

# The Sacred Sounds Scale: Harmonizing 432, 528, 424 and 440 Hz into a Single Tuning

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## Accurate Numerical Definition

There is one tuning in which the frequencies 432, 528, 424 and 440 Hz can peacefully coexist. The scale has 32+1 pure harmonic tones and the reference frequency of 256 Hz. It comes from the Natural Ascending Series of Harmonics 32 to 64 of the 8 Hz Fundamental Tone, and represents its 6<sup>th</sup> double. I call this tuning The Scale of Sacred Sounds.

Representation using ancient Sumerian/Babylonian/Vedic math:

32; 33; 34; 35; 36; 37; 38; 39; 40; 41; 42; 43; 44; 45; 46; 47; 48; 49; 50; 51; 52; 53; 54; 55; 56; 57; 58; 59; 60; 61; 62; 63; 64

Representation using musical ratios:

1/1; 33/32; 17/16; 35/32; 9/8; 37/32; 19/16; 39/32; 5/4; 41/32; 21/16; 43/32; 11/8; 45/32; 23/16; 47/32; 3/2; 49/32; 25/16; 51/32; 13/8; 53/32; 27/16; 55/32; 7/4; 57/32; 29/16; 59/32; 15/8; 61/32; 31/16; 63/32; 2/1

The math for deriving one of the above series from the other is simple. Divide all numbers from the ancient series by the first, then simplify the fractions. Conversely, the series of ratios can be turned into the series of integers by calculating their least common denominator (the smallest whole number that is a multiple of all numbers under the fraction bar) and discarding it.

Logarithmic representation using musical constants (definition given [further down](#)):

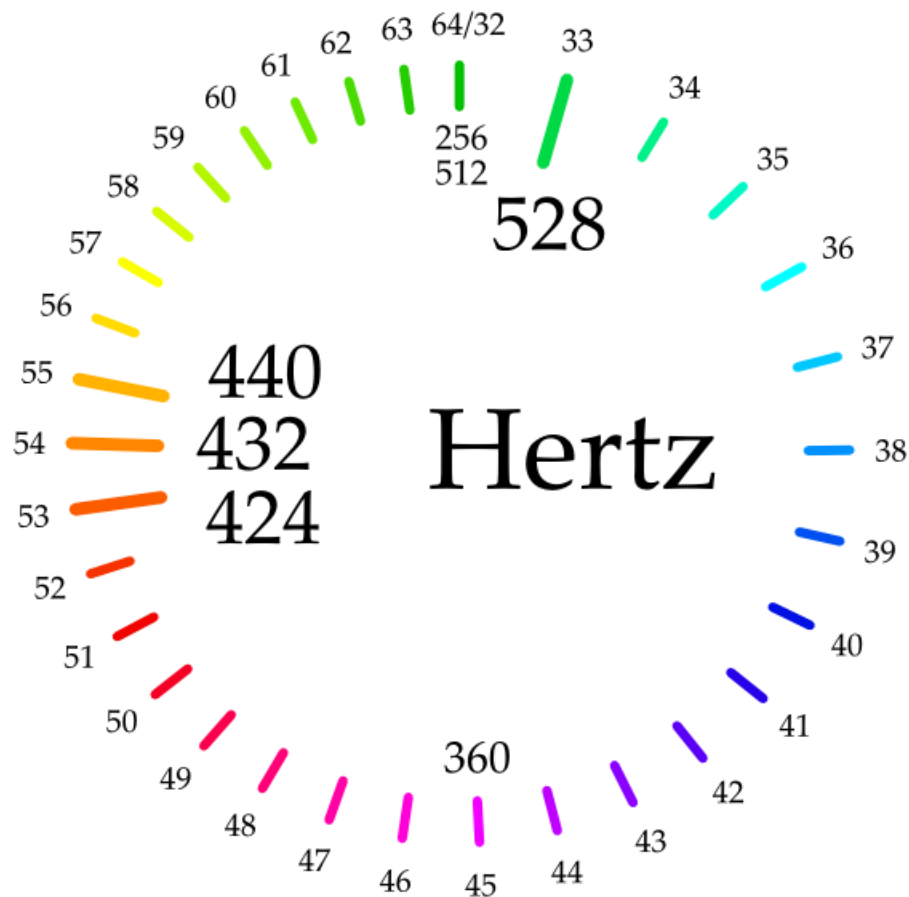
0,000; 30,772; 60,625; 89,612; 117,783; 145,182; 171,850; 197,826; 223,144; 247,836; 271,934; 295,464; 318,454; 340,927; 362,905; 384,412; 405,465; 426,084; 446,287; 466,090; 485,508; 504,556; 523,248; 541,597; 559,616; 577,315; 594,707; 611,802; 628,609; 645,138; 661,398; 677,399; 693,147

If 1/1 oscillates with a frequency of 256 cycles per second, the exact values of the tones expressed in Hertz are:

256; 264; 272; 280; 288; 296; 304; 312; 320; 328; 336; 344; 352; 360; 368; 376; 384; 392; 400; 408; 416; **424**; **432**; **440**; 448; 456; 464; 472; 480; 488; 496; 504; 512[; **528**; 544; 560; ...]

This is how the above frequencies are calculated: every musical ratio (or its result) gets multiplied by 256. Or, every whole number from the ancient set is multiplied by 8, because all figures in the set are the Ascending Harmonics (also called harmonic overtones) 32 to 64 of the 8 Hz Fundamental Tone. Actually, this is where the reference frequency 256 Hz comes from: it is the 32<sup>nd</sup> harmonic of the 8 Hz Fundamental Tone ( $32 \times 8 = 256$ ).

528 does not appear directly inside the central double, but its half – 264 Hz – does. This means that 528 is the second tone from the following double, which continues the above progression with 528; 544; 560; ... and so on Hz. 512 has the role of the last (33<sup>rd</sup>) frequency in the central double, and that of the first in the next.



Sacred Sounds Scale as Ancient Harmonics (outer numbers)  
and some values in Hertz for the 8Hz Fundamental Tone (inner numbers)

## The Right Terminology

Notice how inappropriate the term “octave” – meaning “the 8<sup>th</sup> note” – is here. Even in modern music theory, the 13<sup>th</sup> “note” is still called “octave” despite the fact that the 7-tone system has been expanded for hundreds of years to 12. A correct approach to the Sacred Sounds Scale would be to somehow use the number 33 in the name, because this is the 33<sup>rd</sup> tone, but for the sake of simplicity I use the term “double”. This describes perfectly the acoustic phenomenon of frequency doubling that takes place as the series progresses, and matches accurately any other scale of any number of tones.

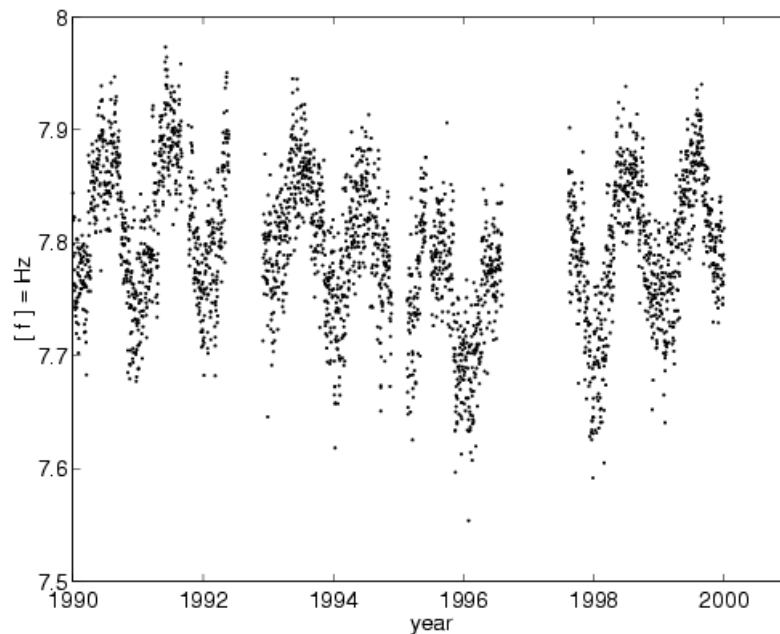
Modern Western music theory considers any tone whose frequency has been halved or doubled to represent the same sound. Musicians even use the same name for tones that are one or many doubles apart, although they are not one and the same tone. Doubling or halving the frequency of a tone does not return the same tone, because  $x \neq 2x \neq x/2$ . This is a mere convention, which has absolutely no natural, no fundamental basis. If you were to double the atomic vibrations of a cat, by some mysterious process, it will no longer be the same cat, and probably no more a living being. If you take a sound and raise its pitch, it is no more the same sound.<sup>1</sup>

In case you were wondering, 424 Hz is the “Standard Frequency of Mother Nature”, or the “RA Music” tuning standard. Check out [ramusic.com](http://ramusic.com) for more info.

The name Sacred Sounds Scale does not imply that certain frequencies measured in Hertz like 424, 432, 440 or 528 are sacred, but that the scale itself – or better yet, the Natural Series of Ascending Harmonics (overtones) from which the scale is derived – is sacred. That's because the Harmonic Series comes from Nature; it is not a product of culture or human intellect. In this regard, the Natural Harmonic Series is pre-human; it has been part of the Universe for as long as the Universe existed. There is nothing more natural, more consonant and in tune with itself than the Harmonic Series.<sup>2</sup>

## Harmonics of a Fundamental Tone

Frequencies like 528, 432 and 424 have been called “Universal”, “Cosmic”, “Sacred”, “Natural” and “Healing”; that's because, together with 440, they are all harmonics of the 8 Hz Fundamental Tone. Although below human hearing range, the extremely low frequency (ELF) of 8 Hz is part of the Alpha brainwave range of frequencies and is one of the spectrum peaks of our Earth's pulse called Schumann resonance, which in the past decades averaged around 7,83 Hz. A study conducted at the Society for Scientific Exploration (SSE) explored the EEG patterns of energy healing, measuring both healer and subject, concluding that this ever-present terrestrial standing wave which varies near 8 Hertz could be a mechanism for distant healing.<sup>3</sup>



Variability of the Schumann resonance measured in Antarctica.<sup>4</sup>

8 Hz is also extremely close to the Prime Frequency of the Mereon Matrix: 7,97 Hz and, according to The Mereon Legacy CIC Research Team, this is the same frequency emitted by dolphins.<sup>5</sup> Template Architects Juliet and Jiva Carter have reasons to believe that 8 Hz is the frequency of the former planet Maldek, which we now call “the asteroid belt”.<sup>6</sup> There is a possibility that this planet, in a correct interpretation of suppressed historical evidence, was the home of a lost continent we all know about...

## What “Tuning” Really Means

The frequency 444 Hz is not part of the Sacred Sounds Scale because it's just an approximated counterpart of 528 from another tuning system. When 528 is integrated in the equal tempered scale of 12 artificial tones, it is the first tone. Conventionally however, it is not the 1<sup>st</sup> frequency that's taken as reference, but the 10<sup>th</sup>. This is of course arbitrary, but it's the standard procedure. That's why musicians never say “tune to 261,625565300599...”; they simply say “tune to 440”.

The math used to calculate the 10<sup>th</sup> equivalent step of 528 Hz is no sunshine, because equal temperament is based on the 12<sup>th</sup> root of 2, that is,  $\sqrt[12]{2}$  or  $2^{(1/12)}$ . The resulting series of numbers have non-recurring and never-ending decimals; these numbers cannot be found in nature, although they are in every song we ever heard in the West (exceptions exist). So the 10<sup>th</sup> step would be  $528 \times 2^{(9/12)} = 887,986614507922...$  which divided by 2 returns 443,993307253961... Hz – almost 444. In this manner, musicians using the common standard will say “tune to 444” and by this they actually mean “tune to 528” in equal temperament.

Notice the inescapable ambiguity of nomenclature: the term “tuning” is used both for “tone scale”, and the “reference frequency” of that scale.

- A “tone scale” is an abstract ladder of sounds, a set of related numbers defining the individual entities of a system and their relation to the first member in the series. In all cultures of the world, it is the tuning of the scale – or mathematical relation between tones – that plays the key role in musical identity.
- The “reference frequency”, also called “standard frequency” and “concert pitch” is a secondary aspect of tuning, through which the first member of the scale, the 1/1, is assigned to a specific frequency expressed in Hertz. The remaining tones of the scale, being mathematically related to the first, will follow it by changing frequency accordingly.

Historically, the reference frequency of the 12-tone scale is defined by the 10<sup>th</sup> tone instead of the 1<sup>st</sup>. This means one extra step in calculating the true reference frequency on 1/1. Let's take as an example the 432 Hz concert pitch. In order to find the correct reference frequency of 1/1, we first have to enquire about the type of our 12-tone scale. We know that 432 is the 10<sup>th</sup> tone, but which type of scale tuning are we talking about: “Pythagorean”, Just Intonation, equal temperament, Harmonic Series, one of the myriads Moments of Symmetry (MOS), or any other alternative?

This is extremely important, because if 432 is a “Pythagorean”  $27/16$ , then  $1/1 = 432 \div 27/16 = 256$  Hz; if it's a Just Intonation  $8/5$ , then  $1/1 = 432 \div 8/5 = 270$  Hz; if it's equal tempered, then  $1/1 = 432 \div 2^{(9/12)} = 256,868736840587\dots$  Hz, and so on: a different value for every scale.

This also complicates the 528 issue, because this frequency is from the start the  $1/1$  of the scale, and finding its 10<sup>th</sup> tone equivalent just for the sake of conformity throws us again in the realm of scales: which scale should we tune to? If it's “Pythagorean”, the answer is  $528 \times 27/16 \div 2 = 445,5$  Hz; if it's Just Intonation, the answer is  $528 \times 8/5 \div 2 = 422,4$  Hz; if it's equal temperament, the answer is  $443,993307253961\dots$  Hz as calculated above, and so on: a different value for every scale.

Can you figure out the  $1/1$  of the 424 Hz reference frequency for the “Pythagorean”, Just Intonation, and equal tempered scales?

In everyday life and modern musical practice though, different scales are by default out of the question. There is only one scale in use, and it is implied as standard: the equal tempered scale. Whenever we are faced with tuning a musical instrument – whether acoustic or digital – to a reference frequency, the scale used is the dissonant and out-of-tune equal temperament. This is because equal temperament has been for so long part of our culture, that its validity is no longer questioned. Furthermore, acoustic instruments like guitars have no way of changing scale – they are stuck in equal temperament. They can change the reference frequency, but that doesn't help much. The only solution is to refret (see “[Musical Instruments](#)” below), or remove the frets completely.





Alvarez MC90 Fretless Conversion Closeup of Fingerboard<sup>7</sup>

In the Sacred Sounds Scale tuning, all the above problems are elegantly addressed by the very nature of the scale, which is harmonically pure and progresses naturally, and by assigning the reference frequency to the first tone in the scale: 1/1. This is in accordance with the Universal Laws of Sound. It's worth mentioning here that, contrary to popular belief, the tone named "A" is not the first in the 12-tone system, nor is "C" for that matter. Historically, and here again we're facing arbitrary conventions, the first tone in the scale, the 1/1, is "D".

## Naming the Tones

This brings us to the delicate subject of naming the tones. It would be pointless to try adapting old names to this new (but in fact as old as the Universe) scale, mainly because the two systems are very different. The standard 12-tone equal temperament is a cyclic approximation of a spiraling scale made exclusively from stacking the interval between the 2<sup>nd</sup> and 3<sup>rd</sup> harmonics on top of itself, dividing tone values freely by 2, whose initial setup of only 7 tones originated the names we came to know as C D E or Do Re Mi, together with their counterintuitive sharps and flats.

In contrast, the Sacred Sounds Scale is tuned nonlinearly according to the Natural Harmonic Series and this makes it incompatible with the standard 12-tone scale – both mathematically and “alphabetically”. If so far I have presented the Sacred Sounds Scale Tuning as a fact, a pre-human natural occurrence, the following tone names are just an idea that seems to work:

The 32+1 tones of the Sacred Sounds Scale could bear letter names. The “Latin” or “Roman” alphabet contains only 26 letters, not counting diacritics. The first 8 of these, A to G plus H, have been already used for the 12-tone system, so in order to avoid confusion they will be overlooked. That leaves us with 18 letters, of which W takes too long to pronounce in most languages, so we’re down to 17. If we were to name only every other tone of the Sacred Sounds Scale, the first would be I, the third J, the fifth K and so on, ending the series with Z and leaving half of the scale unnamed. These unnamed tones could bear the names of tones in front of them with a “+” sign added, thus:

I; I+; J; J+; K; K+; L; L+; M; M+; N; N+; O; O+; P; P+; Q; Q+; R; R+; S; S+; T; T+; U; U+; V; V+; X; X+; Y; Y+; Z

There is no minus, because this is the Ascending Series of Harmonics. It is an always rising progression of unequal, natural musical intervals. All the tones marked with the plus sign are new in the 6<sup>th</sup> double. With other words, the 5<sup>th</sup> double of the 8 Hz Fundamental Tone contains all the harmonics 16 to 32, represented by the letters I to Z with no extra sign added, and the 6<sup>th</sup> doubles in size by adding one extra tone in between all others to complete the harmonics 32 to 64. These are all the letters I to Z marked with “+”.

The choice of making “i” the first tone or 1/1 of the scale is not arbitrary and gives the scale meaning and identity. This one-word letter is taken as the definition of “me” in the English language; it is the source from which all other tones derive their individuality. They all come from, and are all part of the “i” of the scale.

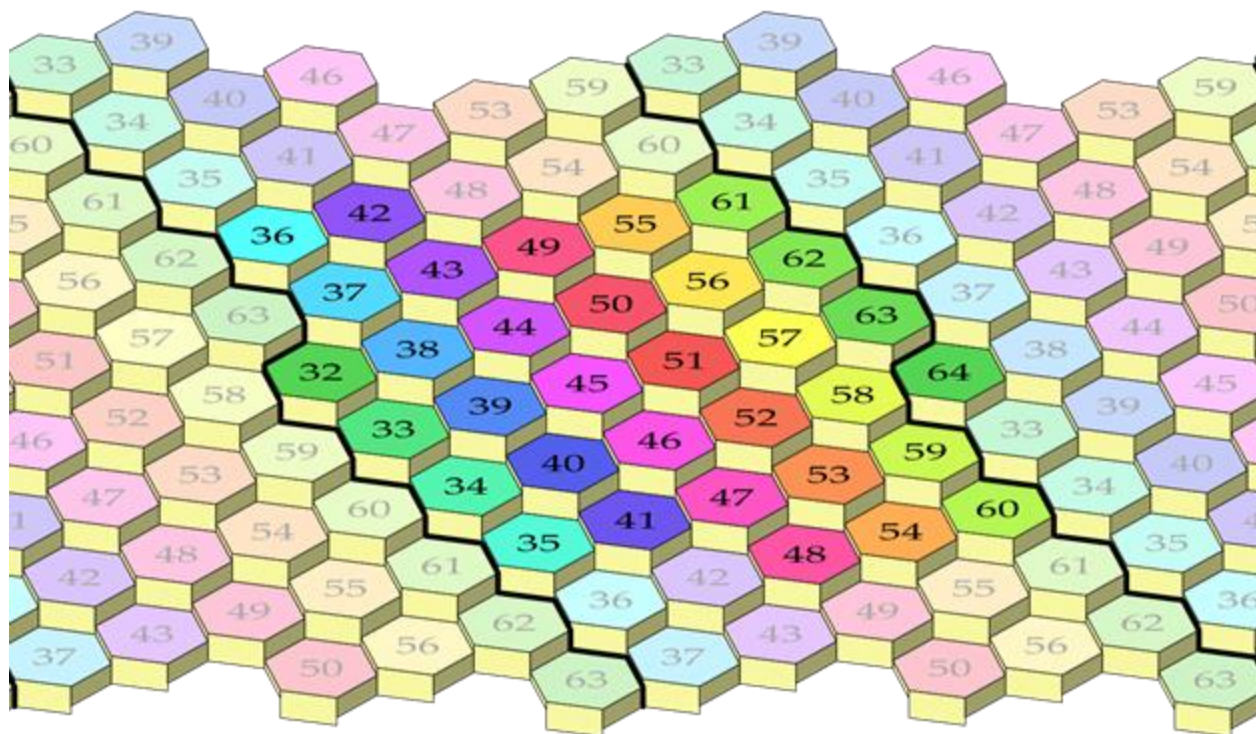
Although not the same with “scientific pitch notation” – a letter-number naming method devised for the standard Western chromatic scale (12-tone equal temperament) – the letter names of the Harmonic Series scale 16 to 32 bear subscript numbers to identify the pitch's double in a similar way. In our system,  $i_0$  has exactly 16 Hz – a value around the low end of human hearing range. Notice that  $Z_0$  sounds the same tone as  $i_1$ . This is because Z is the last musical tone in the scale, and in the next double it is the first. So instead of having two different tones bearing the same name (numbers excluded, like in the current anti-musical practice), we have one tone bearing two names depending on context.

This system allows, for the first time in the history of music, to accurately represent the Harmonic Series precisely as it is, by making use of the tones derived from it and their respective names:

$i_0$ ;  $Z_0$  ( $i_1$ );  $Q_1$ ;  $Z_1$  ( $i_2$ );  $M_2$ ;  $Q_2$ ;  $U_2$ ;  $Z_2$  ( $i_3$ );  $K_3$ ;  $M_3$ ;  $O_3$ ;  $Q_3$ ;  $S_3$ ;  $U_3$ ;  $X_3$ ;  $Z_3$  ( $i_4$ );  
 $J_4$ ;  $K_4$ ;  $L_4$ ;  $M_4$ ;  $N_4$ ;  $O_4$ ;  $P_4$ ;  $Q_4$ ;  $R_4$ ;  $S_4$ ;  $T_4$ ;  $U_4$ ;  $V_4$ ;  $X_4$ ;  $Y_4$ ;  $Z_4$  ( $i_5$ );  
 $i_{+5}$ ;  $J_5$ ;  $J_{+5}$ ;  $K_5$ ;  $K_{+5}$ ;  $L_5$ ;  $L_{+5}$ ;  $M_5$ ;  $M_{+5}$ ;  $N_5$ ;  $N_{+5}$ ;  $O_5$ ;  $O_{+5}$ ;  $P_5$ ;  $P_{+5}$ ;  $Q_5$ ;  $Q_{+5}$ ;  $R_5$ ;  
 $R_{+5}$ ;  $S_5$ ;  $S_{+5}$ ;  $T_5$ ;  $T_{+5}$ ;  $U_5$ ;  $U_{+5}$ ;  $V_5$ ;  $V_{+5}$ ;  $X_5$ ;  $X_{+5}$ ;  $Y_5$ ;  $Y_{+5}$ ;  $Z_6$

## Musical Instruments

The complete Scale of Sacred Sounds can be mapped onto the [Terpstra Keyboard](#), a unique musical instrument that can accommodate absolutely any tuning – be it in the form of modern, popular, ethnic, aboriginal or historical scales of 7, 8, 9, 12, 13, 16, 17, 18, 19, 22, 23, 26, 27, 29, 31, 32, 33, 37, 39, 40, 41, 42, 43, 45, 46, 47, 49, 50, 52, 53, 55 and 56 tones, and even larger numbers like 67 and 74 through the principle of Modularity. Of course a scale having any of the mentioned numbers of tones can be tuned in multiple ways, and to any reference frequency; furthermore, any conceivable tuning of any number of tones can be mapped on Terpstra’s layout.



Mapping the Terpstra Keyboard to the  
Natural Ascending Series of Harmonics 32 to 64

Tones that double/half their frequency are always on the same horizontal axis and at the same key height. Compared to the limitations of the 12-tone system, 32 is better –  $8/3$  times better. Imagine a painter having to paint with only 12 colors, or a poet having to write with a limited amount of words... 32 brings new nuances, subtleties and can better express artistically the intricacies of human experiences and the quest for the Divine.

**UPDATE.** Play the Natural Ascending Series of Harmonics 32 to 64 (Sacred Sounds Scale) online:

[Terpstra Keyboard WebApp | 32-JI-61L Sacred Sounds Scale — archaic ratios notation](#)

[Terpstra Keyboard WebApp | 32-JI-61L Sacred Sounds Scale — musical fractions notation](#)

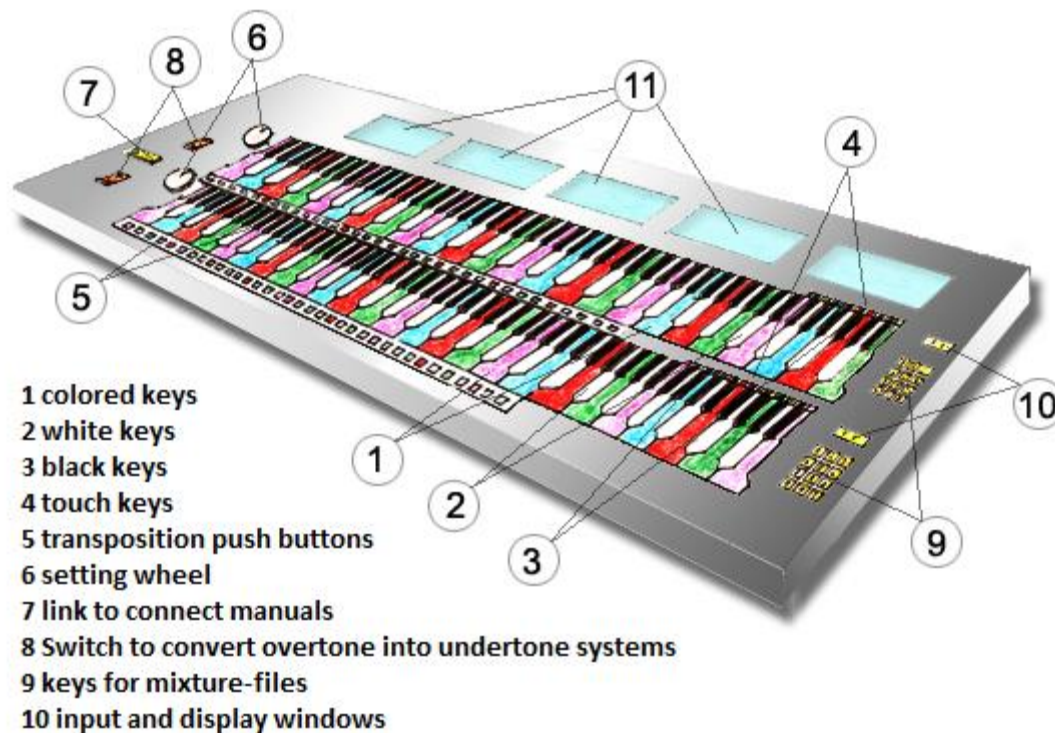
The best part about the [Terpstra Keyboard](#), besides its magnetic key-sensing mechanism that makes it one of the most expressive controllers ever built (every key is a tiny continuous controller), and the fact that each key can change color according to tuning, is isomorphism. This means that unlike the 7-white/5-black standard piano keyboard which is a historical accident with irregular layout, the Terpstra is regular and requires only one finger position for every type of chord, no matter where your fingers are on the keybed.



Terpstra Keyboard (1<sup>st</sup> Gen.) – 280 Color Changing Continuous Controllers<sup>8</sup>

Another alternative to the irregular standard keyboard is the “New Keyboard” devised by Johannes Kotschy, which was purposely designed for the Harmonic Series or Naturetone-System, as its inventor calls it.<sup>9</sup> On this instrument, which was never built, the 32 tones of the Sacred Sounds Scale fall naturally, while the actual tones

are created by the same arrangement of keys through addition of selected overtones. The idea of a tuning system based on Natural Harmonics is not new and has also been proposed – among others – by Sergio Aschero (who calls one of its extended forms “Afinación Armónica base 64” meaning “base 64 Harmonic Tuning”<sup>10</sup>) and Johnny Reinhard (in its maximized form of 128 tones: “128 tuning”<sup>11</sup>).



### The New Keyboard idea<sup>12</sup>

Electronic instruments capable of freeing music from the tyranny of equal temperament have been available since 1919, with the invention of the theremin or ætherphone: a musical instrument that was (and still is) being played without touching it<sup>13</sup>. Unfortunately, most if not all theremin performances make exaggerated use of vibrato, a technique generally used to disguise the ugly beatings of equal tempered chords that accompany performers. As such, theremin music sounds eerie and it was exceedingly used for horror movies. I would love to hear this instrument played properly, without the “shaking hand” responsible for its awkward reputation, and outputted through an advanced sound synthesis module that would enrich its sonic capabilities.

Other electronic instruments genuinely capable of continuous pitch control are the tannerin and ondes martenot. Both have the classic irregular piano layout as reference, to keep you somehow locked into believing that the 7-white/5-black pattern is musically relevant when the exact opposite is true. Once you discard that, the freedom of pitch already available in your hands takes a whole new meaning. This is also true for the traultonium, which can operate without the fixed levers limiting its pitch continuum.

Acoustic guitars can be fretted or refretted to play the Harmonic Series 32 to 64 of the Sacred Sounds Scale. A good example is Dante Rosati's Harmonic Series Guitar, featuring a custom color-coded fretboard (guitar neck).<sup>14</sup> Tom Winspear experimented with a fretboard layout on a 34-inch / 864-mm scale, 5-string acoustic bass converted to Harmonic Series double-string guitar, where the open strings are tuned precisely to  $\dot{I}_2\text{-}\dot{I}_3$   $Q_2\text{-}Q_3$   $\dot{I}_3\text{-}\dot{I}_4$   $Q_3\text{-}Q_3$   $\dot{I}_4\text{-}\dot{I}_4$ .<sup>15</sup> If these strings were tuned differently, the fret pattern would reflect the change accordingly.



Harmonic Series Guitar Neck  
by Dante Rosati<sup>16</sup>



Fretboard experiment  
by Tom Wispear  
on a 5-string Acoustic Bass  
converted to Harmonic Series Guitar<sup>17</sup>



Instrument built by  
luthier Walter Vogt  
which uses his  
Mobile Fret system<sup>18</sup>



The easiest way to experiment with different fret layouts for guitars, and at the same time keep versatility to a maximum, is to use an adjustable, mobile-fret system á la Walter J. Vogt.<sup>19</sup> The configuration displayed (in the right-hand image) above has the tuning  $\dot{I}$ ; J+; M; N; Q+; 105/64; U; Z, where 105/64 stands for Harmonic 105 of the Ascending Series 64 to 128, which is a pure harmonic tone of natural occurrence between S and S+. The 1/1 of the scale has a frequency of 268,190476... Hz (repeating pattern of decimals), as calculated for the 105/64 tone on 440 Hz.<sup>20</sup> Another way of having multiple tunings on a fixed-tone instrument like the fretted guitar is interchangeable fretboards, or Switchboards, as their inventor Tom Stone calls them.<sup>21</sup>



John Schneider's Switchboard guitar  
together with various fingerboards he built for it<sup>22</sup>

Flutes, saxes, together with every other instrument from the wind & reed family that use finger-holes to change pitch in addition to overblowing, can be played in almost any tuning by the use of different techniques which rest on the virtuosity of the player, but can be also precisely tuned to the Harmonic Series by boring the holes

accordingly. In fact, I would venture to say that any musical instrument could be adapted to play at least a part of this scale.

For example, the valved brass family of instruments derive their pitches from the [harmonic] overtone series of different lengths of tubing. By tuning these lengths in rational proportions to each other through different valve reconfigurations, the overtone series becomes readily available on horns, tubas and [valved] trombones.<sup>23</sup> Of course the trombone already has continuous pitch control so it can naturally play unrestricted pitches, just like the slide whistle and udderbot – a unique slide woodwind instrument Jacob A. Barton helped invent in 2005.<sup>24</sup> Johnny Reinhard is known for playing the bassoon in the 128-tone natural scale from the Harmonic Series, which is an expansion of the scale presented here that includes all its pitches.<sup>11</sup> Then there are the alphorn, bucium, trembita and erke, all labrophone-type instruments capable only of producing the overtones of the Natural Harmonic Series. And of course the didgeridoo.

Let's not forget the existing instruments which can play any scale (Harmonic Series scale included) just as they are: violins, violas, cellos and all other instruments from the bowed strings family like sarangi, goje, erhu & all huqin family of instruments, morin khuur, kamança & kemençe & all from kamancheh family, ravanahatha, k'ni, jawzah plus all other derived from the bowed rabāb family of instruments; also plucked instruments like the fretless bass, guitarrón, Hawaiian lap steel guitar & its big brother the pedal steel, shamisen & sanshin, sanxian & shanz (shudraga), dan tam (ta in), sarod, doshpuluur & tobshuur, chitravina (gotuvadyam), komuz, kibangala (gabusi), ud & gambus & cobzã with all other oud family of instruments, guqin ("the instrument of the sages"), sugudu & dramyen, dotara, together with every other fretless instrument from the plucked lute (or rubāb) and zither families, and the list continues. An extensive research is needed to complete the list.

But above all, because of the True Harmonic Tuning of the Sacred Sounds Scale, these are all healing instruments. Each and every one of us is a symphony, a great concert of frequencies resonating on different scales. Our divine blueprint of creation lies dormant within us, and we are the ones who must find the right frequency for activating it. We now have the tools for that. We are our own sound healers – as long as we stay away from tempered tunings.

## Measurement Units

32 might seem like much, but if we pay attention to all the songs that ever touched our hearts we'll notice that no matter the place and time, only 7 tones have been used at the most. There are of course exceptions, but in every culture and in every time-period, the maximum number of tones used in a song was 7. The Chinese 5-tone scale, the 12 tempered tones of Western culture, the classic Arabic 17- and the Indian 22-tone scales use at the most 7 tones in any given composition. So there's no need to go for the entire 32 gamut. And if you don't like 440 Hz, just take it out of your music by not using the ratio 55/32.

Values in cents for the tones of the Sacred Sounds Scale have not been given, because the cent is the most inappropriate logarithmic unit of measurement for musical intervals ever devised. The cent was introduced around 100 years ago and is widely used to hide the ugliness of the artificial irrational numbers that make up equal temperament. Expressed in cents, 12-tone equal temperament looks like a neatly organized progression while any other tuning will look like a disordered mess: from different versions of just intonation to the harmonic series itself. Most people new to music theory have no clue what these cents really are; if they did, they would most likely consider them evil. The cent is a cover-up for dissonance: it gives integer (or rational) values to irrational numbers, and makes rational harmonic numbers seem unnatural.

Computing cents makes use of the base 2 logarithm, because of the false conception that any tone whose frequency is multiplied or divided by 2 is the same tone. To calculate the cent value of any ratio, one takes the base 2 logarithm of that ratio and multiplies it with 1200, that is, with 100 and then with 12. The name "cent" does not come from the multiplication with 100, which moves the decimal two places to the right; it comes from the 100<sup>th</sup> part of an equally tempered "semitone". 12 is the number of tones in equal temperament, so having this number as reference for expressing other tunings is arbitrary. A measurement unit devised for only one scale cannot properly represent others.

Another logarithmic unit known as "savart" takes the logarithm to the base 10 of musical ratios, and multiplies it by 1000 for convenience. This number does not imply a 10 tone tuning, but the 10<sup>th</sup> harmonic in a pure tuning will always have the value of 1000 savarts. Although our number system is of base 10, and even though

the savart is a far better option than the cent, using the base 10 logarithm for musical measurements is still not justifiable.

The measuring unit of musical intervals I call “constant” is based on the natural logarithm, also known as logarithm to the base  $e$ . This is very different from the arguably arbitrary choices of 2 and 10, because  $e$  is the base rate of growth shared by all continually growing processes.<sup>25</sup> From a musical standpoint, “continual growth” is the difference between playing one tone after another as opposed to sliding from one tone to another, where the slide (or glide, sweep, portamento) contains all the sonic information in between the tones.

The natural logarithm does not favor any musical interval, because  $e$  is not a rational number defining only one ratio; it can't be a tone of any harmonic tuning. As such, constants do not favor any tuning system. All scales are treated equally, by conveying pitch differences through the same abstract use of decimals. That's because  $e$  is a transcendental number: an infinite continuous fraction that contains the sequence of all natural numbers and the sequence of all musical intervals.<sup>26</sup>

$$e = 2 + \frac{1}{1 + \frac{1}{2 + \frac{2}{3 + \frac{3}{4 + \frac{4}{5 + \frac{5}{6 + \frac{6}{7 + \frac{7}{8 + \frac{8}{9 + \dots}}}}}}}}}$$

The numerical value of  $e$  represents the theoretical point at infinity where the continuous fraction would converge, and this is why this number has never-ending decimals:

$$e = 2,718281828459045235360287471352662497757\dots$$

The name “constant” comes from  $e$ , because, with the possible exception of  $\pi$ ,  $e$  is the most important constant in mathematics<sup>27</sup> and the base of the natural logarithm. The formula for calculating the constant of any musical ratio is taking its

natural logarithm and multiplying it by 1000, for the convenience of moving the decimals three places to the right. Spreadsheet formula: “=LN(x/y)\*1000” (without the quotes). For example:

$$\ln \frac{3}{2} \times 1000 = 405,465 \text{ constants}$$

Leaving numbers aside, the best way to compare musical intervals is visual. The constant becomes even more powerful when plotted on a number line.



### “What You See is How You Hear” Harmonic Number Line

Every mark represents the natural logarithm of every value, but it is the actual ratios (and harmonic numbers) that get written on the graphic. This harmonic number line is in fact a logarithmic number line and it accurately depicts musical intervals the way we perceive them through the sense of hearing. I call this visual measurement tool the “What You See is How You Hear” Harmonic Number Line.

Note that this construct does not visually represent the lengths of strings or pipes used to generate those tones, nor the distances between flute holes, and has no direct connection with the divisions of the fretboard of stringed instruments, meaning it is not a tool nor template for calculating distances between frets. It is an abstract diagram, a mathematical graph that reflects the way we perceive sound frequencies, and has nothing to do with the way sound is generated and propagated through air.

## Simple Notation

Culturally, it seems like we have been somehow brainwashed into believing that music is this limited set of rules and tools governed by equal temperament – the most dissonant of all scales! Our ears have been conditioned to accept and like it, but that doesn't make it better. The black and white piano keyboard is one of the most difficult instruments to learn and play, and the staff notation devised for it can only make matters worse. I often wonder how this can go around unnoticed.

The standard keyboard is just like having a 4-wheeled vehicle with three round wheels and one square, known to everyone, used and praised by all, but without its practicality and essence ever being questioned. We might build rubber roads and engineer the car with real-time adjustable suspensions plus magnetically floating seats, but that doesn't solve the problem: it does not change the one square "wheel" into a circle. Likewise, we might built synthesizers and develop expressive sensing mechanisms into keyboards, but that doesn't solve the problem: it does not make the irregular layout of the keys regular.

The 5-line staff notation is one of the most ambiguous systems of reading and writing music. Originally devised to fit the anatomy of the irregular piano keyboard, it is cumberously used for all other instruments which obviously have no irregular black and white keys. Even more paradoxical, modern harmony has nothing in common with the Harmonic Series. It tries to approximate it, but it doesn't go there.

The tempered tuning scale, the irregular keyboard, together with the ambiguous staff notation, note names and the cent as measurement unit are merely ideas, symbols and tools used in the past. They are simply concepts that cannot define the true nature of music. They have served us well hitherto so let's just say goodbye 'cause now they need to go where they belong: behind the glass of display cases inside museums.<sup>2</sup>



Ringve, Norway's National Music Museum<sup>28</sup>

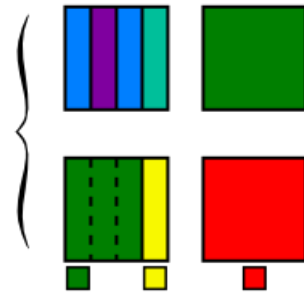
Sergio Aschero, doctor in musicology, spent 35 years devising and perfecting a notation system based on colors, geometric shapes and numbers which is so simple that small kids and the mentally challenged can use it almost instantly.<sup>29</sup>

Having in mind that the [Terpstra Keyboard](#) can change the color of every key and the New Keyboard has colored keys, that colors can be placed or painted on guitar necks and around flute holes, and that maximum 7 tones are generally used in any composition, Aschero's "Numberphonic" notation (Numerofonía) can be easily used in conjunction with the Sacred Sounds Scale of Natural Harmonics. This notation is of course backwards compatible and can be used with the current, or any other tuning systems.

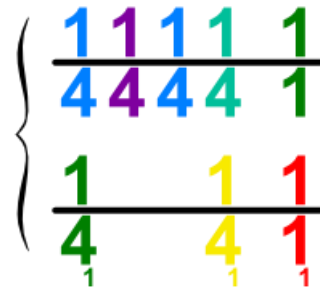


Traditional Musical Notation

=



Geometric Numberphonics



Arithmetic Numberphonics

Phononumerical Writing

The 5-line Staff Notation vs. Numerofonía de Aschero (Geometric & Arithmetic)<sup>30</sup>



## Musical Evolution

The 3<sup>rd</sup> Millennium Musician can't afford wasting time on trying to figure out counterintuitive notation, agonizing to play nearly impossible instruments, and neither on dilemmas like which reference frequency sounds better in equal temperament. As long as the scale is equally tempered, any concert pitch can only bring small and insignificant changes. Now, more than ever, we need to look at music and the science of frequency and vibration with a new set of eyes. And listen with a new set of liberated ears.

“What Music Really Is: *The Manual for The 3<sup>rd</sup> Millennium Musician, Spiritual Seeker and Free Energy Discoverer*” is going to be the first book in written history that describes music for what it really is, and not through the definitions of only one cultural musical system used in only some parts of the world. This is achieved with disregard for locally standardized nomenclature, established conventions and historical-based references, and it means that for the first time in history the innocent music lover won't have to worry about abstract notions with circular reference in order to understand music.

No more “tones” and “semitones” (the word “tone” as it is used in this work means “musical tone” or “sound with regular harmonic structure” and has nothing to do with the definition given to it by Western music theory), no more “sharps” and “flats”, no “thirds”, “fifths” and “octaves”, “major”, “minor”, “augmented”, “tonic”, “dominant”, “diatonic” and “chromatic” – they are all misnomers and impediments.

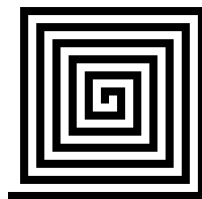
Music is a universal language that cannot be defined through local concepts. All the above refer strictly to the Western musical system which is on its own limited and inconsistent with nature, and as such has no power of conveying what music really is. Yet every study of music rests on these peculiar concepts. The Harmonic Series gets written as notes on the five-line staff, even if this notation cannot represent it properly. Every time the Harmonic Series is explained with the help of a piano, the truth is left out. No matter what trained musicians want us to believe, the musical truth is that the Harmonic Series cannot be found as such among the keys of the equal tempered piano, nor on the frets of equal tempered guitars.

We currently have, and have had for a long time now, all the tools needed to bring back true harmony in music. It's up to us to be conscious and question everything. Instead of going blindly after someone else's dream, let's go for our own. The

musical tools presented here: musical instruments, tone names, measurement units and simple notation, can be used with the Sacred Sounds Scale and also with every other conceivable tuning scales and reference frequencies.

The Sacred Sounds Scale harmonizes the frequencies 424, 432, 440 and 528 Hz into a single Tuning having the 1/1 reference pitch on 256 Hz. This tuning scale comes from the Natural Ascending Series of Harmonics 32 to 64 of the 8 Hz Fundamental Tone and brings an end to the tuning dilemmas and consonance problems of the past centuries.

The “war of the tuning forks” is over now. Peace and Harmony.



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November 2014

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