Achieving Cohesiveness in Healthcare with Music, Motion, Technology, and Accountability: Novel Approaches for Musical Therapy in the Digital Health Era

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Table of Contents

Abstract

"Divide each difficulty into as many parts as is feasible and necessary to resolve it.
It is not enough to have a good mind; the main thing is to use it well."
Cogito ergo sum. (I think; therefore I am.)- Rene Descartes

The demand for music therapists has gradually expanded as healthcare programs seek more non-invasive methods of treatment. The importance of introducing music into different forms of therapies is increasing as the success of such treatment demonstrates benefits that address emotional, physical and even cognitive needs. Why are therapeutic music techniques important? What could music transfer to the brain that drugs cannot?

This paper addresses the importance of music in therapy and education, focusing on the population segments of children with special needs and Parkinson's patients. It also highlights the importance of rhythm in motion with the absence of music.

We also address ways to measure and compare methods, as well as their impact and how technology can help us with that. Some impacts have been observed in the long term, but what if harnessing technology in real time helps us track each step to improve our techniques, maximize the benefits, and more accurately measure results?

How can we be held accountable for our methods, our innovations and varied techniques to improve health conditions for those in need and those who are underserved?

A synergistic combination of elements that we will encounter in this paper through four sections includes Music, Motion, Technology, and Accountability.

Tags: Autism; Autism Syndrome Disorder in Children; Parkinson's Disorder; Music Therapy; Autism and Music Therapy; Motion; Motion capture; Rhythm; Electronic data records; Accountability; Healthcare sector & innovation; Digital Health innovation

Music

"There is no truer truth obtainable by man than that which comes of music." - Robert Browning

Music has always been a powerful tool. Music expresses emotions that we are unable to put into words, it releases anger and tension, and it can be used as a way to motivate individuals and to harmoniously sync the body and the state of mind. We use music during exercise and other tasks to relieve boredom, but also to enliven a motivated activity by following a synchronized rhythm which enhances our stamina. Music is tied into almost every facet of human life, but before expanding on its varied benefits, we will start by focusing on its therapeutic aspects.

Music Therapy, increasingly used to treat everything from Autism to Parkinson's, aims to foster positive growth and clinical improvement in individuals using music as a vehicle for achieving patient-centered goals. The earliest known reference to Music Therapy appeared circa 1789 in *Columbian Magazine* titled "Music Physically Considered."[1] There were, however, no recorded music therapy interventions or systematic experiments using music therapy until later in the 1800s[2]. We do find numerous mentions of music as a healing medium as far back in history as the Biblical scriptures and historical writings from such diverse ancient civilizations such as those in Asia, India, China, Ancient Egypt, and the Greek and Roman civilizations, demonstrating how long music has had a lasting impact on society.

Around the world, there is a growing demand for Music Therapists, and music is becoming integrated into patient care in hospitals, clinics, and home care. These therapeutic applications underscore music's role as a language of the heart and soul, and an important tool to stimulate the brain's function. Music is being used as an aid to brain-damaged patients, and has shown positive results in preventing depression. NIH Director Dr. Francis Collins noted that *"The brain is able to compensate for other deficits sometimes by using music to communicate."* He continues that, for those practices to have the greatest scientific and medical significance, *"it would be a really good thing to know which parts of the brain are still intact to be called into action. To know the circuits well enough to know the backup plan."*

It is crucial to note that music has the potential to act on the brain's plasticity, emotion, physical health, and linguistic processing, particularly Traumatic-Brain Injury (TBI) and Autism-Spectrum Disorder.[3] Related to its applications in the case of severe injuries, according to Carolyn S. Ticker in her publication *Music and the Mind: Music's Healing Powers*, music results in physiological changes as well: heart rate, respiration, skin temperature, skin conductance, and hormone secretion, which leads us to conclude that music can be used to affect both mental and physical conditions. The recurrent use of music in education helps students to recall information, strengthen memory consolidation, increase attention and improve reasoning. How to approach each individual can differ depending on their specific age segment, medical records or

[1] According to the AMTA: https://www.musictherapy.org/about/history/

[2] According to the AMTA: https://www.musictherapy.org/about/history/

[3] Carolyn S. Ticker, Music and the Mind: Music's Healing Powers

injuries. From rhythmic auditory stimulation (RAS), which connects rhythm and movement, to singing, improvising, and composing, the use of music depends on how comfortable the patient is with acquired skills and learning new ones.

Experts across various medical specialties and industries are beginning to hone techniques for using music as an important therapeutic component. However, the biggest current setback is a lack of quantitative data that measures this impact on the delivered treatment along with the musical variable. By being able to effectively analyze the impact of specific music in various populations and settings, music therapists will be able to increase their understanding of how to best deliver music as a tool for healing and individual development.

Motion

"Rhythm and harmony find their way into the inward places of the soul." - Plato

Music moves us: we have all heard or said this ourselves. People also encounter, at least once in a lifetime, someone who appears to "have rhythm" and others who seem to have no rhythm. Some might argue that specific movements attributed to a specific, yet universal music genre demand a specific rhythm, which could lead us to reject the hypothesis of the subjectivity of rhythm. To clarify this, a person is either a good Salsa dancer or not; that itself is a perception drawn by cognitive processes.

Despite its significance in universal expressions of emotions, the music-movement relationship is poorly understood. The PNAS (Proceedings of the National Academy of Sciences of the United States of America) has conducted research where they "*presented an empirical method for testing whether music and movement share a common structure that affords equivalent and universal emotional expressions*. A research team undertook two experiments, one in the United States and the other in an isolated tribal village in Cambodia. These experiments revealed three findings, which concluded that music and movement can express the same emotion, and that this common structure between music and movement was evident within and across cultures (PNAS). As stated earlier in this paper, music is not the only medium to express emotion, as human behavior also reveals unspoken words in movement. We perceive the power of singing in a choir and musical ensembles to be the equivalent, in the absence of sound, to the rhythm and harmony of a military march.

According to Charles Darwin, in his book *The Expression of the Emotions in Man and Animals*, facial expressions and other emotional movements are cross-culturally universal. This lends credence to the notion that both Music ***and*** Motion express emotion. The University of Oslo in Norway published Egil Haga's Ph.D. thesis under the Department of Musicology, wherein he provided thoughtful insights on the correspondences between music and body movement[4]. Haga talks about the inclusion of rhythm when we talk about music and movement, and his research focused on the question of *when we say that music and movement are similar to each other, what do we mean*? Which features in music and movement are we referring to, and what is heard in music that is similar to what we see in a movement? Haga discovered many correspondences when music and movements were analyzed separately.

Based on this and other research, both music and motion could prove impressive and valuable tools to create therapies.

When using therapies that are based on rhythmic motion and melody, we engage with cognitive issues. People with Parkinson's Disease suffer Bradykinesia, or a slowness of movement which can lead to difficulties with simple daily activities in their lives. Progressing movement through rhythmic exercise increases patients' focus and attention to coordinate motion and remember it later.[5]

[4] Egil Haga, Correspondences between Music and Body Movement, Ph.D. Thesis

[5] According to the Parkinson's Foundation: *2018 Center Leadership Conference presentation*

Technology

"Everything is designed. Few things are designed well." - Brian Reed

This section ties together Music, Motion and Technology. In October 2018, the Berklee College of Music hosted an event entitled "Music and Health Exchange: Crossroads of Music and Technology"[6], where I had the pleasure of giving a presentation along with Point Motion's CEO and founder Kevin Clark.

To store data accurately and to capture the status of a patient over time, health centers use what is called EHR/EMR, or Electronic Health Record and Electronic Medical Record. The EMR began as a method to trace and document any patient's medical records and conditions combined with third-party accessibility. The first EMR system was developed in 1972, but was not considered greatly sophisticated, and was used mostly by government hospitals. To clarify the difference between EMR and EHR, EMR gives a snapshot of the medical records of a patient, while EHR provides a snapshot of their overall health condition. Comparatively, they are very similar and complementary, as the idea came from the same concept and the general need to track data in real time and access it from a single point. Using the example of an autistic child who has been receiving music therapy while changing medications or even dosage through the treatment, the EHR allows his therapist to trace the change in behavior back to what could have potentially caused it. EPIC-Health, for example, is an EHR with document management systems that health institutions commonly use.

Similarly, in education, schools use an LMS, or Learning Management System, where they can track, record, and document the delivery of course materials. Derived from the same technology as the EHR, we find the UnitusTI—known as an EDR (Electronic Data Records) Platform—a program/curricula/material management system with publishing, specialized data acquisition structures and psychometrics. UnitusTI caters to the treatment, education and training fields, hence the use of the word "data" is neutral.

What benefit is technology if it does not help humans' work become more efficient? The advantage of digital technology lies in the power of data to provide deeper insights, along with the ability to undertake a more comprehensive tracking of trends and patterns which can in turn be used to build an effective personalized treatment approach.

One of the drawbacks of Electronic Records is that even though it remedies the loss of data and allows health/education staff to make an informed decision of what their patient/student needs, it still requires manual data entry. Point Motion Inc., an innovative digital health / therapeutics company led by C-Level executives who graduated from Berklee College of Music, was able to connect the dots using their musical expertise and through partnering with subject matter experts (SMEs) and EDR platforms. Point Motion's patented technology works through a camera and series of body movements to capture and activate musical filters, sounds and effects. Their aim is to use a musically-enriching experience as a therapy for children with special needs and individuals with

[6] Find Kevin Clark's talk on **Quantifying the Impact of Music in Child Development:** https://www.berklee.edu/music-health-institute/crossroads-music-and-technology

Parkinson's. These individuals can play a computer-based game through body movement, while data is collected from their interactions and sent to an EDR platform to help their therapist make informed decisions. This combination of Music, Motion, and Technology, that enables the patient to experience music in their therapy sessions, encourages patient expression through motion and allows their therapist to access real time data and information via a Cloud-based platform. In this way Music Therapists are able to track their patient's progress using metrics such as focus, range of motion, mobility, expression, and more.

Researchers have talked about the new opportunities provided by the development of technology to introduce novel approaches for the interaction of music and sound to individuals with autism.[7] Through engaging on a cognitive and multi-sensory level via technology-based therapy that is free from social constraints and complex core communication, this method provides a consistent and objective outcome. As a result, we observe sustained interest and increased mastery while maintaining high engagement and motivation. This is not to eliminate the role of the therapist or the importance of human interaction that brings empathy and care in different ways, but to facilitate using therapies and optimizing outcomes for the benefit of the patient/student. The technology permits the establishment of a non-threatening and unbiased environment in which individuals can develop new skills and overcome potential fears and discomfort.

7 Innovative computer technology in music-based interventions for individuals with autism moving beyond traditional interactive music therapy techniques (2018, November 30).

Accountability

"Strive not to be a success, but rather to be of value." – Albert Einstein

It is important to mention here the issue of accountability in using objective and consistent data, ensuring that specialists can make informed decisions when accessing patient records. How can we introduce a new medication to a patient if we can't track their immediate and long-term reaction to the treatment? Treating patients with severe brain injuries, Alzheimer's, Parkinson's, and even children with special needs should not be reactive, but proactive. You would not prescribe an insulin dose to a diabetic child without a way to measure their blood sugar and other health factors. Yet, children with special needs are taking medications that affect their cognitive development without a readily available tool to measure the impact of those medications over time.

In the United States, the Food and Drug Administration (FDA) examines, tests and approves items subject to medical use, like drugs and medical appliances. To get FDA approval, drug manufacturers and pharmaceutical companies conduct clinical trials and testing and submit their data to the FDA. Once the data is reviewed, the FDA can approve the drug "if the agency determines that the benefits of the drug outweigh the risks for the intended use" as defined by law.
The FDA intends to permit the widest possible use of electronic technology that respects their responsibility to protect public health.

There are several parties affected by FDA regulations. For example, a newly signed law, the "Special Registration for Telemedicine Act of 2018", allows physicians and other providers to prescribe controlled substances via telemedicine without requiring an in-person exam. This new law is a huge step forward in the telehealth and digital health industry. The primary factor affecting reimbursement for clinical services rendered is legal policy, but when approved for reimbursement, innovations within the sector will continue to flourish, as even healthcare is driven by profitability.

Innovative care models and regulations should work hand in hand—not burdening each other, but helping to document progress while remaining accountable. Bringing Point Motion Inc. as an example again, this tool helps hospitals measure impact with quantified data which in turn not only helps reach an informed decision and increases the accountability for specific treatments, it also makes it easier to apply for research grants when the impact can be measured and documented.

Technology is an essential component to establishing accountability within a context of finite resources (i.e. time and money). As the population grows, tools will be needed to automate the current processes for assessment that require in-person observation, which are at times subjective and prone to error. Without technology to ensure accountability for the gain/loss in various treatments, there will not be a sufficient workforce to personally supervise clients. This could lead to errors in diagnosis, prescription dosing, and result in underserved populations with fewer financial resources.

Conclusion

It is highly important—through personal shared experiences, data and research, and observed impact—to underscore the value of music and its benefits in healthcare and education. Research is underway to further observe and quantify its impact on the mind—severe brain injuries, Parkinson's Disorder (PD) and Autism Spectrum Disorder (ASD) for instance, as well as its physiological benefits, from reducing stress and anxiety to regulating blood pressure and even skin temperature. It is also crucial to acknowledge the importance of rhythm in motion, with or without music, as a cognitive process.

Technology helps us track our therapeutic methods through EDR platforms and measure the impact of care plans, creating increased accountability on differentiated drug dosing and more awareness of a patient's progress over time.
Different segments and age groups, depending on their special case, may react differently to music technology on a cognitive and social level. However, technology-based music therapy remains a powerful approach in reducing patient discomfort and individual bias. It also engages in motivational musical approaches that foster creativity and build focus and skill mastery.

As a community of music lovers, healthcare professionals, educators, and technology enthusiasts, we should recognize the importance of having a tool that provides the four elements mentioned in this paper of Music, Motion, Technology, and Accountability to improve outcomes for health and education holistically and non-invasively. A way of bridging and enhancing these crucial elements is now feasible, reliable and available.

To learn more about Point Motion, Inc, an innovative digital health company that is harnessing the synergistic power of Music, Motion, Technology, and Accountability, visit www.pointmotioncontrol.com, or reach out to us at info@pointmotioncontrol.com to book a Demo.

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