Why is Music Healing?

One of the reasons why listening to music is so healing for us is due to the power of musical intervals. A musical interval is created when one note is played with another note. The interval can be created by playing two notes together, or one after the other. When two notes are played together the interval has a stronger effect on us.

The frequencies of the two notes of the interval create a mathematical ratio that effects the body in different ways. When we listen to all the intervals in the musical scale it is profoundly healing for our body and our mind.

Recent research has shown that bird song and whale song contains musical intervals. The ratios of the musical intervals are also found in crop circle formations.

Researchers have discovered that musical intervals exert a profound effect on our pulse and respiration. Fabien Maman found that playing musical intervals to cancer cells actually destroyed these cells in his experiments. (Maman, F. 1997)

Every organ, every bone, every cell in the body has its own resonant frequency. Together they make up a composite frequency like the instruments of an orchestra. When one organ in the body is out of tune it will affect the whole body.

Through sound healing it is possible to bring the body back into harmony hence avoiding the need for drugs or surgery.

If we compare the body to a musical instrument, when we hear the various musical intervals it brings us in tune with our natural vibration. Our bodies are made up of the same proportions found in music. When all the musical intervals are sung or played to us in a sound healing session our body is receiving the fundamental ratios of creation.

Each musical interval creates to a different ratio; and they have a balancing effect on the organs and the cells of our body. The musical intervals are musical medicine for our body.

At the College of Sound Healing we teach sound healers how to use the musical intervals for healing. People receiving the musical intervals in a healing session generally report that they feel an improvement in their health and well being.

Scales and Intervals

Western music uses the eight-note scale or octave comprising C D E F G A B C. This is known as the 'diatonic scale,' the white keys on the piano.

The note 'C', an octave above middle 'C', will always be vibrating twice as fast and have twice the frequency of middle 'C'.

When two intervals are played through an oscilloscope different patterns appear on the screen. The octave creates the ratio of 2:1 and the pattern seen on the left. It is interesting that the Roman word for eight is 'octave' and the pattern produced is a figure eight!

When men and women sing together their voices are generally an octave apart. When people listen to the octave they report having feelings of togetherness, balance and wholeness. This interval is restful, meditative, calming and grounding.

The notes 'C' and 'G' in the same octave create a ratio of 3:2. This interval is called the fifth because 'G' is the fifth note of the scale in relation to 'C'.

The interval of the fifth creates the ratio of 3:2 and the pattern shown on the right. This interval creates a feeling of completeness and creativity. It stimulates power and movement. It was used by the medieval mystic Hildegard of Bingen in her musical compositions to express openness, joy and healing."

The interval of the fifth is often referred to as the "perfect fifth" because it has a harmonic relationship with the fundamental tone. When the note 'C' is sounded 'G' will also be produced as a harmonic. The interval of the fifth is compared to a parent-child relationship.

In classical Chinese music the interval of the fifth was considered to balance heaven and earth, yin and yang. All classical Chinese music was based on this interval.

The interval of the fifth is the interval found in sacred music and it has a harmonising effect on the human body. The fifth is the second harmonic when a string is plucked. It gives the note its depth and beauty.

Human Proportions and Musical Ratios

Leonardo Da Vinci studied of the proportions of the male human body as described in a treatise by the Ancient Roman architect Vitruvius.
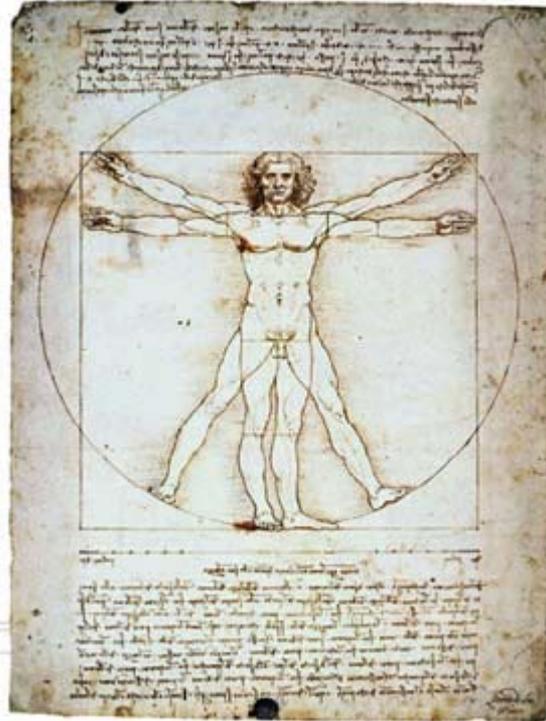
1.A man's height is four cubits (and thus 24 palms).
2.A pace is four cubits.
3.The length of a man's outspread arms from fingertip to finger tip is equal to his height.
4.The distance from the hairline to the bottom of the chin is one-tenth of a man's height.
5.The distance from the top of the head to the bottom of the chin is one-eighth of a man's height.
6.The maximum width of the shoulders is a quarter of a man's height.
7.The distance from the elbow to the tip of the hand is one-fifth of a man's height.
8.The distance from the elbow to the armpit is one-eighth of a man's height.
9.The length of the hand is one-tenth of a man's height.
10.The distance from the bottom of the chin to the nose is one-third of the length of the head.
11.The distance from the hairline to the eyebrows is one-third of the length of the face.
12. The length of the ear is one-third of the length of the face.

Reproduced from the web site - http://www.facialbeauty.org/divineproportion.html

Human Body
The proportions of the human body also conform to the whole number ratios found in the harmonic series.

The distance from the pubis to the feet compared to the overall height of the body creates the ratio 1/2, corresponding to the interval of the octave.

When the height of the whole body is compared to the distance from the person's feet to their nipple, this will form the ratio of 4:3, corresponding to the interval of the fourth. This ratio will also be found when the height at the arm socket is compared with the height at the navel.

When the height at the navel is compared to the distance from the navel to the top of the head this will create the 3:2 ratio, the fifth. This ratio will also be found when the length of the inner side of the arm including the palm is compared with the length of the forearm without the hand.

In a person 170cm high, the navel will lie at a height of 102cm. The two measurements form the ratio 5:3, corresponding to the interval of the sixth.

Chinese acupuncture uses these proportions to determine the location of acupuncture points on the human body.

In all cultures the faces that are considered most beautiful are the ones that most closely conform to these whole number ratios.

From the web site - http://www.facialbeauty.org/divineproportion.html

Intervals in Nature

In his book "The Power of Limits" (1981) says "the intervals of the 5th and 4th occur again and again in nature, e.g. vein structures of leaves. Researchers have discovered that consonant and dissonant chords, different intervals and other features of music exert a profound effect on man's pulse and respiration. (Doczi, G. 1981)

Modern science now shows that geometric patterns lie at the centre of atomic structures. When Andrew Gladzewski carried out research into atomic patterns, plants, crystals and harmonics in music he concluded that atoms are harmonic resonators. He showed that physical reality is actually created by the geometric patterns found within sound frequencies. (Tame, D. 1984)

Whale and Bird Song

Recent research by scientists in America has revealed how musical intervals are found in whale song and bird song. They analysed the calls of humpback whales and birds as well as sounds of amphibians and insects.

The scientists found that, "The recordings of whale songs, speeded up about fourteen times, sound amazingly like bird songs. Indeed this whale music is said to be surprisingly beautiful, something like the sounds of oboe, muted cornet and bag pipes. As with bird songs, humpback songs follow specific musical rules."

"The main differences between bird songs and their whale counterparts is that the former usually last only a few seconds while humpback songs last from about ten minutes to half an hour. Moreover birds typically rest between songs. Whales on the other hand may sing and re-sing their songs for many hours on end. "

"An examination of bird song reveals a similarity with human music. There are interval inversions, simple harmonic relations, and retention of melody with change of key. Some birds pitch their songs to the same scale as Western music."

The researchers note: "Even though they are capable of singing over a range of at least seven octaves, humpbacks use musical intervals between their notes that are similar to or the same as the intervals in our scales. Most surprisingly, humpback songs contain repeating refrains that form rhymes. This suggests that whales use rhyme in the same way that we do: as a mnemonic device to help them remember complex material."

"For example, notes in the song of the wood thrush (*Catharus mustelina*) are pitched such that they follow our musical scale very accurately. The interval between the first and second parts of the song of a ruby-crowned kinglet (*Regulus calendula*) is often a full octave. The canyon wren sings in the chromatic scale (which divides the octave into 12 semitones) and the hermit thrush (*Catharus guttatus*) in the pentatonic scale (which consists of five different tones within the octave more common in African and Eastern music). "

"Advances in audio technology allowed the late Luis Baptista to draw fascinating parallels between bird song and human music. For instance, when birds sing songs they often use the same rhythmic variations, pitch relationships, permutations, and combinations of notes as human composers."

Whales
The researchers note: "Even though they are capable of singing over a range of at least seven octaves, humpbacks use musical intervals between their notes that are similar to or the same as the intervals in our scales. Most surprisingly, humpback songs contain repeating refrains that form rhymes. This suggests that whales use rhyme in the same way that we do: as a mnemonic device to help them remember complex material."

"Their use of themes is similar to that found in some of our musical compositions. Firstly the theme is sung, elaborated upon and then a return is made to the original but now slightly modified theme. This construction is called, in musical theory, the A-B-A form of composition. Typically there are several distinct themes, up to six, in a song."

"Over a season, whales gradually change their song. Since all sing the same song, they must all agree on the modifications. After a rest of about six months, the whales burst forth into song again and all remember the old song, even without practice over that long interval. Their memories must be phenomenal. Now however, as they begin to sing again, the humpbacks change the details. After several seasons, the song is completely different."

"Besides these whales, only man has the capacity to change his speech patterns. The fact that whale and human music have so much in common even though our evolutionary paths have not crossed for 60 million years, suggests that music may predate humans. Rather than being the inventors of music, we are latecomers to the musical scene."

(Gray, P.; Krause, B.; Atema, J.; Payne, R.; Krumhansl, C. and Baptista, L. - Enhanced: The Music of Nature and the Nature of Music - Science AWI Quarterly, 2001 Vol. 49, No.3)

Architecture and Intervals

Harmonics in Architecture

Goethe the great German philosopher called architecture "frozen music". The ratios that we find most beautiful in architecture all adhere to the harmonic series: -

2:1 the octave	e.g. C/C	found in the proportions of picture frames
4:3 the fourth	e.g. F/C	
3:2 the fifth	e.g. G/C	found in the proportions of picture frames
5:4 the third	e.g. E/C	
5:3 the sixth	e.g. A/C	found in the proportions of window frames
8:5 the minor sixth	e.g. A flat/C	found in the proportions of corners

All these ratios create forms in nature and architecture that are visually pleasing. These ratios can be found in Ancient Greek Temples and in Pyramid construction.

Platonic Solids

The ratio of the 2/3 (the interval of the fifth in music) is found when studying the relationship between the faces, edges and corners of platonic solids: -

The Tetrahedron (4 sided object) has 4 faces and 6 edges
The Hexahedron (6 sided object) has 8 corners and 12 edges
The Octahedron (8 sided object) has 8 faces and 12 edges

Plants and animal cells are packed together in the shapes of these platonic solids. Bees and wasps create hexagonal shaped nests. Conches, nautiluses and other mollusks reflect the harmonic proportions in the formation of their shells.

The Golden Mean

The Golden Mean (or Golden Section), represented by the Greek letter 'phi', is one of those mysterious natural numbers that arise out of the basic structure of our cosmos. Phi appears regularly in all things that grow and unfold in steps, and that includes living things. The decimal representation of phi is 1.6180339887499.

You can find the Golden Mean in a number of places. If you start with the numbers 0 and 1, and make a list in which each new number is the sum of the previous two, you get a list like this:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, ... to infinity

This is called a 'Fibonacci series'. Leonardo de Pisa (circa 1180-1240 AD), better known as Fibonacci, discovered the uniformity of ancient harmonic wisdom. He realised that the natural branching, flowering, and spiralling forms in nature follow the same uniform laws found in musical scales.

If you then take the ratio of any two sequential numbers in this Fibonacci series, you'll find that it falls into an increasingly narrow range:

1/1 = 1
2/1 = 2
3/2 = 1.5
5/3 = 1.6666...
8/5 = 1.6
13/8 = 1.625
21/13 = 1.61538...
34/21 = 1.61904...
and so on, with each *addition* coming ever closer to phi (1.6180339887499...).

If you have a rectangle whose sides are related by phi (say, for instance, 13 x 8), that rectangle is said to be a *Golden Rectangle*.

If you divide the above rectangle's long side according to the Golden Mean you will produce the square that you see on the right of the rectangle. If you then divide the central line inside the rectangle according to the Golden Mean you will create another square in the top left hand corner of the rectangle.

If you continue dividing the next line inside the rectangle you create a smaller square in the bottom left hand corner of the rectangle. If you continue this dividing and then draw a line through all the points that you have divided you will end up with a spiral pattern (see below).

This pattern, created by the Golden Mean is found in snail shells, spiral nebulae of galaxies and the petal arrangement of daisies and roses. The Golden Mean proportions were used in the construction of the Greek Parthenon and the Egyptian Pyramids. Since the Renaissance, the Golden Mean has been used extensively in art and architecture, it figures for example in the Venetian Church of St. Mark built early in the 16th century.

It has become a standard proportion for width in relation to height as used in facades of buildings, in window sizing, in first story to second story proportion, and in the dimensions of paintings and picture frames.

Rectangles formed from the golden section creating the spiral pattern found in nature
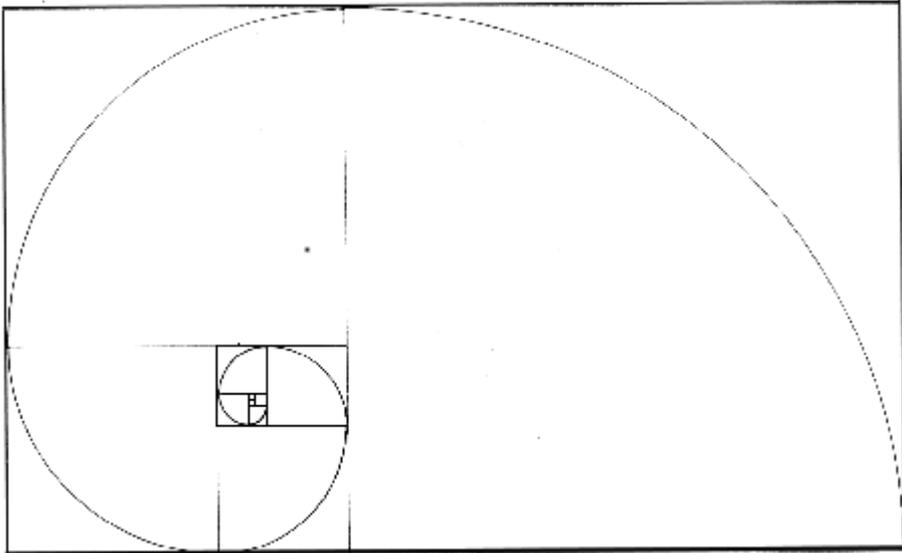
The Fibonacci series relates to all of the musical intervals, which comprise beautiful chords. The following table shows some Fibonacci ratio musical chords using the fundamental tone 'A':

A	A	D	F	E	C	E	C#	F#	C#	D	F
root	octave	4th	aug.5th	5th	min3rd	5th	3rd	6th	3rd	4th	aug.4th
1/1	2/1	2/3	2/5	3/2	3/5	3/8	5/2	5/3	5/8	8/3	8/5

The Fibonacci ratios were also utilised in sacred temple architecture, including the towering Gothic Cathedrals. Guillaume Dufay (c. 1400-1474) from the Netherlands composed music for the dedication of Florence's cathedral of Santa Maria del Fiore in 1436.

His musical piece was based on the Fibonacci series of tones, which corresponded to the dimensions of the cathedral's dome. These 'musical temples' were part of the medieval renaissance of sacred geometry, Hermetic mysteries and the flowering of art and music.

The French architect LeCorbusier noted that the human body when measured from foot to navel and then again from navel to top of head, showed average numbers very near to the Golden Ratio. He extended this to height compared with arm-span, and designed doorways consonant with these numbers.

Studies have shown that the patterns of tree branching adhere to the Golden Mean proportion, although again not exactly, while the dendritic cracking in certain metallic alloys which occurs at very low temperatures is Golden Mean based.

Mike Kay found that many of Mozart's sonatas divide into two parts exactly at the Golden Section point. Was this a conscious choice or did he do this intuitively? His sister said he was always playing with numbers and was fascinated by mathematics. (American Scientist March/April 1996)

All of creation expresses itself through number and number is frequency, manifest as colour, sound and form, and even as emotion and states of consciousness. The effects of harmonious design based on sacred proportions can be experienced when one enters an ancient temple in Egypt or a Gothic cathedral, such as Chartres.

The effect can be immediately sensed as harmonious, powerful and centring. Being inside a space designed with sacred proportion helps us to access other dimensions of consciousness.

"The most common proportions found in ancient Egyptian temple architecture correspond to the most harmonious intervals found in music: the octaves, fifths, fourths, thirds and sixths. In the temple of Horus at Edfu, the dimensions of one chamber's measurements of width to height equalled 2:3, which defines an interval of a fifth in music. (Antoine Seronde - Rediscovering Music in the Architecture of Egyptian Temples)

This expansion and transformation experienced by being inside a sacred space can also be reached directly through listening to sacred music, or 'aural geometry'. Most divinely inspired music, such as Gregorian chant, some 'new age' music, and the music of indigenous cultures, features the musical interval of the fifth. An easy way to understand a musical 'fifth', would be to use the white keys of a piano, and play middle C and counting C as the first note, play the fifth key up, which is G.

"The Egyptians utilised musical scales analogous to our own. The positions of the harpists' hands on the strings clearly indicate ratios such as the fourth, fifth and octave, revealing an unquestionable knowledge of the laws governing musical harmony." (Lucy Lamy - Egyptian Mysteries).

"The sky and its stars make music in you."   *Denderah Temple wall inscription, Egypt*

The Ancient Greeks believed that architecture should reflect the divine proportions found in nature. Influenced by such beliefs, the architects of temples such as the Theseum in Athens, and the Parthenon, have provided us with a set of architectural principles we call classical.

The classical design feels human in scale and shape, while conveying stability, order, and harmony. The classical design thus illustrates the ties between humanity, nature, and the sacred. (Callisto Radiant - Mystical Meaning in Sacred Architecture)

Gothic Cathedrals
Between 1100-1300 AD hundreds of Gothic Cathedrals were constructed across Europe, inspired by the eastern Hermetic knowledge rediscovered by the mystical order of monk-knights, the Knights Templar.

During the tenure and excavations of the Templars at Solomon's Temple in Jerusalem, they discovered the vaults of hidden artefacts and scrolls concerning the alchemical sciences of sacred geometry and architecture, sound, astronomy and genetics. Ancient sacred relics are also said to

have been in the Templar's cache of discoveries there, including the Ark of the Covenant and the Holy Grail.

The building of the great Gothic cathedrals such as the ones at Chartres, Notre Dame in Paris, Salisbury, St.Denis and Cluny was inspired by these transforming discoveries. These edifices were monuments to the rediscovery of ancient mysteries, a new elevated awareness, and were constructed using the principles of sacred geometry, harmonic acoustics for their transforming potential.

The Christian church usually has the layout of a Latin cross. This echoes the Crucifix, but also the human form that of a man with his arms stretched out. At the crossing there usually is a dome, capped by a tower. This may represent the human heart reaching for heaven.

Between the ninth and twelfth centuries churches were built with rounded arches and massive masonry walls. This style of architecture was called Romanesque. Romanesque churches favoured the use of simple, modular dimensions, and a strong feeling of rhythm. Rhythm, naturally, is reminiscent of the cycles of life as well as of music.

The use of sacred geometric shapes and proportions during the medieval period reached its pinnacle in Gothic design. The architects of the Gothic period focused their attention away from the obvious stability and simple modular structure of the Romanesque designs and concentrated instead on ingenuity of design and engineering to create an other worldly feel.

The wisdom of Greek sacred geometry had been absorbed into Christianity. Arab advances in mathematics made their way into the schools of Europe, giving architects powerful tools. Using diagonal arches and flying buttresses, instead of thick walls of masonry, to counter the force of gravity, Gothic architects could create structures of tremendous vertical height.

In the Medieval scheme, the vertical dimension was holy, especially in the interior of the church and on the church's facade, directed the viewer's eyes upward. Gothic churches also incorporated the dimensions used in Greek temples.

Rob Krier analysed the Cathedral of St. Etienne, in Auxerre and found numerous instances of whole number ratios used in the proportions of the building. For example, and the ratio of the depth of aisle to nave is 1:2.

Krier also found evidence of the Golden Proportion, both in the dimensions of the floorplan and in the dimensions of the facade. The crossing divides the nave into two halves, the ratio of width to length of each roughly equal to 1:1.618. (Callisto Radiant - Mystical Meaning in Sacred Architecture)

France
In the 12th century in Europe hundreds of Gothic churches and Gothic cathedrals were built. In France alone between 1170 and 1270 over 500 Gothic churches and 80 Gothic cathedrals were constructed. The builders used the whole number ratios found in the harmonic series. The builders of these great cathedrals wanted their buildings to reflect nature.

The whole number ratios used in the construction of the Gothic churches and cathedrals reflected a deeper reality. The ratio of 1:2 found in the length of the aisle compared to the length of the nave represents Duality while the three stages of sides represent the Trinity. (Elkington, D. - In the Name of the Gods)

Planets and Intervals

Kepler

The German astronomer, mathematician and mystic Johannes Kepler lived from 1571-1630 and was possessed his entire life with finding the cosmic proportions and musical harmonies, represented by the distances and orbits of the planets. His writings reveal that in addition to his lifetime of calculations and observations, he was deeply influenced by Egyptian hermetical science. His monumental work 'Harmonice Mundi', or Harmonies of the World, contained five books covering his life's work on the correspondences between music, astrology, geometry and astronomy.

In 1619 Kepler published his final work *'The Harmonies of the World.'* In it Kepler presented his discovery that when Saturn is farthest away from the sun it moves at a rate of 106 seconds of arc in a day; when closest to the sun it moves at a rate of 135 seconds of arc per day. The ratio between these extremes differs by just two degrees from the ratio of 4:5 that equals the musical interval of a major third.

He then calculated the musical intervals for the remaining five planets and the moon (Uranus, Neptune and Pluto had not been discovered at that time). He worked out a system for determining the proper pitch, the proper octave for each planet, and the speed at which the planet would slowly change from its fundamental pitch to the indicated interval pitch, and back again according to the planet's distance from the sun

In the case of Saturn, for example, its pitch would be Sub-Contra "G" (a major second below the lowest pitch on the piano); the major third above this pitch would be Sun-Contra "B". Since Saturn takes thirty years to revolve around the sun, it would take fifteen years for the fundamental pitch of "G" to slowly reach "B" and another fifteen years for it to return to "G" once more.

The ratio's discovered by Kepler are shown in the following table:

Planet	Ratio of Arc	Interval Ratio	Music Interval	Pitch Name	Time of One Revolution
Saturn	1'48" : 2'15"	4:5	M 3rd	Sub-contra G-B-G	29.5 years
Jupiter	4'35" : 5'30"	5:6	m 3rd	Contra B-D-D	11.9 years
Mars	26'14" : 38'1"	2:3	p 5th	F^{1}C^{2}F^1	687.5 days
Earth	57'3" : 61'18"	15:16	m 2nd	G^2-A^{b2}-G2	365.25 days
Venus	94'50" : 98'47"	24:25	unison	unison E^3-E^3	224.7 days
Mercury	164'0" : 384'0"	5:12	m 10th	C^4-E^5-C^4	88 days
Moon	26'26" : 35'12"	3:4	p 4th	G^5-C^6-G^5	28 days

(From McClellan, R. 1991 p 121-122)

According to Stephen Hawking in his book 'On The Shoulders Of Giants', Kepler discovered how planets orbited and he paved the way for the later Isaac Newton to discover why. Kepler's work focused on the five Platonic solids, their harmonic ratios, and how these shapes correlated with planetary orbits and sound frequencies.

He found the musical tones of individual planets, and the musical scales of planetary movements. He was even able to determine that "four kinds of voice are expressed in the planets: soprano, contralto, tenor, and bass" (Stephen Hawking). Kepler had found the music of the cosmos, and that the same harmonic principles found in the stars, and life forms on earth are musical.

Distance Between the Planets

Early scientists found that the distance from the Earth to Mercury is twice distance from Venus to Mercury. The distance from Mars to Mercury is twice the distance from Earth to Mercury. Hence the orbits of planets are based on the 2.1 ratio of the octave (the first harmonic in the harmonic series).

Using these ratios scientists predicted that a planet should exist between Mars and Jupiter. Later the asteroid belt was discovered, which is believed to be the remains of a planet. (Tame, D. 1984 p237)

The 4:3 ratio is found in the ratio when the times that it takes for Venus and Mars to revolve around the sun are compared. Peter Hamel says that for every proportion in the human body there is a corresponding relationship with the ratios formed by comparing the orbital distances from the sun of different planets. (Hamel, P.1978)

Dr Pomerantz
According to Dr Pomerantz that the sun sends out 80 overtones over 2-3 minute periods. He described the sun as "a great musical instrument." (Tame, D. 1984 p236)

The German astronomer, mathematician and mystic Johannes Kepler lived from 1571-1630. He devoted his life to finding the cosmic proportions and musical harmonies, represented by the distances and orbits of the planets.

Today's scientists have found that each planet does create 'sounds'. Recently the space probe Cassini has passed close to Jupiter, capturing its 'sounds' and dramatic moving images from the red planet.

The 'sounds' are actually patterns detected in the magnetic field between Jupiter and the Sun, recorded by Cassini as low-frequency radio waves, and converted into sound wave frequencies so they can be heard.

NASA's Cassini Listens To Eerie New 'Sounds' Of Space Near Jupiter - Science Daily Jan 8th 2001 - from the web site - http://www.sciencedaily.com/releases/2001/01/010108073050.htm

NASA Voyager Jupiter Space Sounds - http://www.youtube.com/watch?v=e3fqE01YYWs

Cells and Musical Intervals

In 1974 Fabien Maman was working as a jazz guitarist. During a concert tour with his group in Japan, he noticed that at the end of each piece the audience didn't clap. They would clap only at the end of the concert. The silence after each piece bewildered him at first but after the initial apprehension he began to anticipate and even enjoy the silence.

In the silence he began to feel the effect that each piece of music had on him. He noticed that after a concert he had more energy. After three months of touring Japan, Maman realised that clapping in between pieces was actually destroying some of the benefits of the music.

Fabien noticed that certain musical keys had an energising effect on both the musicians and the audience. The same piece of music played in a different key or at a different time of year had a different effect.

In 1981 Fabien Maman met Hélène Grimal, a senior researcher at the National Centre for Scientific Research in Paris. She was interested in the effects of music on human cells. Through their friendship, Maman and Grimal were able to devote a year and a half to a study of the effects of sound on cancer cells.

They went to the University of Jussieu in Paris five nights a week for a year and a half, carrying out their experiments at night in the biological research laboratories. They had to wait until the subway stopped for the night so that its vibration wouldn't affect their experiments. They experimented with healthy blood cells, haemoglobin, and cancer cells.
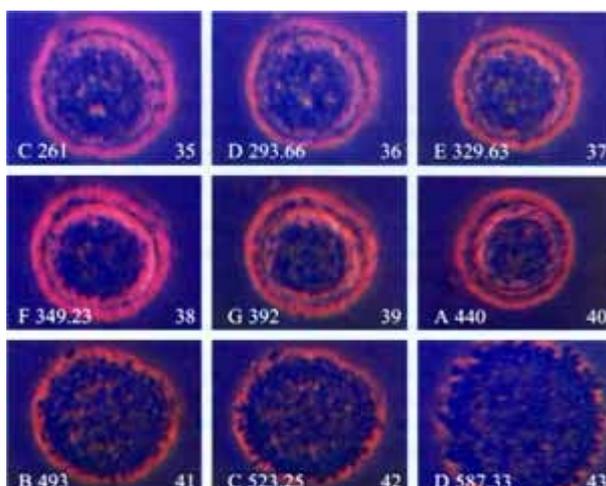
Cancer Cells

In the first experiments they mounted a camera on top of the microscope to photograph the inside structure of each cell as it reacted to the different sounds they produced. In the second group of experiments they used Kirlian photography in order to record the changes in the electromagnetic field of the cells as they received the sounds. (Kirlian photography shows the subtle energy field around living things).

In the course for their investigation, they took thousands of pictures. The sound was produced at a distance of 30 centimetres from the cells, at an amplitude of 30 to 40 decibels. Even though this is very quiet the sound always produced noticeable changes in the cells. As the sounds progressed up the musical scale there would be an 'explosion' of the cancer cells at a certain frequency as the sound travelled outward from the centre of the cell to its outer membrane.

Using drums, gongs, flutes, guitar, bass, xylophone and the human voice, they investigated the effects of sound on normal and malignant cells.

Fabien says, "I used the tempered scale and sounded the chromatic intervals one note at a time at a distance of thirty centimetres from the cell. The experiment yielded the most dramatic results when I used the human voice and the musical scale. The combination of the human voice and the musical scale caused the Hela cancer cells to explode more rapidly and predictably" (See photographs below). (Maman, 1997, p61)

Hela cancer cells being broken up by the musical scale played on a xylophone

The French physicist Joel Sternheimer says that elementary particles behave as if they were musical notes on the chromatic scale. Fabien says that the explosion in the cancer cells is caused by the resonance between the sounds that we create and the elementary particles contained in the cell.

"The accumulation of all the sounds of the musical scale created an intolerable dissonance that broke up the cancer cells." (Maman, 1997, p61)

Maman and Grimal found that at sound frequencies between 'A' at 440Hz and 'B' 493Hz the cancer cells would break down, their structure thrown into complete disorganisation. The healthy cells, however, remained intact or became stronger. He says,"The healthy cells appeared supple and able to freely receive, absorb and return the energy. In contrast, the cancer cells appeared inflexible and immutable in their structure." (Maman, 1997, p90)

Healthy Cells

Fabien Maman took healthy blood cells and played a xylophone to them. He photographed the changes in the electromagnetic fields around the cells using Kirlian photography.

Subjected to a chromatic scale, the energy field around the blood cells changed its shape and colour. The colour produced in the energy field of the cells was affected more by the frequency of the sound, while the quality of the sound influenced the shape of the cell's energy field. A slight difference of half a tone would produce a completely different shape and colour in the energy field of the cell.

He found that the note 'C' made the energy field around the cells longer, 'D' produced a variety of colours, 'E' made the field spherical and 'A' (440Hz) changed the colour from red to pink.
Blood cells responding to the sound of a person's voice

Fabien says about the note 'A' (440Hz), "Thus, A 440 is a powerful sound of harmonisation. This Indian pink colour which can be seen in the picture always appears when A 440 is played, no matter what instrument is used. Pink is generally acknowledged as the colour of love. (Maman, 1997, p73) (See photographs below)

In his next experiment, Fabien took a sample of blood from a person's finger. He asked the person to sing to their blood cell. Then he photographed what happened to the blood cell when the person sang the seven notes of the Major scale.

With each note the cell's energy field changed its shape and colour. When the person sang an 'F' to their own blood cells, the cells resonated perfectly with the voice, producing a balanced round shape and vibrant complementary colours of magenta and turquoise. (Maman, 1997, p73) (see photographs below)

Kirlian photographs of blood cells responding to the sound a person's voice
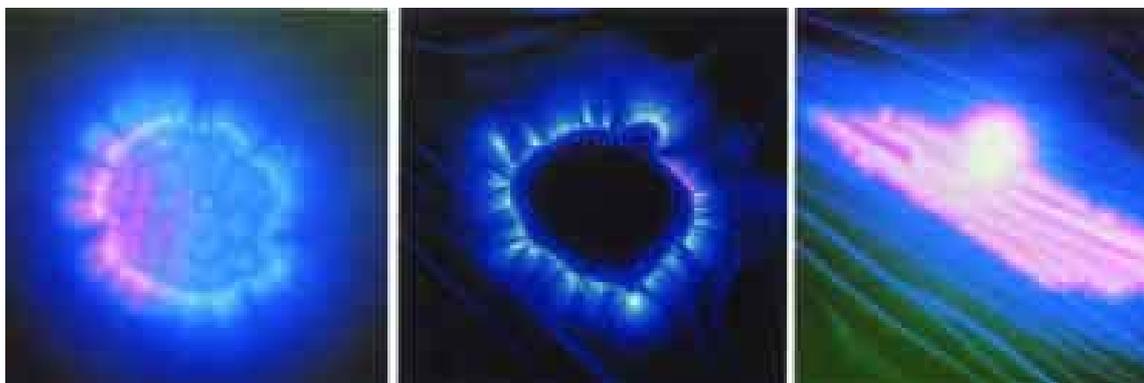
Crop Circles and Intervals

In the 1960's a Swiss scientist called Hans Jenny spent over ten years conducting experiments to discover the effects of sound waves on materials such as glycerine, mercury, gel, liquids, powders and iron filings. Jenny used modern technology to construct a 'Tonoscope', an instrument which would produce a picture of the patterns sound creates in these different materials.

Jenny would send electronically produced sound through oscillating crystals to vibrate the metal plate on which different materials were placed. Jenny called his study 'cymatics,' from the Greek word 'kyma' which means 'wave'.

Different sounds would produce different patterns. As the sound frequency was increased these simple forms would break up and more complex patterns would appear.

Jenny observed how sound vibration created geometric shapes. A low frequency sound produced a simple circle, whereas a higher frequency increased the number of concentric rings around a central circle.

Crop Circles

In his book 'Secrets in the Fields' Freddy Silva says, "Many of the vibrational patterns found in Jenny's photos mimic crop circle patterns. These include the circle surrounded by concentric rings, the tetrahedron at Barbury Castle in 1991 (see below), the spider's web mandala at Avebury from 1994 and the highly structured star fractals of 1997. Other photos demonstrate geometry within the crop circles' pattern."

The Times reported on the 18th June 2008 that a Wiltshire crop circle contained the symbolic code for first ten places of pi (see below).

"Mathematicians are stunned by a new crop circle which apparently represents a perfect coded image of a complex equation." "The circle is, apparently, a coded image representing a complex mathematical number - the first ten digits of pi - and even astrophysicists admit they find it "mind-boggling"." "The circular pattern was created in a barley field near Barbury Castle, an Iron Age hill fort, earlier this month. Measuring around 46m (150ft) in diameter, it has had crop circle enthusiasts and experts stumped."

"The symbol was identified eventually by Mike Reed, a retired astrophysicist who contacted Lucy Pringle, a crop circle photographer and expert, with an explanation." "Maths codes and geometric patterns have long been an important factor in crop circle formations - one of the most famous formations ever created showed the image of a complex set of fractals known as The Julia Set, in a field near Stonehenge, 12 years ago." ('Wiltshire crop circle identified as symbolic code for first ten places of pi'- The Times June 18th, 2008)

The patterns found in crop circles are similar to ancient Hindu and Tibetan Mandalas.

"Prof. Gerald Hawkins discovered that the laws of Euclidean geometry are found in the crop circles formations. Hawkins' Euclidean theorems also produce diatonic ratios, (the ratios of the Western Musical scale). This proves that there is a link between crop circles and musical notes."

"Many crop circles appear to have associations with sound. One circle contained a curious ratchet feature from which is constructed a musical diagram also dating to the Greeks, the Lambdoma. Also known as the Pythagorean Table, it defines the exact relationships between musical harmonics and mathematical ratios."

"In 1996 a crop circle at St. Neots demonstrated the combination of two important figures: the 3-4-5 triangle and the Golden Mean, producing the geometric diagram necessary to produce musical ratios" (see below).
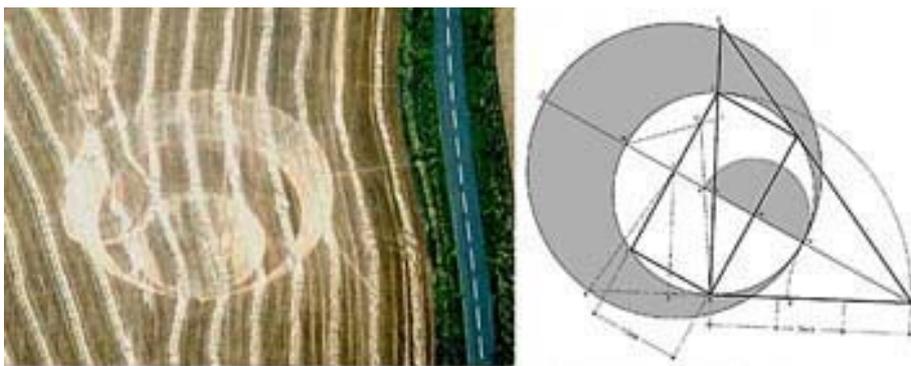
A harvested crop circle at St. Noets shows the 3,4,5 triangle and the Golden Mean

"It was a the formation at Goodwood Clatford which had its plants bent six inches from the top that created a cymatic pattern etched in 5000 sq. ft of barley. Cymatics is the study of vibrational wave patterns. One of its earliest pupils was Margaret Watts-Hughes who, in 1891, captured precise geometric patterns on film as she sang sustained notes into a device containing lycopodium powder"

"It would be another 76 years before Swiss scientist Hans Jenny published the first of his painstaking studies on the transmission of sound through physical mediums, this time in the shape of monitored electronic frequencies."

"He observed how sound vibration created geometric shapes. A low frequency produced a simple circle encompassed by rings, whereas a higher frequency increased the number of concentric rings around a central circle. As the frequencies rose so, too, did the complexity of shapes, to the point where tetrahedrons, mandalas and other sacred forms could be discerned. Like Margaret before him, Jenny enabled humanity to observe 'frozen music'. "

"Many of the vibrational patterns found in Jenny's photos mimic crop circle patterns. These include the circle surrounded by concentric rings, the tetrahedron at Barbury Castle in 1991, the spider's web mandala at Avebury from 1994 and the highly structured star fractals of 1997. Other photos demonstrate geometry within the crop circles' pattern." (Silva, F. 2002)

The Effects of Different Musical Intervals

If two notes are played at the same time into an oscilloscope then different patterns will emerge. (An oscilloscope is an instrument that measures sound waves).

Two people singing in unison will create a circle pattern on the oscilloscope while two people singing two notes an octave apart will create a figure eight pattern. (Octave means eight in Latin).

Fabien Maman says an interval is the resonance of the musical space created by the sounding of two notes simultaneously or separately. Each interval has a different vibratory effect upon our body, mind and emotions.

Each musical interval will create a different feeling in the listener. These are feelings reported to Kay Gardner from her workshop participants: -

Unison 1:1 (e.g. C/C) – Kay Gardner says that creates a feeling of sameness, rootedness and unity. (Gardner, K. 1990 p105-112)

1:1

Fabien Maman says that the fundamental 'interval' is the resonance of one note played twice. "This interval is found in mantras. Most mantras are chanted on a monotone - one note. After a few minutes of repeating the same word or words on one note the mind becomes quiet. This 'interval' brings immobility, rest and old memories." (Maman, F. 1997, p23)

Mary Elizabeth Wakefield & Michel Angelo say that "Two identical pitches sounding together, a 1:1 relationship. This is the sound most indicative of the primal cosmic union, and represents perfect serenity and peace." (Wakefield, M & Angelo, M - Music as Medicine)

Minor Second 16:15 (e.g. C/C sharp/D flat) – Kay Gardner says that this interval creates a feeling of tension, unease and expectancy.

Major Second 9:8 (e.g. C/D) - Kay Gardner says that this interval creates a feeling of lightness, opening and has a mild dissonance.

Fabien Maman says that the interval of the second creates a tension. "It is difficult to hold this interval for a long time. This interval brings tension between two polarities, creating movement. The interval of the second is used in Modern Classical music, which uses strong dissonance. This dissonance will be even greater with a minor second interval e.g. C-D flat."
(Maman, F. 1997, p23)

Mary Elizabeth Wakefield & Michel Angelo say that, "Like the 3rd, the 2nd (the 7th overtone and higher) can be major (two semi-tones) or minor (one semi-tone); it creates friction, agitation and dissonance, and contains the potential for movement beyond pre-existing limits and strictures. It promotes growth, and can be likened to the grain of sand in the oyster – an initial source of irritation that in time gives rise to the beauty of a pearl." (Wakefield, M & Angelo, M - Music as Medicine)

Minor Third 6:5 (C/E flat) - Kay Gardner says that this interval creates a feeling of dissonance, uplifting. (It is found in the call of a sparrow, childhood taunts).

6:5

Major Third 4:5 (e.g. C/E) - Kay Gardner says that this interval creates a feeling of hope, sweetness. (It is used in Church music).

4:5

Fabien Maman says that the interval of the third touches the emotions. "Bach used this interval to touch the higher emotions. It can produce feelings of lightness, strength and joy. Country and Western music uses the minor third e.g. C-E flat to touch the heavier emotions such as sadness or heartache." (Maman, F. 1997, p24)

Mary Elizabeth Wakefield & Michel Angelo say that, "This simple interval can possess great sweetness, and suggests possibilities, compatibility, stillness and repose. In keeping with the traditional symbolism of the number 3, the major 3rd was considered a harmony of divine perfection." (Wakefield, M & Angelo, M - Music as Medicine)

Perfect Fourth 4:3 (e.g. C/F) - Kay Gardner says that this interval creates a feeling of serenity, lightness, openness. (It is used in Pagan chants such as "The Earth is Our Mother")
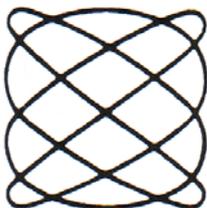
4:3

Fabien Maman says that the fourth interval gives a strange impression that is like awakening after a dream. "The startling effect of this interval is felt powerfully in Bulgarian women's chants." (Maman, F. 1997, p24)

Mary Elizabeth Wakefield & Michel Angelo say that, **"This interval touches the heart"** (Wakefield, M & Angelo, M - Music as Medicine)

Tritone 45:32 (e.g. C/F sharp) - Kay Gardner says that this interval creates a feeling of suspense, the occult, outer space, strangeness. This interval was called "The Devil in Music" in the Middle Ages and was banned by the Church. (It is used in Bernstein's song 'Maria')

"When the fourth is augmented (e.g. C-F#), the left and right sides of the brain are stimulated. The augmented fourth is the interval heard in the sound of the Tibetan bowl. This extreme tension is maintained until resolution in the fifth interval." (Maman, F. 1997, p24)

Mary Elizabeth Wakefield & Michel Angelo say that, "The most dissonant of intervals (32:45), the tritone was referred to by medieval music theorists as the "diabolus in musica" ("devil in music"). It is energising, lifting (in that it can resolve upward to a perfect 5th), and encourages creative thought, with an anticipation of something unexpected. It is also referred to as an augmented 4th or diminished 5th." (Wakefield, M & Angelo, M - Music as Medicine)

Perfect Fifth 3:2 (e.g. C/G) – Kay Gardner says that this interval creates a feeling of completeness, comfort, creativity.
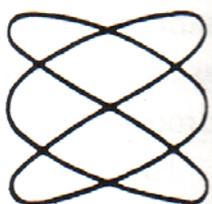
3:2

Fabien Maman says that, "The fifth interval expands in all directions and provokes the widest movement of energy in space. It can be heard in Brazilian music where there is often the interval of the fifth between guitar and voice."

"Because of its stimulating nature, the cycle of fifths can be used both to concentrate and align chakra energies. The following order can be used to relax the body and bring about the maximum expansion of consciousness: - F C G D A E B." (Each note being five notes above the last)

According to Fabien two people whose fundamental vibrations create an interval of the fifth will have a stimulating relationship. A couple whose fundamental vibrations create the interval of the fourth or the second will have a relationship filled with dissonance and conflict. (Maman, F. 1997, p25)

Mary Elizabeth Wakefield & Michel Angelo say that, **"t**he 5th is opening and stimulates power and movement. It can bring forth new life, creative ideas and rebirth. The 5th is also the functional fulcrum within an octave, in that it can facilitate movement either to the upper tonic note, or a return to the fundamental. It was used most notably by the medieval mystic Hildegard of Bingen in her musical compositions to express openness, joy and healing." (Wakefield, M & Angelo, M - Music as Medicine)

Minor Sixth 8:5 (e.g. C/A flat) - Kay Gardner says that this interval creates a feeling of poignancy. (It is used in Love Story and Chopin's Nocturnes)

Major Sixth 5:3 (e.g. C/A) - Kay Gardner says that this interval creates a feeling of upliftment, peace, floating. (It is used in the song 'My Bonny Lies Over the Ocean')

5:3

Fabien Maman says that the sixth interval is the sweetest interval. Fabien Maman says that listening to the sixth interval is "like receiving the quintessence of the fragrance of an opening flower." This interval is generally used in children's lullabies. The sixth interval seems to carry no weight, no tension, no stimulation and no emotional heaviness. The sixth interval creates a feeling of total opening, of offering yourself to the universe, contrary to the third interval, which is contained. (Maman, F. 1997, p26)

Minor Seventh 7:4 (e.g. C/B flat) - Kay Gardner says that this interval creates a feeling of expectancy, suspense, movement. (It is used in Bernstein's song 'There's a Place for Us')

Major Seventh 15:8 (e.g. C/B) - Kay Gardner says that this interval creates a feeling of discord, strangeness, eerie, ethereal. Rudolph Steiner associates this interval with the Higher Self. (It is used in the song 'Bali Hi')

Dissonant intervals can be used to stir up the emotions, bring unresolved emotion to the surface, which can be then resolved by moving to consonant interval above. (Kay Gardner - Sounding the Inner Landscape p105-112)

Fabien Maman says that the seventh interval creates extreme tension, but it is not a paralysing tension like the second interval. It is a healthy tension that provokes a growth in consciousness. Beethoven was the first Western composer to use this interval. Hector Berlioz, in his biography of Beethoven, said that the first time Beethoven's music was played in the Paris Opera House, the consciousness of the audience 'exploded'. (Maman, F. 1997, p27)

Ravel also used the interval of the seventh. Jazz composers such as John Coltrane began to use this interval in the 1960's, a time of great social change.

 "The seventh musical interval represents the ultimate dissonance before resolution into the stillness of the octave. It has a powerful purpose in physical, musical and spiritual evolution." (Maman, F. 1997, p30)

In his experiments Fabien found that it was generally the seventh interval that destroyed the cancer cells. As the notes of the scale was played to the cancer cells in test tubes they began to break up when the notes A# and B were played. The effect was particularly strong when metal instruments were used. He says that this reveals the power of the seventh interval to affect change at the cellular level. "

"The cancer cells could not bear the dissonance of the seventh interval. Throughout the experiment the cancer cells appeared rigid, inflexible, and seemed to fight each note of the musical scale until they finally exploded around the addition of the seventh interval. Healthy cells, because they could breathe in the resonance of the sound, remained intact and some even seemed to be revitalised by the addition of the seventh interval." (Maman, F. 1997, p31)

"The seventh interval will be resolved into the stillness and peace of a new octave, which will provide a mirror for civilisation to come. The seventh interval pushes us towards expansion to a higher octave of inner peace, not a conceptual 'return' to a nostalgic memory. Even the most enlightened master cannot escape completely the vibration of the musical interval in which he or she lives. We all belong to the sound current of our moment in time." Fabien Maman

(Maman, F. 1997, p31)

Octave 2:1 (e.g. C/C an octave above) – Kay Gardner says that this interval creates a feeling of togetherness, sameness.
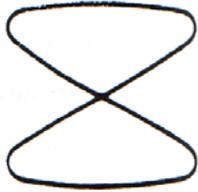
2:1

Mary Elizabeth Wakefield & Michel Angelo say that, " This interval is restful, meditative, calming and grounding, and represents the harmonious union of yin and yang. It is perhaps best exemplified by the sound of men's and women's voices singing together in unison, since (due to the nature of their vocal cords and the conventions of musical notation) their "unison" melodies are, in effect, sung an octave apart." (Wakefield, M & Angelo, M - Music as Medicine)