted to the octave, the series of chakras or any traditional progression of frequencies.

<u>Directly related to sacred geometry musical ratios, we will mention:</u>

The "*Fibonacci set*" (www.tuningforktherapy.com). This set offers the following frequencies:C-256, C-512, G-384, A-426.7, 5/8, 8/13, 13/21, 21/34.

The "*Goldman 8-13 Tuning Forks*". (www.healingsounds.com). The 8-13 ratio is not known in western music and cannot be played on the piano. The ratio was computed using 288 Hz as the fundamental frequency; the 13th harmonic of this fundamental was calculated and divided by 2 until its frequency (468 Hz) fell within the same octave as the fundamental.

The "*Holy Harmony Tuning Forks*". (www.healingsounds.com). The 9 Holy Harmony Tuning Forks contain the 6 frequencies ("the original Solfeggio") found in "*Healing Codes*" by Dr. Leonard Horowitz and Dr. Joseph Puleo; plus 3 newly discovered frequencies completing this numeric series.

SG201.6.8.1 Toning (1)

Toning uses the vibratory power of the human voice, coupled with focused intention, to bring about self-healing, release, relaxation, personal growth, creativity, and helping to balance self and others.
Toning is simply the time elongation of a note or tone, using breath and voice. Toning is a universal language of sound, as it is using basic vowel sounds common to all people: A - OE - E - O - U or a traditional sacred sound like OM [◆SG201.3.5.4] No need to know how to sing or even have musical understanding. Anyone who can speak can also tone.

Toning is creating nonverbal sounds, usually simple clear vowel sounds but one can also experiment with sighing, moaning and humming as forms of toning.

The primary effect of toning is well-being: release, relaxation and relief. It just feels good and brings joy to the heart to start humming to oneself. Usually done subconsciously, humming, singing or even whistling softly are a sure sign of self-contentment. Toning is taking these natural expressions of the body to a conscious level and using them to allow the natural flow of energy and re-establish the harmonic rhythms of the physiological and mental functions. Toning is a tool of self-integration.

Going further, toning is actually learning how to tune into one's "personal tone" or "sacred chord", the overall frequency signature defining who we are. You can start by humming the main vowel sound in your name and then exploring creatively musical modulations on it, as well as feel where it resonates in your body-mind-soul.

Beyond self-use, toning is a way of healing & resonant communion with others: family, friends, community, nation, humanity and the entire universe.

www.healingsounds.com The site of Jonathan Goldman. Many resources.
www.templeofsacredsound.org An interactive site with 3 Toning Chambers: OM, AH, HU.

SG201.6.8.2 Toning (2) World Peace

Toning is increasingly used for world healing. On February 14th, 2002, the first World SOUND Healing Day was initiated.

In the words of Jonathan Goldman: *"On World Sound Healing Day, sound healers, meditators, peace activists and lovers of all humanity and sentient consciousness send a Sonic Valentine to the Earth with the heart sound "AH" filled with the intention of Peace and Love! This is an opportunity in which YOU can partake in to assist Global Harmonization - the process of creating harmony and peace on the Earth."*

The instructions are simple:

1. On Feb. 14th, anytime, anywhere (wherever you are, whatever time it is), take at least 5 minutes out of your day and project the heart sound "Ah" filled with Light & Love to Mother Earth, as a Sonic Valentine for Global Harmonization.

2. If possible, please gather with others in a group at any time on Feb. 14th to collectively tone together for this event.

Similarly, each year in July the Jonathan Goldman Healing Sounds Intensive takes place in Colorado. One of the highlights of this nine days Intensive is the DAY OF TONING, a wonderful and profoundly transformational time for planetary healing.
In Boulder, there is a large gathering of hundreds of people toning together the heart sound "AH" for over an hour. In the middle of the toning circle is a large quartz crystal bowl filled with water. At the completion of the global toning, each participant receives a cup of this water to drink. According to a testimony: *"This water tastes like divine nectar, filled with the energy of Light & Love that we have projected to the planet."*
The remainder of this water is then placed in a creek that flows into the continental divide and ultimately takes this energy to the oceans to flow throughout all of Mother Earth.

SG201.6.8.3 Toning (3) Babies & Children

While it is increasingly accepted to sing, talk, play music and communicate telepathically with babies while in the womb, now we also have Toning as a new modality to help build a harmonic bond between mother & baby.

After birth, *Toning for Children* of all ages is just as meaningful. It helps the parents and children to release the daily challenges, relax together and commune energy blockages and assist their energies to resonate in a field of family peace and harmony. All you need to do is get together in a cozy Toning Circle, state you are going to tone for e.g. "*joy in the family*" and then tone as you would for yourself.

In the words of sound healer Rhonda J. Rudolph-Turner: *"As children grow older it is very beneficial for them and their life experiences to teach them to tone for themselves. It is a very good way to show them how to release their anger or frustration in a positive way by toning the 'Release' tone that helps the energy of the emotion to be released. Another important tone for them to learn is 'Being at Peace with Yourself and Your Life'."*

Rhonda and other sound healers suggest that finding for a child their unique Personal Tone (their overall sonic frequency signature) is the best gift we can offer them. It will center them in their own source, help them in focusing on a cosmic identity and provide a vibratory "nest" supporting them all their life. You can tone to children their personal tone (just like their personal name) daily and, when they are old enough, teach them to tone for themselves, with a focused intention, and encourage them to keep toning for themselves and for others. One could say that this is a new form of the traditional daily prayer.

SG201.6.9 Sound Healing & Medical Science

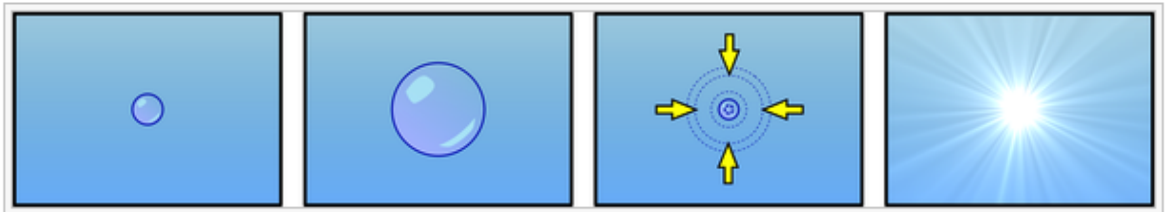
SOUND, the NEXT FRONTIER in HEALING. Mitchell L. Gaynor, M.D., a leading oncologist and director of integrative medicine at the Strang-Cornell Cancer Prevention Center, states in his book *The Healing Power of Sound*, that "the very tools high-tech scientists have used to understand molecular biology are revealing that mind-body communication occurs on the deepest levels of cellular function. Based on my reviews of this burgeoning research, I have come to believe that mind and body are not merely connected, they are unified. I also believe that understanding mind-body unity is essential to recognizing how sound - which has vibratory effects on cells, organs, emotional effect on the brain, and which taps a spiritual dimension as yet undefined - is the next frontier in holistic healing."
Mitchell Gaynor uses crystal toning bowls and voice toning in his practice with cancer patients.

SONOLUMINESCENCE. A bubble of air can focus acoustic energy a trillionfold to produce picosecond flashes of light. While the scientific explanation of the phenomenon is still elusive (but bears on new quantum physics), one can buy inexpensive kits to produce it. In 2001, it was actually discovered in nature: certain species of shrimp can use their club-like forelimbs to strike so quickly and with such force as to induce sonoluminescent cavitation bubbles upon impact. The traditional understanding of healing in terms of *sound-as-light* and *light-as-sound* may soon become household item.

TIME-REVERSE ACOUSTICS. When "Hello" is electronically re-focused back as "Olleh" we have a "Time-Reversal Mirror" (TRM). The tracking and focusing precision of TRMs is much better than that of conventional ultrasounds and opens up new medical applications, from diagnostic to TRM hyperthermia.

HIFU. A new ultrasound device, used in conjunction with magnetic resonance imaging (MRI), allows neurosurgeons to precisely burn out small pieces of malfunctioning brain tissue without cutting the skin or opening the skull. High-intensity focused ultrasound (HIFU) is different from the ultrasound used for diagnostic purposes, such as prenatal screening. The technology is currently used to ablate uterine fibroids and is in clinical testing for removing tumors from breast and other cancers.

➔ **Sonoluminescence. Wikipedia.**

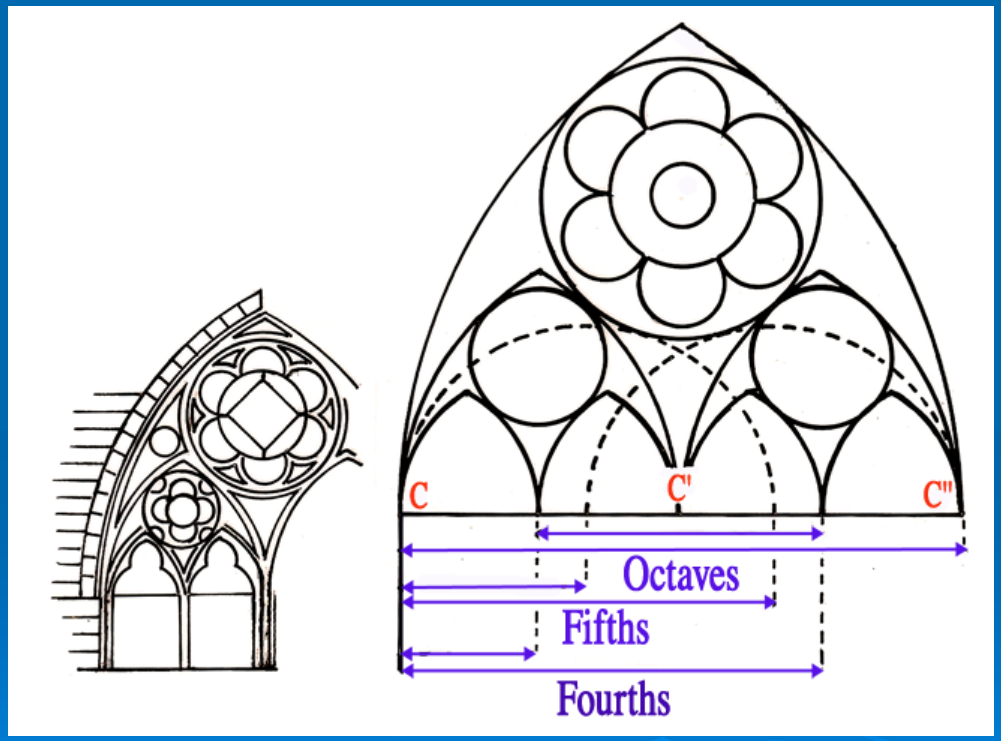


From left to right: apparition of bubble, slow expansion, quick and sudden contraction, emission of light

SG201.6.10 Music in Architecture

Since Johann Wolfgang von Goethe, it is well known that architecture is "frozen music". He is the poet-philosopher who also said: "Beauty is a manifestation of secret natural laws, which otherwise would have been hidden from us forever".

Music and Sacred Geometry in architecture is a vast subject that will be presented in ◆SG207.



Architecture has an essential healing function: it creates the 3D spaces that shape our lives.
In ancient times, architecture was based on sacred geometry and music ratios.

In preview of later study, we give here one single example: the Vesica musical geometry [◆SG201.3.8.1] harmonizes with the tracing of the Gothic windows in the "Medieval Renaissance" (11th - 13th c.)

(After M. Schneider. *Constructing the Universe. Activity Book*. 2003.)
www.constructingtheuniverse.com

↑ Tracing of window. Notre Dame Cathedral, Paris.

↑ Symmetrizing the Vesica-based musical ratios gives the outline of the gothic Window.

SG201.6.11 The Law of the Octave

The Law of the Octaves is a fundamental principle of Harmonics based on the whole number ratio 2:1 and perceived as a perfect "*diapason*" or consonance. To form an octave is to double or halve a given frequency (or musical string), thus obtaining a "higher octave" and a "lower octave". In both cases, the seed or essence of the original frequency or tone is conserved and carried on, albeit at a higher or lower "pitch".
The octave is also the first resonant harmonic in the natural overtone series and its largest interval: 1:2. The octave is the only part of our contemporary tonal system that is not "tempered".

The Octave is a harmonic ladder providing a common denominator for astronomy, mathematics, the musical scale and color perception. "*Octavus sanctos omnes docet esse beatos*", proclaims a medieval inscription in the abbey-church of Cluny, France: *"The Octave teaches all saints to be blessed".*
Such is the power of the Octave as Oneness manifested and re-generating itself.

Octave Transposition

In his pioneering book "*The Cosmic Octave*" (1998), Hans Cousto, a Swiss scientist, has applied the Law of Octaves to make audible and visible the "music of the Spheres". Other researchers, like musician J. E. Berendt and adventurous scientists, have also come up with recordings of the tones of planetary periodicities or pulsars, and the music of DNA, atoms, crystals…

Here is the basic technique. According to the physic formula: frequency = 1/period, a period (time) of oscillation or vibration and its frequency are inversely proportional. This base frequency must then be doubled (*octavized*) until it reaches the range of sounds audible by the human ear (16 to 16,000 Hz or about 10 octaves). Again, 40 octaves higher, the audible frequencies reach the range of colors visible by the human eye (380 billion Hz to 760 billion Hz or about 1 octave).
Thus, transposing astronomical periods to sounds & colors is a straightforward process which only requires finding the reciprocal value of the period and multiplying by 2 a number of times.

SG201.6.12 The Tones of the Earth

To keep our feet on Mother Earth, we are just going to look at the Earth Day, Month and Year.

The Earth Day.

The most important frequency for life on Earth is the 24 hours Earth "day" or exactly 23 hours, 56 minutes and 4 seconds = 86,164 seconds. The frequency of this time period is its reciprocal value or 0.00,001,160,576… Hz. Transposing (multiplying by 2) through 24 octaves gives the tone "G" = 194.71 Hz.

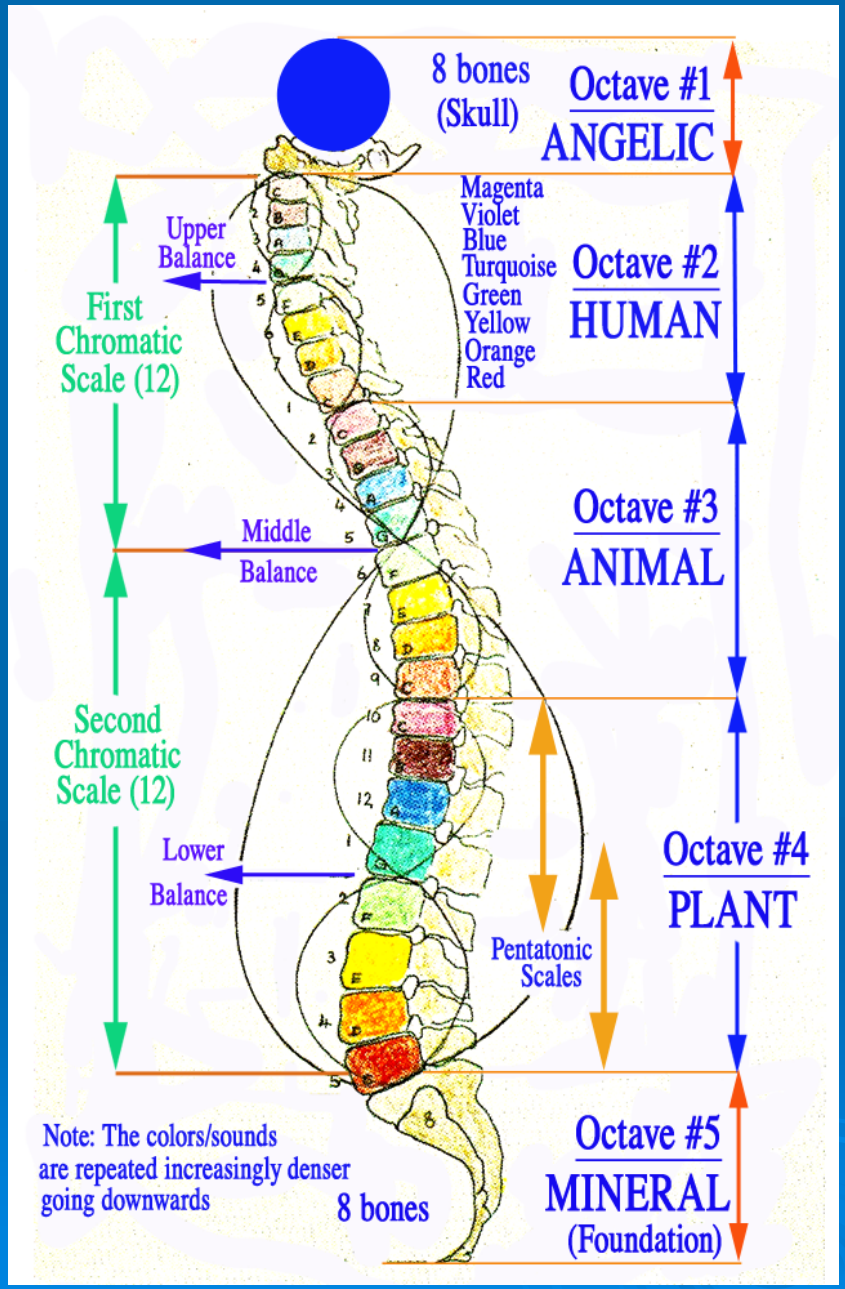
In music theory, G is the treble clef and is essential as the fifth note from C and the fundamental ratio of the fifth ("*diapente*") or 2:3. In French, G is called "*sol*" which means both the earth (*sol = soil* or *ground*) and the sun (*soleil*); moreover it is the root word for *solfege* (*solfeggio*) or music theory (*sol-fa*).
Moving through 40 octaves from sounds to colors we find, in the 65th octave, a resonant frequency of 427 billion Hz (702 nanometers) which produces a luminous orange-red. One octave higher, at the 66th octave of the earth day, the resonance of DNA is reached.

The Earth Month

Based upon the *synodic month* (full moon to full moon), we obtain a month tone of 420.837 Hz or unimportant "G" sharp in our music system. However, early classical music resonated with the Moon: Mozart's A tone tuning fork vibrated at 421.6 Hz, Handel's at 422.5 Hz and Bach's at 415.5 Hz.

The Earth Year

The Earth Year is calculated on the basis of the tropical year of 365,2422 days or 31,556,926 seconds. The audible range is reached within 32 octaves giving a sound frequency of 136,102 Hz of just below "C" sharp. While no direct relationship exists for western music, this frequency of 136 Hz is the fundamental tone in Indian classical music. [◆SG201.1.3.3]
Called SA (*sadja*) this tone is the primordial Indian music training. J. E. Berendt explains: *"The young (Indian) musician must play or sing this note for years until it has become securely established as a vibrating part of his self. Never again can he be mistaken about pitch."* (The Third Ear, 1985).
This SA tone (transposed earth tone or earth-sun tone) is known in the East as the "*father of notes*" and is the note used for the mantra OM. All organic life on Earth is tuned to this sun rhythm tone.
The corresponding chromatic frequency is blue-green (471 nm).



SG201.6.13 The Musical Spine

In the 1980s, the late Theophilius Gimbel, a pioneer in color-sound therapies and founder of the Hygeia Studios, published his research. Among Gimbel's many contributions, he shared his insights about the human spine as a musical instrument. In his words:

"The human spine is a miracle of creation which has arisen out of sound… It is a column of light & sound capable of channeling the earth vibrations and the cosmic energies by playing on them together.

The skull is succeeded by the development of the various vertebrae… The sound of each vertebra follows a descending scale as they increase in physical density…."

(Theo Gimbel. *Healing Through Color*. 1980)

Each vertebra is a toning bell within the musical harmonic progression of the spine.
There is a sound (personal frequency tone) that plays & reverberates through the body-mind-spirit of a human being, using the spine as a resonant 5 octaves cosmic flute.

SG201.6.14.1 Dance, Rhythm & Celebration

All dance forms are derived from the sacred knowledge of cosmic harmony. In ancient cultures, Sacred Dance was a way to maintain personal & community contact with the universal rhythms: it ensured that the life force was conducted into the body and the land, at regular calendric festivity times. Ceremonial & celebratory dancing resonated the body to the "*Music of the Spheres*" i.e. the natural rhythms of the earth, the planets and the galaxies.
The human spine, as an antenna of light & sound via the chakras, is a vibrating monochord plucked at each vertebra to play rich combinations of chords capable of tuning body-mind-spirit to an exquisite communion with the cosmos.

Rhythms and drumming are based on the primary ratios of the musical chords. Sacred drum beats are the bare bones of music, the simplest mathematical ratios of the first integers. They are combinations of 1 - 2 - 3 - 4: 1 - 1, 1 - 2, 2 - 1, 2 - 3, 3 - 1, 3 - 2, 3 - 4 etc… And they entrain & entrance the very bones of human beings…

↑ 11:11 1992 Sacred Dances. Giza, Egypt.

SG201.6.14.2 Meditation on the World's Drum

//lostseouls.com/blog38

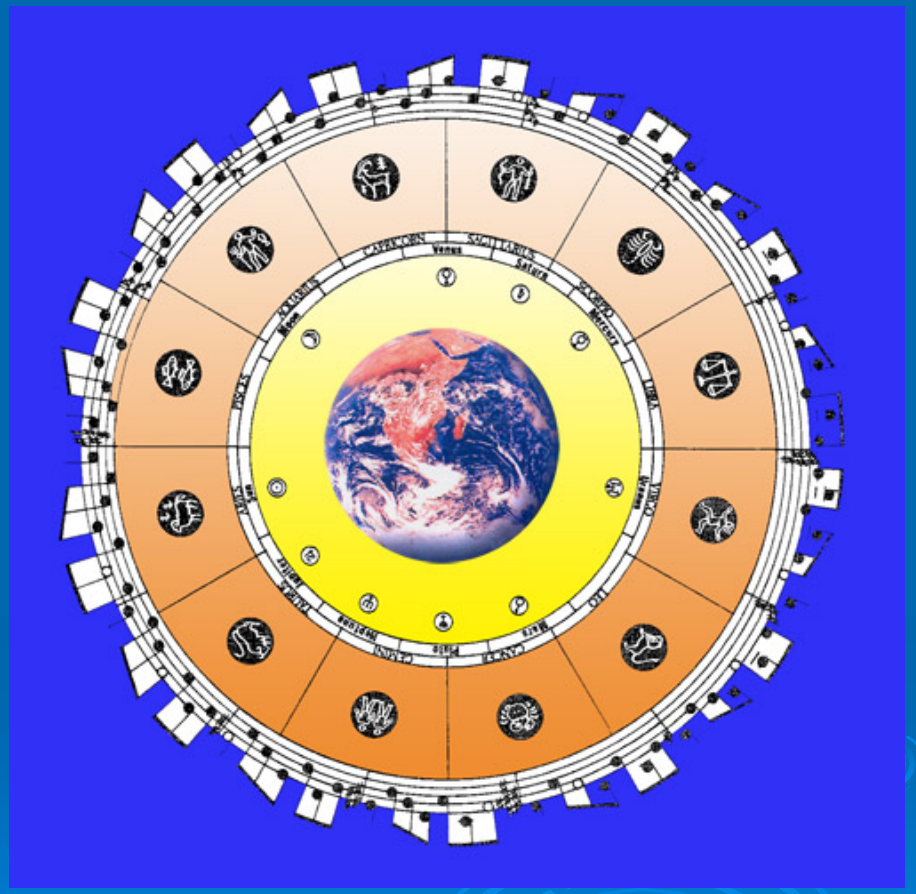
SG201. Ca Conclusion

Remember, we are co-creating the universal symphony. We are weaving our voice into the myriad of other frequency emitting/receiving instruments of the cosmic orchestra.

We all are natural musicians, from atoms to galaxies. We are where we are to celebrate and resonate together HARMONY by learning how to play chords of unison, fifth and fourth - the basic musical intervals of the Golden Ratio PHI.

When we chant, tone, play music or actually even entertain a thought or an emotion, we enter into the resonant field of the naturally occurring overtones, reverberating throughout the cosmos. It is up to us to emit/receive tones & frequencies that carry a feeling of harmony, beauty, love and peace. Or else we cut ourselves off the universal symphony.

Global harmonization is enhancing peace & beauty on Earth.



Harmonically yours,
Aya

SG201. Cb Online SG School Curriculum: Intro & Intermediate

Sacred Geometry Introductory Level: 8 Modules

SG 101	Intro I	Sacred Geometry: Universal Order & Beauty
SG 102	Intro II	History & Traditions of Sacred Geometry
SG 103	Intro III	Sacred Geometry: A Grand Tour
SG 104	Intro IV	PHI: the Golden Ratio & the Fibonacci Series
SG 105	Intro V	Pentagons, Pentagrams & the Penta-Modules
SG 106	Intro VI	The Golden Rectangle & Golden Spiral
SG 107	Intro VII	The Five Platonic & 13 Archimedean Solids
SG 108	Intro VIII	The Vesica Piscis: Cosmic Womb of Creation

Sacred Geometry Intermediate Level: 8 modules

SG 201	Interm I	The Monochord, Music & Cymatics
SG 202	Interm II	The Power of Archetypal Numbers
SG 203A	Interm IIIA	Sacred Geometry Resurgence in Science - Part 1
SG 203B	Interm IIIB	Sacred Geometry Resurgence in Science - Part 2
SG 204	Interm IV	PHI in the Human Body, Biology & DNA
SG 205A	Interm VA	The SG of Nature - Part 1: Plants & Phyllotaxis
SG 205B	Interm VB	The SG of Nature - Part 2: Animals & Minerals
SG 207	Interm VII	SG in Architecture, Sacred Sites & Green Design

SG201. Cc Online SG School Curriculum: Advanced

Sacred Geometry Advanced Level: 8 modules

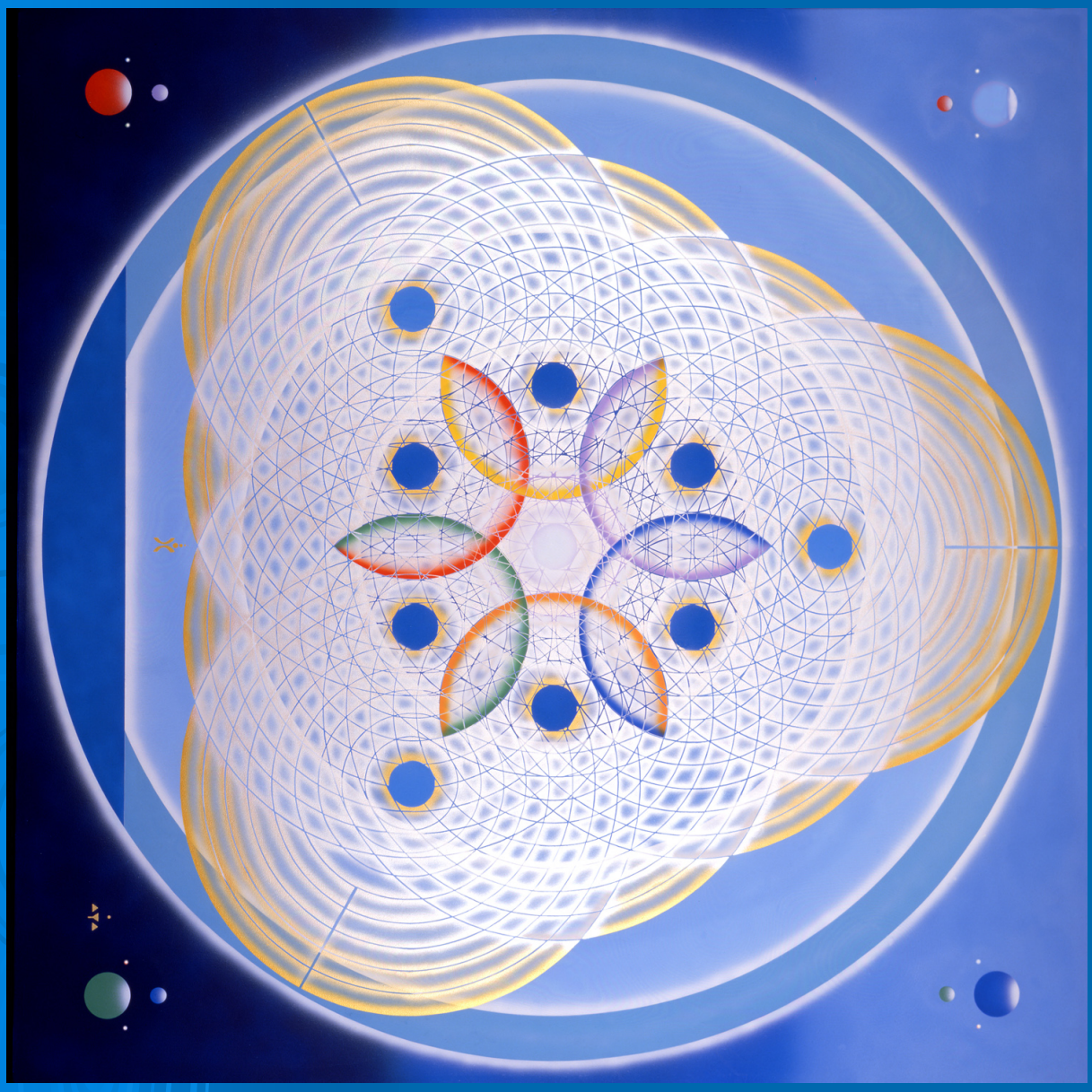
SG 301	Adv I	Golden Cosmos: Planets, Stars & Cosmology
SG 302	Adv II	SG in Art, Culture & Creativity
SG 303	Adv III	Universal Symbols: Primordial Knowledge
SG 304	Adv IV	Labyrinths: a Mini-Pilgrimage to Self
SG 305	Adv V	Mandalas & Yantras: Sacred Vortices
SG 306	Adv VI	Languages & Gematrias: Sacred Communication
SG 307	Adv VII	Sacred Geometry in the Healing Arts
SG 308	Adv VIII	Harmony on Earth: Science & Consciousness of Harmony

Upon completion of each level (Introductory, Intermediate & Advanced), a Certificate of Graduation from the Sedona School of Sacred Geometry will be presented to Certification Students.

Postgraduate seminars on current Sacred Geometry research, discoveries & updates will be organized in harmonic future.

Questions: phi@schoolofsacredgeometry.org

SG201. Cd StarWheel Blessing



SW#75. "Tetraktys Lake". www.starwheels.com

SG201. Ce
Contact Info

Sedona School of Sacred Geometry
www.schoolofsacredgeometry.org
phi@schoolofsacredgeometry.org
PO Box 3714, Sedona, AZ 86340

StarWheel Mandalas by Aya
www.starwheels.com
www.starwheels.com/infopage.php?pagename=starwheelgallery
aya@starwheels.com

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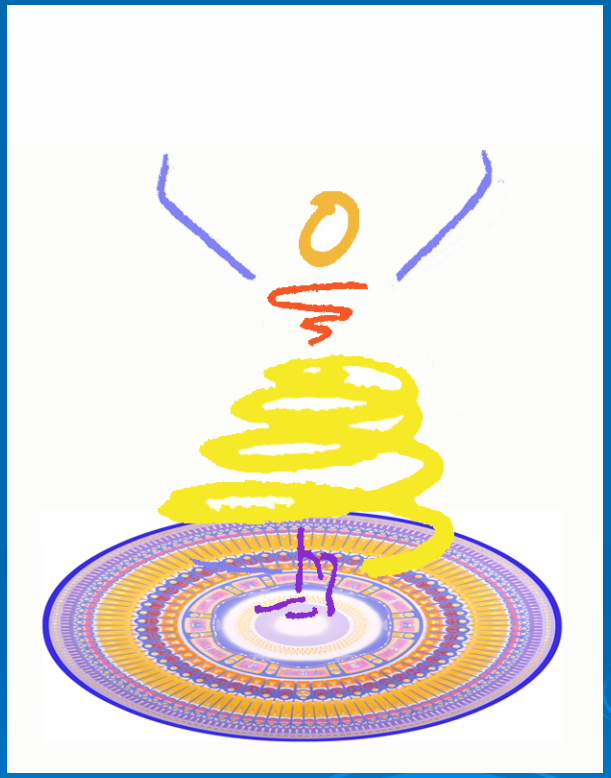
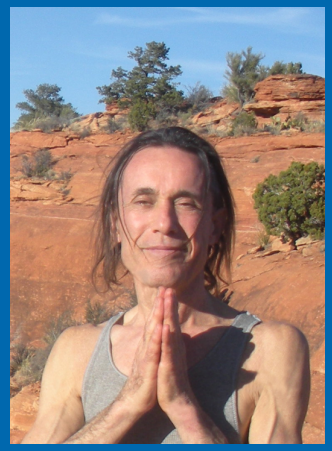


Φ celebration



SG201. Cf About Aya

A native of France, Aya is a visionary artist and celebration yogi who has dedicated his life to serve humanity and to develop sacred arts education. In his late 20's, Aya realized that his professional life in the French diplomatic service was not fulfilling his heart's desires; he quit everything to go on an extended vision quest. His path took him around the world to visit a variety of sacred sites & cultures and to receive inspiration from many teachers.

In 1985, in Santa Monica, CA, Aya was gifted with a spiritual vision prompting him to create a series of 108 airbrushed neo-mandala paintings: the "StarWheels". The StarWheels, a happy family of vibratory flowers for the Earth, are looking for sacred spaces to be graced with their presence... (www.starwheels.com / www.starwheelmandalas.com)

Moving to Sedona, Arizona, in 1997, Aya has been involved with sacred arts classes & events, mandala creation, Sedona guided tours, labyrinth making and Sacred Geometry teaching. Aya has presented several StarWheel art exhibits, has sponsored community awareness events at the Sedona Library, has developed, in collaboration with Gardens for Humanity, the Peace Garden arboretum at the Sedona Creative Life Center, was a speaker at the Sacred Geometry Conference (Sedona, 2004), co-designed several labyrinth sites (The Lodge at Sedona, Magos' Ranch...), and was on the management team of the Raw Spirit Festival in 2006 - 2008.

Realizing that Sedona was progressively becoming a global spiritual university for many seekers from around the world, Aya founded in 2005 the Sedona School of Sacred Geometry. The school is offering online access to Sacred Geometry PDF modules, with 17 modules completed so far. In the school's website, Aya states: *"We are living at the extraordinary and exciting times of a global transformation to a higher order of human consciousness... Sacred Geometry is the expression and resurrection of our deep innate wisdom, now awakening from a long sleep: seeing again the all-encompassing, fractal-holographic unity of nature, life and spirit... The keyword is HARMONY."* (www.schoolofsacredgeometry.org)

Aya's visionary dream, supported by his non-profit educational organization, the StarWheel Foundation, is the co-creation of an international eco-village "The School of Celebratory Arts" - a green, tropical environment encouraging young people of all nations to develop their creative consciousness and thus contribute to a new, spirited, life-respecting global civilization on Earth. (www.starwheelfoundation.org).

Since 2012, Aya is dancing the body divine, after his re-discovery of Yoga, Partner Yoga and AcroYoga. Aya is currently the AcroYoga.org Jam coordinator for Sedona and a teacher of yoga swing asanas.

Blessings in Anjali!