

Thom

By George Essence

I wondered if I should get right back to fundamentals, and talk about Professor Thom, who through his work realised that he was looking at whole number dimensions. One of his great discoveries was the Megalithic Yard (MY), 2.72 feet (approximately).

People in general imagine that the history of maths is based on commerce, counting sheep for instance. However anyone who has worked in a market knows that commerce is based on mark up. Mark up is done in ratios, which are 100%, 50%, $33\frac{1}{3}\%$, and 25%. As it happens, these are also the well known musical intervals of the octave, the 5th, 4th, and major 3rd. I did not know this, or even what these intervals are, before I looked at the book written by a professor of music, E.G. McClain. McClain wrote a book, *the Myth of Invariance*, saying that the Rg Vedas are actually about music.

To paraphrase what he said, all numbers that are made from 1, 2, 3, and 5 by multiplication can be thought of as music, specifically the musical intervals I have mentioned, and a few more, all of which are indeed multiples of 1, 2, 3, and 5. My own work has been to combine the work of these two professors, and apply the combination to Stone Age architecture, and to another ancient text, the *Epic of Gilgamesh*.

The results were so fruitful that I have been occupied collecting them for some years. So many famous archaeological sites turn out to have a harmonic design, including the Egyptian pyramids, Stonehenge and Woodhenge, that I am surprised when I cannot find McClain's ratios somewhere.

In music the ratios are the octave, 2/1, the 5th is 3/2, the 4th is 4/3, the major 3rd is 5/4, and the minor 3rd is 6/5. The next ratios are not made of 1, 2, 3 or 5. They are 7/6 and 8/7. Then 9/8 and 10/9 are both used as "whole tones". The next permissible harmonic ratio is 16/15 which serves as a semitone. You do not need to know what these are in music (it's quite complicated) to understand this essay, but these ratios are called "harmonic ratios".

On a quantity of 100, a 50% mark up would be 150. This is a multiplication by 3/2, very difficult, you imagine. But 3/2 is a perfect fifth, something that anyone who makes music recognises instantly. For instance the famous banjo duel in "Deliverance" begins, I think, C G D, which is 3/2 repeated twice, two 5^{ths}. The note "C" itself is based on the frequencies 1, 2, 4, 8, 16 cycles per second (cps) etc. I am told that musicians have moved these up by a quarter tone to make them a bit more interesting, and that "C" sounds outstandingly dull compared to other notes. The "C"s have no 3 or 5 in them.

That fact of course makes you wonder whether a "second" might be a profound cosmic measurement. It's based on 60 to the minute, and a minute is 60 to the hour. 60 can be made up using the ratios for music given above. $60/1 = 3/2 \times 5/4 \times 2/1 \times 2/1 \times 2/1 \times 2/1$. You could say that this is a chord C-G-B in harmonic ratios, and is combined with 5 octaves.

There are 24 hours to the day. $24/1 = 2/1 \times 2/1 \times 2/1 \times 2/1 \times 3/2$ which is octave, octave, octave, octave, and 5th, musically. It could be C-G and 4 octaves. 360 days is almost a year, and is also a musical harmonic interval, since 360 is a sequence of musical harmonics too. $3/2 \times 5/4 \times 3/2 \times 2/1 \times 2/1 \times 2/1 \times 2/1 \times 2/1 \times 2/1 \times 2/1$. 2160 years is one zodiac "Age". 2160 is also a harmonic sequence. $2160/1 = 3/2 \times 3/2 \times 3/2 \times 2/1 \times 2/1 \times 2/1 \times 2/1 \times 2/1 \times 2/1 \times 2/1 \times 5/4 \times 2/1 \times 2/1 \times 2/1$. There are 12 Zodiac Ages, and 12 is yet another harmonic sequence, $12/1 = 3/2 \times 2/1 \times 2/1 \times 2/1$.

So the whole precession of the equinox down to our smallest time unit is harmonic and musical. Of course there are the discrepancies. There are 5 extra days of the year. These discrepancies make the precessions and recessions that make the universe and our lives interesting.

We have an intuitive feel for harmonic proportions, as any teacher knows who has market workers as pupils. An otherwise illiterate un-mathematical pupil can often add on $33\frac{1}{3}\%$, 50%, 100%, 25% when working on a market stall. Musically he is making chords ($4/3$ is a 4th, $3/2$ is a 5th, $2/1$ is an octave) and $5/4$ is a rather flat major 3rd. The boss can just whistle two notes and the child can tell immediately and intuitively how much to charge the customer. The child will add on exactly $5/4$ (25%) if asked in this way.

With regards to the true nature of tuning, $5/4$ is not in fact the major 3rd interval that we expect. Today we are taught to use "true tuning", which allows us to use a whole keyboard and expect every note to be in tune. Harmonics do not create exact true tuning. They create 12 tones that do not fit inside the octave exactly. Harmonics create a precession of frequency in music as they do in Time, where a year is 365 days, not 360. We listen to true harmonics when we listen to overtone singers. The overtones are produced by the throat as a musical instrument. They are in tune with the universe!

True tuning was the invention that sparked off the baroque revolution. It's a mathematical adjustment that allows the keyboard to be in tune over all 7 octaves. It uses $2^{(1/12)}$ as a semitone and more importantly $2^{(2/12)}$ as a tone. Ancient people using actual harmonic ratios used a limited form of 12 tone music. The tone varied to suit the context. It was either $9/8$ or $10/9$. Babylon in 1000 BC had inherited this harmonic system via the ancient Egyptians and Mesopotamians.

I can say "via" because there is evidence that a harmonic musical structure known as the "spiral of fifths" was known 70,000 years ago. This structure is represented graphically in a very distinctive way. It is a criss-cross pattern, representing a sequence of 5^{ths}. These patterns, marked on red ochre, have been found in the Blombos cave in South Africa for example and dated 70,000 BC.

Using harmonic ratios as a base of investigation into Stone Age culture, it's possible to deduce a scenario for their religion which appears to fit mythology and sacred writing very closely indeed, as if they had evolved from it. Harmonic ratios work as a base for the intuitive feel of a child for music and tone. An embryo recognises the tone of its mother's voice while still in the womb. It certainly can't add $1 + 1$ at that stage.

The different timbres of wind instruments such as flute, clarinet, recorder, oboe etc are due to the different combinations of harmonic resonances that each instrument produces in addition to its intended note. The pipe makes the intended note and in addition a pattern of higher harmonic notes, which can be shown to peak at the ratios $2/1$, $3/2$, $4/3$ etc. The proportions of the harmonic pattern vary depending on the instrument. These harmonic resonances are not true tuned, but they do create an additional 'dynamic' warmth of tone that is missing from digital recordings but present in the old analogue vinyl.

Thom's data fits harmonic ratios as simply as it fits arithmetic. Every battle won by Thom for the MY as the measurement of unit distance is a battle won for harmonic ratios also, simply because harmonic ratios are just two whole numbers put together in pairs.

But harmonic ratios go much further. In 12 tone music, some ratios are "musical" as I have said. They work with a 12 tone system. They are the familiar $1/1$, $2/1$, $3/2$, $4/3$, $5/4$, $6/5$, $9/8$ and $10/9$ which are "harmonic". The complement of $5/4$ is $8/5$ and the complement of $6/5$ is $5/3$. $8/5$ and $5/3$ are not harmonic ratios, but they occur whenever harmonic ratios occur, so I must include them in the list.

Megalithic sites such as Stonehenge, Woodhenge, the Sanctuary at East Kennet, the Egyptian pyramids and so on are designed with these precise ratios, AND NO OTHERS. The face slope of the Great Pyramid is $10/9$ with an accuracy of less than 0.1% according to the official surveyor of the Cairo Museum, Mark Lehner. The Egyptians even built temples and so on at specific latitudes in harmonic relationships with each other.

In the *Epic of Gilgamesh*, in its "standard version" which dates from about 1100 BC, Gilgamesh himself is named "two thirds" which is the same as $4/3 \times 1/2$, or a 4th going down the scale. "Going down the scale" turns out to be a key to understanding what the Epic is about as a cosmic myth. Moreover, he is "two thirds god".

I explained in the section on time that the zodiac itself is a harmonic construction. Each house corresponds to one of the harmonically created 12 notes of the octave. It is a curious fact that the Fibonacci sequence viewed as ratios is a harmonic sequence. The first 5 terms are musical, being $1/1$, $2/1$, $3/2$, $5/3$ and $8/5$. These are the only ratios in the sequence that are made with 1, 2, 3, and 5 and no other. The distances between the planets (broadly speaking) conform with this sequence.

The attraction of music is that it is about pattern recognition. It allows a leeway for "error", a tolerance, which arithmetic does not. We are musical creatures, not arithmetic ones.

On the subject of Geometry; I suggest that a geometry based on these musical intervals was developed between 4000 and 3000 BC in Egypt and became very sophisticated, and was eventually the basis for Euclid's geometry. The geometry is very "hands on" and intuitive. It is not at all abstract. Its proportions can be sung, or drawn in sand.

I also suggest that arithmetic came after music, together with a more formal written language. They were both needed for an empire that encouraged commerce on a wide scale. On a small scale, counting sheep is naturally done by tally. There is no need to have names for numbers. Giving a name or symbol to a number is a clever abstract trick. It is neither “hands on” nor intuitive.

If arithmetic using numbers with names or symbols rose out of the old geometry, then prime numbers would have been some of the first to be isolated, because they make geometric patterns that are the farthest from harmonic ratio patterns.

The base of the Great Pyramid is an exact square accurate to within a few inches. The length of its side is 278MY, or twice 139MY, if 1MY = 2.719 feet. The diagonal measures 393 MY = 2 x 196.6MY. $196 = 14^2$ or 14 “squared”. 14 relates to the facets in the feathers of the pharaoh’s white helmet, and to the Saros eclipse cycle, and to the 56 (4 x14) Aubrey holes at Stonehenge. There are other reasons for the “twice 139” to do with the design of the Egyptian temples. 139 is a curious number.

1, 2 and 3 were not “numbers” at all, but sacred ratios that generated the 12 tone music. They are seen in the holy tetractys of Pythagoras, which is a triangle formed by 1,2,3 and 4. 4 is included because $4/3$ is actually $2/3 \times 2/1$, it is the exact inverse of $3/2$. $4/3$ is the only inverse of a harmonic ratio that is itself also a harmonic ratio.

A prime number has no factors. All numbers can be arranged in rectangular arrays. For example 12 can be arranged as 1x12, 2x6, 3x4 because it has factors 2,3,4, and 6 as well as 1 and 12. As a rectangle a prime number can only have one shape, a long thin rectangle of width 1, like 5x1 (or 1x5).

Numbers that were not sacred ratios of music probably began as the prime numbers. Then the numbers in between the primes are multiples of sacred numbers and lower primes. For instance after 13, $14 = 2 \times 7$, $15 = 3 \times 5$, $16 = 2 \times 8$, 4×4 . But then 17 is another prime and can only be 1x17. It has no sacred ratios in it.

The first 5 primes are therefore $5+7+11+13+17$. They add up to 53, which is also a prime number. $53 \text{ MY} = 144 \text{ feet}$, or 12^2 , so perhaps our “foot” is defined as a sacred value originally connected with prime numbers in Stone Age culture. As it happens 53 MY is also the exact radius of the Aubrey holes circle at Stonehenge

The next 5 primes are $19+23+29+31+37$. They add up to 139 which is also a prime. 139MY is exactly half the side on the base of the Great Pyramid. But instead of 2.72 feet you must use 2.719 feet for the MY. 2.719 differs from the mathematical exponential “e” by just 0.05%. “e” is connected to the rectangular hyperbola $y=1/x$, a curve that fits over rectangles of equal area. The Egyptians would have drawn rectangular hyperbolas on their grid.

In the Underworld of the Stone Age (Stone Age culture is all about the Underworld) travel (in trance obviously) consisted of double journeys of 5 steps each, making a “V” shape (like the Roman symbol for 5). The steps were created musically by the ratio $2/3$, according to the Epic of Gilgamesh. Each step would be seen by a modern musician as dropping down a perfect 4th, but for Gilgamesh it was 5 zodiac houses anticlockwise around the zodiac (mathematically the same thing).