Sounds and Colors

Nothing of what I am presenting in this chapter is fundamentally new. But the angle with which it is being presented does have new aspects with regard to harmony and healing.

The word "frequency" has become a dominant buzz word in the vocabulary of "new agers" and subtle energy enthusiasts. "Raising one's frequency" is a frequently verbalized objective in a multitude of situations, from meditation to spirituality to alternative healing. Often the words "frequency" and "vibrations" are used interchangeably. What is really meant with this expression is often open to interpretation. It is necessary to define our understanding of this word in the context of this chapter.

The word frequency is borrowed from quantum physics, from which we know that everything, not only sounds and light and electromagnetic waves, but also the atoms and, ultimately, our cells and organs, are in a constant state of "vibration." This vibration is usually very fast and can be understood as occurring in the fashion of a wave, i.e. with up and down motions, oscillating around a zero point that lies half-way between the extremes. The number of times that the wave completes a full up and down cycle per second is called "frequency." This number is often indicated in Hertz, whereby 1 Hz equals 1 cycle per second. We know many examples. Electricity supply to homes in the United States is transmitted at a frequency of 60 Hz. Radio broadcasts operate in the 540 – 1600 kilohertz (AM) and 88 – 108 megahertz (FM) range, and so on. The human capacity to hear sounds ranges from about a low of 40 Hz up to about 20,000 Hz.[1] The colors we humans see have frequencies ranging from about $4*10^{14}$ to $8*10^{14}$ Hz (400 – 800 TeraHertz).

Usually people think that higher frequencies (or vibrations) are "better," more desirable, more powerful. Before we continue, we must first disperse the myth of this wide-spread, false understanding. Because, if the "*the higher the better*" notion were true, we would immediately have to conclude that higher sound tones are better (soprano would be better than tenor or bass), and colors would intrinsically be better than music. We know that this is not so. Let's look a bit more at music. Those of us who have learned to play musical instruments know from experience that tuning is typically done to a frequency of 440 Hz for the "concert a_4 sound." If one of the orchestral instruments is tuned at a higher frequency, say, at a_4 = 450 Hz, it is not better but "mistuned," and its sound *in concert* with other, "correctly" tuned instruments would be horrible. This is so even though the incorrectly tuned instrument *in and by itself* sounds just fine, regardless of the higher pitch. If a musician practices a piano concerto on a piano tuned to a_4=450 Hz it sounds perfect, but when that piano is wheeled into the concert hall and the soloist plays together with the orchestra tuned to a_4=440 Hz, the conductor and most people in the audience will get goose bumps. The same would happen if the piano were tuned to a lower frequency, say, 430 Hz. In both cases the tuning would have to be done to end up with *harmony*, either by tuning the frequencies downwards or upwards. So raising frequencies or vibrations should not be the goal, but the objective

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[1] The fact that sound frequencies are based on sound wave propagation in air, at much slower speeds that propagation of light and electromagnetic wave, is immaterial for this context.

should be to ***harmonize***. Simply “raising” the frequency or vibration would not always do the job; harmonizing is required, not just raising.[2]

Now that we understand that raising frequencies does not improve but rather simply ***modify*** situations, let us play with an astonishing example that leads us from sounds to colors. We will see that the visible color spectrum has analogies to the audible sound spectrum. Go to a piano or keyboard and find the “a_4” key.[3] That key is typically tuned to 440 Hz. Now go down 7 white keys to the left. It’s again an “a” key – now called the “a_3” key. It sounds exactly like the “a_4” key, has the same “vibration,” but it’s one “octave,” or one pitch, lower. The sound of “a_3” has a frequency of 220Hz, i.e., exactly one-half of the of “$a_{4.}$” If you go further down to the left, by another octave, or 7 white keys, you get to “a_2” – again principally the same sound but another octave or pitch lower. Now you are at 220/2 = 110 Hz. Yet another, and then one more octave further to the left will get you to what is typically the lowest key on a piano,[4] the “a_0” key. It “vibrates” with 110/4 = 55/2 = 27.5 Hz and is often considered the lowest discernable note a human ear can clearly distinguish from the next higher note.

So now we know that from “a_0” to “a_4” you have 4 octaves, or 4 pitches of the same sound.[5] Now we go back to our “a_4” note and realize that virtually all the themes of music that we so love and appreciate can be played with (white and black) keys within about an octave of the “a_4” key. But the “a_4” is certainly not the basic note of all music, but only of that music that happens to be written in the “a major” or “a minor” keys. There are 12 keys (or half-notes) between two octaves, and the frequency of each of these are very well defined and increase when you go, for example, from “a_4” to the next higher octave, the “a_5.” Each of these keys can be selected as basis for a song theme.

It is well known, mostly still by intuition, that music can have a healing effect. ***Sound therapy*** is a more and more widely recognized form of therapy for certain health challenges. But the sound frequency that is most effective for one person is not necessarily the best for another person. We are all different, and some sounds are more congenial to us than others. Sound therapists will be able to narrow down the best frequencies for their clients. Play some basic harmonic sounds on a piano, such as the c-major chord c-e-g-c. Then play and compare it to other chords, such as the g-major (g-b-d-g), a-major (a-c#-e-a) or alike. Is there one that you prefer? Perhaps you like the c chord best. Now play the corresponding minor chord, such as a-minor in this case (a-c-e-a). Eventually you will perhaps end up with a clear preference of a dominant sound note or combination of notes. Say, the a-minor chord (a-c-e-a) is your preference.

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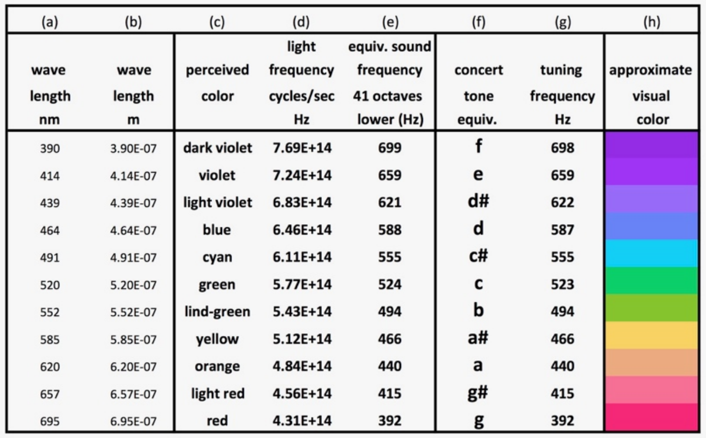
[2] To fill the gap of understanding when using the physics metaphor of vibrations in a metaphysical context, one might add another, not yet mentioned aspect of waves, the wave ***amplitude***. This would describe the ***amount*** of motion of a wave around the zero-point, the distance between the low and the high points. For sounds, the amplitude describes its ***loudness***. For example, the concert “a_4,” as given by the tuning fork, will be loud when you hit the fork with force, or quiet when you hit it gently, but it will always be at the same 440 Hz frequency.

[3] It’s just to the right of the center of the keyboard; find it as the white key to the left of the right of a series of three black keys.

[4] A typical piano with 88 keys starts with the “a_0” key, which vibrates at 27.5 Hz.

[5] In fact, if you were to optically analyze an “a_0” piano base string in motion, you would see that it has small nodal points at ½, ¼, … of the length of the entire string, and there are corresponding vibrations of double, quadruple, … of the original frequency. These are called upper or super frequencies, appearing on one and the same lower pitch string. They are usually much lower in amplitude and therefore less obvious to hear, but the fullness we perceive of any one note is often the result of these concomitant upper frequencies.

Keep your result in mind and let’s go on to seeing if there is a fitting correlation to colors that find your preference.



(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
wave length nm	wave length m	perceived color	light frequency cycles/sec Hz	equiv. sound frequency 41 octaves lower (Hz)	concert tone equiv.	tuning frequency Hz	approximate visual color
390	3.90E-07	dark violet	7.69E+14	699	f	698	🟪
414	4.14E-07	violet	7.24E+14	659	e	659	🟪
439	4.39E-07	light violet	6.83E+14	621	d#	622	🟪
464	4.64E-07	blue	6.46E+14	588	d	587	🟦
491	4.91E-07	cyan	6.11E+14	555	c#	555	🟦
520	5.20E-07	green	5.77E+14	524	c	523	🟩
552	5.52E-07	lind-green	5.43E+14	494	b	494	🟩
585	5.85E-07	yellow	5.12E+14	466	a#	466	🟨
620	6.20E-07	orange	4.84E+14	440	a	440	🟧
657	6.57E-07	light red	4.56E+14	415	g#	415	🟥
695	6.95E-07	red	4.31E+14	392	g	392	🟥

Figure above: Correlation between colors and sounds. For example, the concert tone “a”, having a tuning frequency of 440 Hz, corresponds to the color “orange” which, as physics tells us, has a frequency of $4.84 *10^{14}$ Hz or cycles per second and, just for further reference, has a wave length range peaking approximately at 620 nm or $6.2*10^{-7}$ meters. Note that the f# tone is omitted, because it would fall into the not clearly visible range.[6]

To get to this, let us imagine we play your preferred chord at a higher and higher sound pitch. Each time higher by an octave. Starting with “a_4” as base note we go an octave higher to “a_5” then a few more to “a_8” (which has a frequency of 440*2*2*2*2 = 7040 Hz), which is about the highest tone on a piano. We can still hear that tone, but for some of us the next higher octave, bringing us to 14080 Hz, would take us to the upper level of our hearing ability. Our favorite note or chord would remain the same, it would just be perceived at a higher and higher octave. Imagine now that you would go up higher and higher, 40 more octaves up, from “a_4” all the way to what would be equivalent to “a_{44}”. At that point, the frequency of that “sound” –still representing your healing sound, just at much higher pitch – would be $4.84*10^{14}$ Hz, or 484 terahertz.

Now comes the interesting part: that particular frequency is nothing other than the midrange ***frequency of the color orange***. Look at the figure above. You can now correlate each concert base tone with a color equivalent. Orange corresponds to your base tone “a”. In your preferred a-minor chord, the notes “c” and “e” are the next two sounds of your preferred interest – not quite as pronounced as the “a”, but still of higher than average interest. Going to the table above, the note “c” corresponds to the color green. “e” corresponds to violet. So, in this hypothetical case a color composition consisting mostly of orange, green, and violet would be of particular meaning for you. A scenery with these colors could perhaps make up your healing “bouquet.” Perhaps it tells you that you like flowers, in particular orange and violet flowers, embedded in some green leaves.

Of course, this realization goes both ways. If you are an avid lover of flowers, and in particular orange and violet colored flowers, you might respond particularly well to sound therapy in the a-minor

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[6] The note f# has 370 Hz and falls in the 736 nm wavelength range at the 44th octave, or, at the next higher octave, it has 740 Hz and corresponds to 369 nm wavelength. Both wavelengths are outside the clearly visible range for most people.

key. If you like blue (corresponding to c#) even better than green, your music preference might be more in the a-major than a-minor key.

What would this mean in practice? There are many ways to implement these findings. In general, your sound therapist would concentrate on intonation of your preferred sounds, keys and chords. She could complement sounds with visual displays of the related colors. If your healing colors conveniently match the colors of certain flower bouquets, she could suggest a visit to your local florist …