The art of medicine

Music for healing: from magic to medicine

Music has had an illustrious position in the course of human history: not only as an art, but also as a medium for healing. Only recently has there been growing interest by the research community in trying to understand how music affects patients and physicians. Within the past few years, human and animal studies have examined the psychological and physiological effects of music. Yet a fundamental question underlying the role of music in health is also to ask why music developed in the first place and why it produces an emotional reaction and attenuation of the human stress response in the listener despite serving no essential biological need.

The discovery of simple flute-like instruments disinterred with Cro-Magnun and Neanderthal remains suggests that music has existed since prehistoric times. Scholars, such as Robert Dunbar, believe that ancient musical rituals—drums beating, voices chanting, bodies swaying—may have been the earliest form of religion and served to invoke a sense of deindividuation. However, while hypotheses abound about how and why music evolved and remained part of the human fabric, few have experimental or descriptive evidence to corroborate them. The oldest example of the contextual use of music for healing may be the depiction of harp-playing priests and musicians in frescos from 4000 BCE. During this era, a *Codex haburami* (hallelujah to the healer), was performed as sonorous reimbursement for medicinal services rendered. In 2000 BCE, the cuneiform writings of Assyrians depict the use of music to circumvent the path of evil spirits. In later centuries, the first specific application of music as therapy developed in ancient Greece, with Aesculapius recommending the use of music to conquer passion. Perhaps not until the 6th and 5th centuries BCE, did an interest develop in trying to understand the effects of music on human beings.

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Harmensz van Rijn Rembrandt, *David playing the harp before Saul* (1658)

At that time, the Pythagoreans were the first to elucidate the mathematical relations of tones. They were fascinated by concepts that would help to define the infinite: to understand space, they developed astronomy; to understand numbers, they introduced mathematics; and to understand music, they created harmony theory. Severinus Boethius (480–526 CE), who has been credited with discovering the relation between the weight of a hammer hitting an ambos and the pitch of the resulting sound, also detailed how the Pythagoreans examined the relation between various rhythms and their resulting alterations of human affect in his work, *De institutione musica*.

An important figure with great interest in how music affects man was the philosopher Plato. He believed that the study of music could resolve the inherent dichotomy of the soul, claiming in *The Republic*: "Music is most sovereign because rhythm and harmony find their way to the inmost soul and take strongest hold upon it, imparting grace, if one is rightly trained." He also extrapolated from the Pythagorean grouping of various musical qualities to define the modal system, which has been so influential in the development of western music. The modal system detailed unique qualities and generative properties of different musical progressions. Phrygian mode, for example, should be used to create an atmosphere of peace and acquiescence. Aristotle was also deeply engaged in understanding the effects of music, but deviated from the Platonic approach of using music to refine the aesthetic, and instead focused on the cathartic properties. He believed that music allows one to overcome "feelings such as pity and fear, or enthusiasm", and that mystic music allows one to "heal and purify the soul". Although they held disparate beliefs on how music affected man—Plato perceived music as a force to slowly build up the individual psyche, whereas Aristotle hailed music's force to destroy this illusion—both philosophers believed in the ability of music to heal.

Religious overtones in musical expression continued to hold importance into the Middle Ages, when the necessity of music for compounding and sustaining wellness was so highly regarded that law mandated those aspiring to

study medicine to also appreciate music. It was believed that healing the psyche through music also healed the body, and there were specific musical applications for defined diseases. For instance, the alternating sound of the flute and the harp served as a remedy for gout. Despite this incorporation of music into more structured medical therapy, the belief that musical healing stems from a magical action unbound by a natural course survived well beyond the medieval period. However, these beliefs slowly changed during the late 19th century with a growing interest in the physiology of acoustics, a field pioneered by the German physicist and trained physician, Herman von Helmholtz. Results from his research—which included experiments with tools such as an electrically excitable tuning fork and investigations of the emotional effects of harmonies on the human psyche—fostered the application of music in a defined clinical setting.

An early documented case of a physician in the 20th century using music in the context of surgery occurred in 1914, when Evan O'Neil Kane published his report in *JAMA* on the use of the phonograph within the operating room. The next year, W P Burdick published a more detailed account of the experiment in the *American Yearbook of Anesthesia and Analgesia*. He recalled: "Dr Kane, upon witnessing the benefic effect of the phonograph in the recovery wards, moved it into the operating room itself, and found that patients almost universally tolerated anesthetic induction better and also benefitted from reduced anxiety before undergoing the 'horrors of surgery'." Four decades later, the effect of auditory analgesia was shown by the observation of a decreased need for pharmacological analgesia in patients undergoing painful dental procedures if they are exposed to both loud auditory stimulus as well as background music. Thus, if a patient was subjected to a very loud sound, the crescendo of which is under his or her control, the attention to the auditory stimuli would diminish the response invoked from the pain pathway once the dental procedure began.

Extrapolations from this study led to further research that suggested music intervention during procedures resulted in reductions in haemodynamic variability, postoperative pain, the amount of sedative and analgesic medication needed, and even an overall improvement in the postoperative recovery period. Recent studies are now looking into how these positive effects of music might be mediated. For example, in our own research we have investigated the benefits of music on patients in intensive care units. One mechanism of music-induced stress relaxation might be the restoration of the disrupted homoeostasis in these patients through a modulation of the hypothalamic pituitary adrenal axis. Indeed, we found a significant decrease in dehydroepiandrosterone, epinephrine, and interleukin-6 concentrations, and other components of the stress response in a group of critically ill patients exposed to Mozart's music, compared with healthy volunteers. We also found that growth hormone plasma concentrations increased significantly in these patients. Such findings, together with the work of others, are beginning to illustrate the immunomodulatory effects of music. Aside from clinical randomised controlled trials such as ours on music-induced stress relaxation, bench research has provided possible insights about this effect, especially with regard to the role of sex-specific hormones and dopamine synthesis. Female sex hormones seem to promote an exaggerated stress response that is amenable to music anxiolysis, when compared with male sex hormones. The same hormones might also increase the sensitivity of women to music mediated anxiolysis. Although the underlying mechanisms governing this response warrant further research, such observations indicate that there may be sex-specific responses to severe illness and to music. Other studies indicate that exposure to music might lead to an increase in calcium/calmodulin-dependent dopamine synthesis in the brain, and that the subsequent increase in dopamine reduces blood pressure via dopamine 2 receptors. This mechanism may also be implicated in understanding the stress-reducing effects of music in the hypermetabolic response to severe injury.

The evolution of music as therapy began as a key element of healing in a magical or ritual context. Today, music is viewed as an adjunct to overcome some of the anonymity and deindividuation of the clinical environment, as well as a valuable tool to positively influence patients' stress response. However, research remains in its incipient stages and much work remains to be done. Not only do the beneficial physiological effects of music need to be considered, but also the potential adverse effects associated with its use, including potential distraction of physicians in the operating room, the negative arousal effects of vocal music, and the incompatibilities of varying personal preferences. Furthermore, not all music is created equal, with classical and dichaotic music having very different effects. Music may well be a potentially powerful tool for improving clinical outcomes with little known risk when applied appropriately and judiciously. Whether music in medicine will grow to be widely accepted as an adjunctive therapy will depend on a better understanding of its role through clinical and scientific experimentation.

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Further reading

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