432Hz, a superior tuning. Myths or Facts?

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Abstract

Musician have standardized their tuning pitch at A=440Hz back in 1939, but ever since the 19th century there had be debate over the standardization of tuning frequency. In recent years, discussion is brought up again by singers, YouTube content creators and New-Age spiritual practitioners. Despite varies reasons, believers think that A=432Hz is a better tuning frequency and have positive effect in relieving stress. Various archives are reviewed ranging from YouTube videos to controlled lab research in seek of uncovering the myths behind the 432Hz tuning. Studies have shown that human are capable of distinguishing the two tunings. Despite subjective preference in perceiving the frequencies, different effects are found in physiological responses. However, it is difficult to conclude superiority of either frequency, the author suggested to use the effect to musician advantage. Letting the choice of tuning frequency be a choice of artistry to reach desired effects.

Keywords: 432Hz, 440Hz, tunings, physiological responses

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Introduction

In recent years there is a growing discussion on the standard pitch of music, million subscribed Youtubers like Adam Neely (2017), Paul Davids (2017) and Rick Beato (2017), discussed on the topic with over 5 million combined views. Although, the above content creators disagree on the idea of A=432Hz being a superior tuning, some of their viewers hold a contrary opinion. Thus, it is easy to find millions of views on YouTube videos that claims playing 432Hz music, and provide a magical relief to stress.

Although music perception might be subjective and it is almost impossible to test spirituality of a tuning, this research will view the 432Hz tuning with a more scientific approach. Reviewing existing literature in hope to discover any possible effect on human body when listening to the believed superior tuning.

History of tunings

432Hz tunings might just become a topic on the internet and New-age community, the fight between standard pitch had always been here since the first trial of pitch standardising in France back in 1859. Due to the advance in technology, better strings are made capable of producing higher frequency, thus Concert halls and Opera house gets larger, orchestra tended to rise their tuning for the intense and powerful climax. Also instrument maker try to win competition of sales by making brighter instruments. In result the standard tuning had been pushed higher and higher to an extent singer are suffering from performance (Cavanagh, n.d.). According to Haynes (2002) study the tuning of Royal Albert Hall in 1877 was even up to A=455Hz, while France standard A=435Hz by law.

Despite the trend of playing at a high frequency with brighter sounds, some performers even refuse to perform unless the orchestra tuned down their pitch (Haynes, 2002). Famous

composers like Richard Wagner and Giuseppe Verdi also complaints about the high frequency and suggested to be played in a lower frequency. From a letter Giuseppe Verdi wrote to the music commission of Italy government at their times, we can see that Verdi supported the idea of a universal tuning, and he do suggest the government to adopt A=432Hz instead of higher tunings like A=450Hz in Rome back in the days. He added that the lowered tuning would not take away the brilliance of performers but produce a more majestic sound while avoided the screams of too-high tuning (Celani, 1996).

The discussion continues until music broadcasting become a new way to enjoy music. The broadcasting industry pushes toward a standardized pitch, and at 1939, an international conference was held in London setting the A=440Hz, which is now documented in the International Organization of standardization as ISO 16:1975. A compromise between the varies pitch standard, and for the accuracy for sound to reproduced electronically (Cavanagh, n.d.). However, in the 1980s The Schiller Institute started a campaign in bringing the Verdi A back as the standard pitch, as the pitch is more suitable for singer to sustain high notes thus the middle is richer and fuller (Abdella 1989). The concept is supported by Celani (1996), claiming that the Verdi A would provide better shift of registers and the piece would sound more expressive.

The idea of A=432Hz being a superior pitching standard also links to New-age practices. Believers thinks that certain vibration of sound have a magical effect in healing and enhancing. They often based their saying from Dr. Emoto's (2004) water crystal experiment, where positive words would made water form a more symmetrical crystal. 432Hz believers took a step further and think that having the tuning developed from the Schumann Resonance, the electromagnetic waves cycle of Earth atmosphere, has better maths and more spiritual (Adam Neely,2017; Cross,2018; Palmblad, 2018; Osborne, 2019). Believers also claims that the 432Hz tuning fits that golden ratio, hence a prettier tuning that better align with the universe (Crotti, 2016). However, the above theory is rather sketchy and slipshod, as believers rounded up the Schumann

Resonance from 7.86Hz to 8Hz, and Dr. Emoto's experiment have not taken pitch into account, it might seem that the believer had tweak the existing theory in order to match their own hypothesis. Despite scepticism, there are comment under Paul Davids's (2017) YouTube experiment (He played the same tune with 440Hz and 432Hz) stating that they do find 432Hz more pleasant and soothing.

Physical Difference between 432Hz and 440Hz

Now that we have the historical background of the debate, we should also look into details of physical difference of the two-tuning pitch. Sound is a vibration of air waves, and such vibration are measured in cycles per cycle. Hence 1 Hz refers to 1 cycle per seconds (Calamassi and Pomponi, 2019). This means at the A on the space of a treble clef (A_4) the air would vibrate 8 times less in Verdi A comparing to the international standard. Given the discussion of standard pitch raised by Verdi and The Schiller Institute only focus on the referencing pitch for tunings, but not the tuning system. Thus, both uses equal temperament method. The difference between the two pitching might be as little as 0.5Hz in A_0, the lowest A on a piano.

Given the difference between the two-pitching standard are so little in some of the places. While many 432Hz believers tended to be active in searching for 432Hz music or tune their instrument accordingly. The impressions of 432Hz being a superior tuning might be due to the placebo effect caused during their active search or tunes. Just like the barnum effect to other new-age practices like the horoscope readings. In order to eliminate such possibility, it is important to first study whether human is capable of distinguishing the difference between the two-pitching standard.

Perceived difference

Palmblad (2018) also find the claim of 432Hz lack of scientific groundings, and thinks that the frequency of the two tunings are very close to each other, which might be impossible for

human to tell the difference. Therefore, an experiment is conducted around the question *"What differences can be found between tuning systems in A = 440 Hz and A = 432 Hz regarding sound quality, timbre and emotional response?"* (p. 10). Thirty participants are asked to listen to two versions of the same composition Palmblad wrote, one in A=440Hz and the other in A=432Hz. Both samples are created with digital samplings to avoid any human errors and intonations issues. The participants are then asked to 1.) rate the similarity of the versions from 0-30, 2.) whether they have a preference between the two version, 3.) associate word that corresponds to each composition.

The result shows that human is capable of distinguishing the difference between the two tunings. As only 2 of the 30 participants scored 30 out of 30, while one of them did mentioned their preference of 440Hz more, which might make the rating 30 as being extremely similar instead of being identical (Palmblad, 2018). His research also reflected that audience might prefer the A=440Hz more than Verdi A. As 43.33% of the participants preferred the international standard, 13.33% more than the other, while 26.67% of them shows no preference. This confirms a study Fastl (2013) mentioned in the 21st International Congress on Acoustic, where students are asked to rank list of composition is played with grand piano that is tune to A=440Hz and A=432Hz. Similar result is shown with only 1 of the 6 composition have a higher ranking for the A=432Hz tuning. Fastl added that the result might due to the exposure of 440Hz tuning that is widely used these days, and created a bias.

These adds up to the experiment Palmblad (2018) did. As he found out that 62.5% of his musically educated participant prefers the 440Hz tuning, while the preference is evenly spread between 440Hz, 432Hz and no preference for the participants with no musical education. The study also found that there is no significant characteristic tied with either of the tuning, as tuning might be associated with contradictory response. Thus, no real patterns are found associated with a unique emotional quality.

Similar findings are presented in the research by Uy (2019), where participants are played ten sound clips of 5 different string instruments, each clip are played twice, once with 440Hz and the other with 432Hz. Emotional measures and Physiological measures are recorded from each participant. Uy (2019) found no significant data was found in the emotional valence and arousal between the two tunings, suggesting that there is no specific emotion response tied with either of the tuning, just like Palmblad (2018)'s study reflected that none of the tunings could be associated with significant characteristic or emotional quality. Although the emotional measure suggested no difference between tuning frequency, significant data are found in the physiological difference between tuning frequencies (Uy, 2019).

Difference is physical response

Di Nasso et al (2016) did a research regarding the effect of 432Hz music on anxiety during endodontic treatment. Their result reflected that listening to music during the dental surgery would significantly reduce the systolic blood pressure, diastolic blood pressure and heart rate, suggesting a more relax and calm state. However, Di Nasso et al (2016) base their experiment only on the comparison between listening to 432Hz music and not listening to any at all, it might be bias to draw a conclusion that 432Hz could reduce the above physiological measures, as listening to any music, not 432Hz specifically might also have the same result.

Halbert et al (2018) also explored on the idea of 432Hz music could reduce blood pressure and hear rate, which helps reduce the stress level. Unlike Di Nasso et al (2016), the participant of the research is exposed to 30 minutes of music that contains both 432Hz and 440Hz music. Thus, a controlled experiment is performed to each of the participant to get a more accurate result. Contrary to Di Nasso et al (2016) research, there are no significance in the change of blood pressure while listening different frequency of music, but the result does suggest that 432Hz

music do decrease heart rate while no such effect was found associate with the 440Hz tuning. Such result is also confirmed by a more extensive pilot study did by Calamassi and Pomponi (2019), which they also monitor the changes on 1.) blood pressure, 2.) heart rate, 3.) respiratory rate and 4.) oxygen saturation.

Similar to Halbert et al (2018) study, participants are asked to visit the lab twice, listening to the same track in different frequency (432Hz and 440Hz) with a washed-out period of 24 hours, to avoid any prolonged effect (Calamassi and Pomponi, 2019). The experiment reflected a decrease in heart rate and not significant drop in blood pressure when participant listen to 432Hz music like Halbert et al (2018) had reported. However, the study shows that the blood pressure would increase when participant listen to 440Hz, hence when compare to the two-tuning frequency, a slower blood pressure is present for the 432Hz tuning. Moreover, a drop in respiratory rate was found in 432Hz music but not 440Hz, suggesting that the decrease in heart rate to a certain extent might due to slower breathing. As Calamassi and Pomponi (2019) concluded 432Hz music might have potential beneficial effect to human body in comparison to 440Hz music. Thus, music in different frequency would certainly affect the physiological responds differently. Like these researchers suggested, further studies with larger sample group is require to demonstrate the lasting effect and the underlying mechanism behind the result (Halbert et al, 2018; Calamassi and Pompon, 2019; Uy, 2019).

Effect on other animals

Although longitudinal study about difference in 432Hz and 440Hz is yet to be done on human, Russo et al (2017) did a 4 weeks long study on neuropeptide Y (NPY) and Ghrelin secretion on rat's hypothalamus in relations to 432Hz and 440Hz music. The NPY and Ghrelin regulate appetite and control food intake behaviour. They separated the rats into 3 groups, Group 1 listening to back ground noises, Group 2 with 432Hz music and group 3 with 440Hz music. Both music group listen to The Division Bell by Pink Floyd one hour/ day. Result found that listening to

music would stimulate our eating and reduce our metabolic rate. Furthermore, such effect is found higher when the rats are exposed to 440Hz music compared to the 432Hz group, which leads to more weight gain.

Discussion

After reviewing the above research in regards of differences between 432Hz and 440Hz. It is confirming that human body are able to distinguish the two frequency (Palmblad, 2018), and 432Hz music is not a myth with no root. Despite subjective preferences, there is almost no doubt the two frequencies would affect our body and rat body differently. 432Hz music, according to the researches (Di Nasso et al, 2016; Halbert et al 2018; Calamassi and Pomponi, 2019; Uy, 2019) have a better effect in relieving stress as the 432Hz activists claimed (Paul Davids, 2017). This might due to the mediation effect, as 432Hz will slow down your heart rate and respiration rate (Halbert et al 2018; Calamassi and Pomponi, 2019; Uy, 2019). On the other hand, 440Hz music would increase blood pressure and heart rate (Calamassi and Pomponi, 2019), stimulate eating and reduce metabolic rate in rats (Russo et al, 2017).

Since both frequency affect physiological responses differently, it is almost impossible to say that one frequency is superior than the other without a content or purposes, like we are not able to say pen is superior than a pencil, as pen is not able to be used in space while pencil marks are not permanent. However, the differences could be used to our advantages. Like the orchestra back in the 19th Century, musician today could adopt the 440Hz tuning when they want to achieve intensity and climax, or the 432Hz to produce a more soothing sound when relaxation music is played. Letting the choice of tuning frequency be a choice of artistry, or even contemporary composers could include the desired tuning frequency in their composition, creating a pitch-standardized piece instead of an international pitch standard. Further study should be conducted in the comparison on the effect of frequency difference, as there are interesting results from the recent researches. Scholars could also look into different tuning frequencies, such as

A=415Hz, which was more dominant in the Baroque period of music, to see if the effect of reducing heart rate is 432Hz specific or due to the lower frequencies. Or comparing 440Hz and 441Hz, to see if human ears are able to distinguish the 1Hz differences in tuning, thus seeing whether there are difference physiological responses if human are not able to perceive the difference consciously.

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