California Institute of the Arts

The Hidden Power of Frequency on the Human Experience

by

Noah Eatman

A thesis submitted for the degree of
Bachelors of Fine Arts in Music Technology

Herb Alpert School of Music
Music Technology: Interaction, Intelligence & Design

2025

In 1895, the world famous Harvard University had a problem. The school had just built the Fogg Art Museum. “A first of its kind space intended to serve as a teaching facility and art museum, to help establish art study in the United States.”[1]

However, there was one issue. For reasons unknown, when Fogg eventually opened to the public for classes, some of the rooms could not hear the teacher. It's important to keep in mind that at the time no one thought about achieving optimal acoustics when constructing a building. When building a space, having to think about how sound moved inside of it was not at all a priority. In comes an American physicist named Wallace Clement Sabine. Holding a Bachelor’s degree from Ohio State University, and pursuing a Master’s degree at Harvard’s physics department. He was a young professor without a PhD and no experience in music or sound. The challenge was handed to him because of his lack of seniority. He and his assistants spent years studying the acoustical qualities of many rooms on Harvard’s campus in order to determine what could cause the difference of sound between rooms. Their findings showed that the architecture and the surfaces of the troubled rooms were causing sound waves to not travel to their fullest extent. This story highlights a time in human

[1] Harvard. “History.” Harvard Art Museums. Accessed May 2, 2025. https://harvardartmuseums.org/about/history#:~:text=Fogg%20Museum,-The%20Fogg%20Museum&text=Designed%20by%20architects%20Coolidge%2C%20Shepley,museum%20professionals%20in%20North%20America.

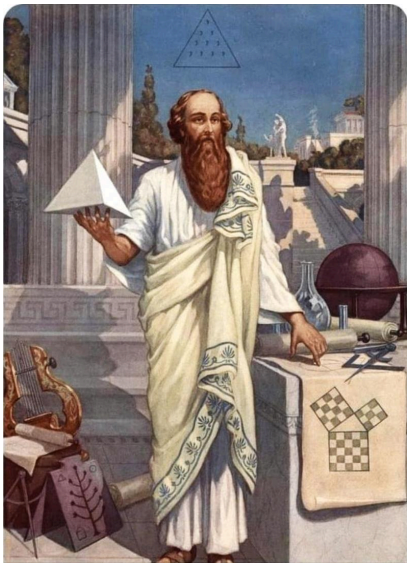
history where we underestimated the power and importance that sound frequencies can have to our existence. In many ways, my journey of questioning and studying the impact of sound and music mirrors this same spirit of discovery.

Music has always been a part of my life. Growing up in a family of musicians, I was surrounded by sound — not just as a hobby and passion, but as a way of understanding the world. My father toured as a classical musician and worked in radio, and many members of my family shared a deep love for music. This environment fostered a natural curiosity in me: Why does music feel so essential to human experience? Why can a single note or rhythm move us so profoundly? Now, as a student in CalArts' Music Technology program, I am passionate about not just creating music, but understanding the science behind its power. That curiosity is what led me to choose this topic and to explore it through a research paper rather than a creative project — to ground my passion in study and discovery.

At the heart of this exploration lies an invisible but powerful force: frequency. Despite frequencies being invisible to us, they have the ability to impact our lives more than we sometimes acknowledge. In order to explore the profound impact of music frequencies on human life, this paper investigates historical perspectives, therapeutic applications, and the physical effects of sound. From the ancient teachings of Pythagoras to modern clinical research and real-world applications, this study explores how sound frequencies influence the human experience - enhancing healing, reducing stress, activating the brain, and even posing risks of auditory damage—revealing that music is far more than entertainment; it's a powerful force that affects our mental, emotional, and physical well-being.

While it is often cliche to say - music is universal. It is no surprise that music is connected to our biology. A column in a peer reviewed journal about Psychiatry states, "Music is

a part of the cycle of natural life. …Day and night, seasonal changes, and all physiological and biological functions are rhythmic."[2] This comparison between music and life is an attempt to illustrate just how connected to frequencies we are. Beyond the overarching connections to how nature and music are similar, it is clear to see that we have an innate attachment to sound considering that it is one of our five senses that shape our reality. However, the frequencies of music are not just random sounds, there have been studies shown that when music is playing nearly the entire brain is activated including, "the hippocampus and amygdala, which activate emotional responses to music through memory; the limbic system, which governs pleasure, motivation, and reward; and the body's motor system."[3] This activation of the brain is something that humans have been familiar with for a long time, but may not always know exactly why.



Before we had scientific proof, history shows that humans have been tuned into the fact that music can be used as a tool. Whether it was drums and singing in a tribal ceremony, or it was monks chanting, frequency has been at the core of many spiritual practices. One of the first people known to try and articulate how frequencies can be beneficial was Pythagoras of ancient Greece. He was the first person to discover and document that the size and weight of an object will affect the sound produced when something makes contact with it. By having this realization,

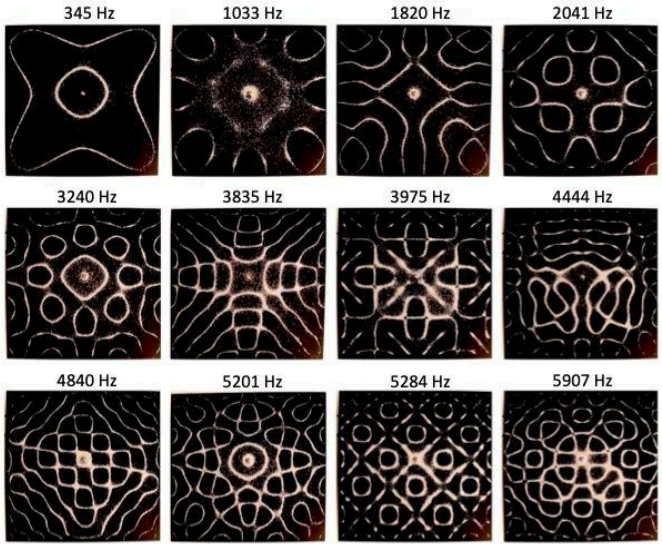
---

[2] Meymandi, Assad. "Music, Medicine, Healing, and the Genome Project." Psychiatry (Edgmont (Pa. : Township)), September 2009. https://pmc.ncbi.nlm.nih.gov/articles/PMC2766288/.

[3] Harvard. "History." Harvard Art Museums. Accessed May 2, 2025. https://harvardartmuseums.org/about/history#:~:text=Fogg%20Museum,-The%20Fogg%20Museum&text=Designed%20by%20architects%20Coolidge%2C%20Shepley,museum%20professionals%20in%20North%20America.

he used that same concept with strings and ultimately created the first musical scale which is the foundation of the Western music theory we use today. His extensive work on tones and frequencies meant that he himself began to feel how they could be used with purpose even before there was any scientific studies to prove its effects. According to Antonius Diogenes, "Pythagoras used to put himself in the right mood in the morning by means of the lyre and song, by singing old paeans (ritual healing songs) of Thaletas of Sparta or passages from Homer and Hesiod, which he considered suitable for calming the soul"[4] Long before scientific instruments could measure the effects of sound, Pythagoras intuitively understood that music and frequency held the power to influence the human mind and spirit—a truth that modern science is only beginning to catch up with.

The exploration of vibration went even deeper with the curiosity of inventors from the early 20th century. In the midst of mass technological advancements from people like Nicola Tesla and others, some began trying to understand why and how frequencies affect us. One of Tesla's most referenced statements is, "If you want to find the secrets of the universe, think in terms of energy, frequency, and vibration."[5] Ideas like this inspired



[4] "Pythagoras." Google Books. Accessed May 2, 2025. https://books.google.com.mx/books?hl=en&lr=&id=A8ixyQJA7_MC&oi=fnd&pg=PP11&dq=pythagoras%2Bhealing%2Bfrequency&ots=R5P92HIGUB&sig=Gxo9kFk0tz26LGGkOb4WUfBG2M8&redir_esc=y#v=onepage&q&f=false.

[5] *"Nikola Tesla Quotes,"* Goodreads, accessed April 28, 2025, https://www.goodreads.com/quotes/16920-if-you-want-to-find-the-secrets-of-the-universe.

people such as Hans Jenny, the founder of Cymatics. While Jenny brought forth ideas that were, and still remain, controversial to some in the scientific community, he also provided much needed submissions of study into the conversation around frequency's purpose in our life. Jenny used Cymatics to give people a visual representation of sound. By placing either sand or water on a vibrating plate, the formations of the substance would create almost mathematical shapes in response. According to author Erica Longdon, Cymatics "provides physical evidence that when sound frequencies move within a medium such as air, sand, or water, they alter the vibration of matter"[6]. Given that humans are majorly made up of water, the notion that the restructuring of cells from frequency is much more realistic when considering the findings from Hans Jenny. While this is certainly not a proven scientific fact, it is enough for a strong hypothesis to claim how sound is impacting our bodies more than we realize.

These people throughout history all contributed to the curiosity of modern science which has allowed us to take something that was invisible and hard to understand, and give it meaning and importance. In a world full of advancement in medicine, Western medicine is now finding music and frequencies to be an ally in conditions and diseases that they do not know the root cause of. According to Harvard Medicine, some of society's toughest challenges "ranging from Parkinson's to depression to Alzheimer's, could someday have therapeutic solutions derived from an understanding of music."[7] Even the professionals at Harvard are not quite certain exactly how, scientifically, it will help patients and the general public alike - but they know that it certainly has the potential to. They continue on to state that with a better understanding of the

---

[6] "Vibrational Sound Healing." Google Books. Accessed May 2, 2025. https://www.google.com/books/edition/Vibrational_Sound_Healing/XX7YDwAAQBAJ?hl=en&gbpv=0.

[7] Harvard. "History." Harvard Art Museums. Accessed May 2, 2025. https://harvardartmuseums.org/about/history#:~:text=Fogg%20Museum,-The%20Fogg%20Museum&text=Designed%20by%20architects%20Coolidge%2C%20Shepley,museum%20professionals%20in%20North%20America.

brain's mechanisms, we could begin to learn "the exact type of music able to provoke a particular cognitive, motor, or emotional response."[8] Being able to dial in on how to identify these phenomena could lead to progress toward various brain diseases.

The challenge to cracking this code lies in the fact that while we know music does activate our senses and brain - it does so for each of us very differently. A song that makes one person feel happy might make someone else feel sad or even cry. This unique ability is exactly why professionals in the field of study know it is potent for helping us and why I felt so inclined to research the topic in the first place. With that being said, the deeper I got into this project, the more I realized that this isn't an easy topic to learn or explain. While researching frequency and its impact on our bodies, there was a big mix of hyper focused studies from scientists and controversial claims from modern wellness practitioners. The studies are so focused that it would be hard to make a blanket statement on how music can heal and the practitioners claims are not always backed with science which invites skepticisms. Overall, they are both working in tandem to highlight the quest for understanding why music is so connected to us and prove that it is not just entertainment, but in fact beneficial to our physical existence.

For example, one of the studies that I discovered aimed to "improve the nursing model by exploring the effects of child-friendly music in the mental health of children with Henoch–Schönlein purpura nephritis."[9] A group of about a 100 children were split into two groups. One group had child friendly music playing while nursing activities took place, while the other group did not have the music during these activities. With such a simple difference, the group with music reported improvement in inflammatory levels and immune function. For

---

[8] Harvard "History." Harvard Art Museums

[9] Pediatrics, Department of. "Effects of Child-Friendly Music Nursing in the Ward on... : Noise and Health." LWW. Accessed May 2, 2025. https://journals.lww.com/nohe/fulltext/2025/01000/effects_of_child_friendly_music_nursing_in_the.4.aspx.

children who are battling such a sensitive state of being, they need all the help they can get. This study shows just how a subtle change of frequency in their environment can actually be beneficial. This study was released in February of 2025 and likely because it is focused on a group of patients with a disease that many have never heard about, it is flying under that radar and not sparking much conversation in the public eye. A scientific finding like this is the type of discovery that contributes to the overall understanding that music is connected to our healing more than we know.

Another example of a recent medical study with a hyperfocus is one that explored the effects of short term music therapy on negative emotions and quality of life in women giving birth for the first time. In this study, 90 first-time pregnant women, also scientifically referred to as primiparas, were divided into two groups based on when they were admitted to the hospital. One group received routine care and the other received short-term music therapy in addition to routine care. Similarly to the results of the previous study, they found that the presence of music, in this case, music therapy, was able to, "reduce the stress response of primiparas, relieve their anxiety and depression, shorten the total labour process and improve their quality of life."[10] Giving birth is no easy feat and is certainly something that comes with a lot of stress for the women attempting to do so for the first time. This study proves that music can be a tool for us to help future mothers feel better about the experience. The study's conclusions suggest that music and frequency can not only enhance the childbirth experience, but also contribute to overall well-being and quality of life.

[10] Department, Nursing. "Effects of Short-Term Music Therapy on Negative Emotions... : Noise and Health." LWW. Accessed May 2, 2025. https://journals.lww.com/nohe/fulltext/2025/01000/effects_of_short_term_music_therapy_on_negative.1.aspx.

Beyond the hyper focused scientific studies on music's effects on specific patients or diseases, there are large groups of people around the world who are now intentionally using frequency for their own health benefits and self care practices. Whether at a local yoga studio or online, people utilize sounds bowls or resonant frequencies to create what is known as binaural beats for their meditations or just to decompress. Binaural beats occur when two slightly different frequencies are played in each ear, and the brain perceives a third tone—the difference between them. According to Medical News Today, these tones have the ability to "significantly reduce anxiety and stress"[11] because the third perceived frequency is impacting our brainwaves to help us relax. While some are skeptical of the true impact of practices like binaural beats and frequency healing, the surge in popularity and personal testimonials that are now arising do propose that the conversation around their purpose for healing is not over.

One thing is apparent after observing the numerous studies and claims about music and frequency - it is powerful. While we typically see praise for the benefits and positive impacts that come from being around vibration, it is worth noting that its power can also be something to be wary of. If you have been to a live concert before, you may be familiar with the feeling of going home afterward and still hear ringing in your ears despite being in your quiet bedroom after the night is over. Studies have shown that exposure to loud frequencies for too long of a period can

[11] "Binaural Beats Therapy: Benefits and How They Work." Medical News Today. Accessed May 2, 2025. https://www.medicalnewstoday.com/articles/320019.

be harmful. A recent 2025 study showed how even in venues adhering to the World Health Organization standard for safe listening loudness, “the average music venue patron has some degree of permanent hearing-damage symptoms and should be aware that they are very likely to exceed their safe-noise dose (and risk irreversible hearing damage)”(Schuster-Bruce). As someone who works in live music spaces, I am aware of these risks and wear earplugs when working in loud environments. Since the loud music is typically something that many people want to experience, it may come as a surprise that it could be hurting them physically and potentially long-term.

Sound is something that we all are affected by in many ways, but yet it is not something we can see or grasp. We can’t hold it in our hands but we know it when we hear it. I was interested to write this paper as that concept has always fascinated me. I wanted to know why something that we all adore, but don’t question, has such a big impact on our lives and culture. After months of research, I now understand that sound is more than just a sensory experience - it is a biological, emotional, and even spiritual force that shapes how we feel, heal, and connect to each other. From ancient thinkers like Pythagoras to modern scientists exploring music therapy and binaural beats, the idea that frequency affects our well-being continues to gain traction. At the same time, the rise of frequency-based wellness practices and the risks of overexposure in modern music culture show that we must be mindful of how we interact with sound. Every new thing I discovered made it even clearer that we’re only just beginning to understand what music’s full capability could be on our health. There’s so much more beneath the surface than I first expected, and I’m sure there’s still a lot left to uncover. As someone rooted in both music and science, I feel more inspired than ever to continue exploring how frequencies influence our health and consciousness. This research paper is not the end of my journey—it’s the foundation

for a deeper commitment to understanding, experimenting with, and sharing the impacts of sound in our lives.

Bibliography

"Binaural Beats Therapy: Benefits and How They Work." *Medical News Today*. Accessed May 2, 2025. https://www.medicalnewstoday.com/articles/320019.

Department, Nursing. "Effects of Short-Term Music Therapy on Negative Emotions." *Noise and Health*. Accessed May 2, 2025. https://journals.lww.com/nohe/fulltext/2025/01000/effects_of_short_term_music_therapy_on_negative.1.aspx.

Ear, 1Department of. "Evaluating Listening Behaviours of Nightclub Goers." *Noise and Health*. Accessed May 2, 2025. https://journals.lww.com/nohe/fulltext/2025/01000/evaluating_listening_behaviours_of_nightclub.9.aspx.

Harvard. "History." *Harvard Art Museums*. Accessed May 2, 2025. https://harvardartmuseums.org/about/history.

Jones, Daisy, Shaun Cichacki, Sammi Caramela, Anthony Franklin II, Matt Vatankhah, Matt Jancer, and Luis Prada. "Exploring the Actual Science behind Why Music Makes Us Feel Good." *VICE*, August 9, 2024. https://www.vice.com/en/article/healing-properties-music-frequencies-therapy/.

"MillianSpeaks | Vocal Care & Maintenance Coach." "The Melody of Mood: How Sound Frequencies Influence Your Brain." *Medium*, August 23, 2023.

https://medium.com/@millianspeaks/the-melody-of-mood-how-sound-frequencies-influence-your-brain-d9a4050fb8d.

Meymandi, Assad. “Music, Medicine, Healing, and the Genome Project.” *Psychiatry (Edgmont)*, September 2009. https://pmc.ncbi.nlm.nih.gov/articles/PMC2766288/.

“Nikola Tesla Quotes.” *Goodreads*. Accessed May 2, 2025. https://www.goodreads.com/quotes/16920-if-you-want-to-find-the-secrets-of-the-universe.

Pediatrics, Department of. “Effects of Child-Friendly Music Nursing in the Ward.” *Noise and Health*. Accessed May 2, 2025. https://journals.lww.com/nohe/fulltext/2025/01000/effects_of_child_friendly_music_nursing_in_the.4.aspx.

“Pythagoras.” *Google Books*. Accessed May 2, 2025. https://books.google.com.mx/books?hl=en&lr=&id=A8ixyQJA7_MC&oi=fnd&pg=PP11&dq=pythagoras+healing+frequency.

“Pythagorean Tuning.” *limits*. Accessed May 2, 2025. https://www.math.drexel.edu/~dp399/textbooks/mathmusic/pythagorus.html.

“Vibrational Sound Healing.” *Google Books*. Accessed May 2, 2025. https://www.google.com/books/edition/Vibrational_Sound_Healing/XX7YDwAAQBAJ?hl=en&gbpv=0.

Yun, Gao, and Xia Jiali. “Research and Exploration on Cymatics in Sound Visualization.” *E3S Web of Conferences*, February 7, 2024. https://www.e3s-conferences.org/articles/e3sconf/abs/2024/16/e3sconf_agritech-ix2023_03002/e3sconf_agritech-ix2023_03002.html.