BIO-GUIDED Music Therapy

A Practitioner's Guide to the Clinical Integration of Music and Biofeedback

ERIC B. MILLER

FOREWORDS BY JOSEPH P. SCARTELLI AND C. NORMAN SHEALY

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Contents

Foreword by Joseph P. Scartelli

The modalities of biofeedback have provided a method for individuals to communicate with physiological functions that are beyond normal awareness and control. Additionally, the technology has developed in sophistication to permit an individual to *learn* to control very small physiologic changes or adjustments in his or her body. This simple, yet elegant, communications link has opened the door for the client to hear or see a signal that reflects minute changes in physiology, which will ultimately lead to increasingly greater control of those functions. In a very similar manner, music therapy has afforded countless individuals a path to deeper levels of awareness, be they physical, psychological, social, or even spiritual. As with biofeedback, processes are activated in which the music and the therapist combine to provide the communications bridge between the client's awareness and the conditions that prevent that person's optimal functioning. Also, like biofeedback, this communication link affords the client an opportunity to *learn* and, therefore, improve.

The key, of course, is affording the client the *opportunity to learn* and become an *active participant* in the process. Although, at first glance, it might appear to be a simple task to engage an individual in such an endeavor, breaking that ground requires that the client be made aware of the function, be trained in how to practice it with the aid of the feedback and, over time and with guidance, ultimately develop the skills required to self-manage the functions that will permit optimal performance. These may be muscle activity, brain waves, extremity temperature or the electrical conductance of the skin. In *Bio-Guided Music Therapy*, Dr. Eric Miller illustrates the powerful tandem created by combining music therapy and the various modalities of biofeedback applications (EEG, EMG, thermal, etc.) to address a variety of psychological, cognitive and physiological conditions. Through a training protocol resulting in an enhanced self-awareness, the individual is *required* to be an active participant.

The truly wonderful and amazing advances in medicine, pharmaceutical sciences and medical technology have progressed and continue to evolve at a wildly impressive rate. As a result, diseases and conditions that were

once life-threatening are now routinely addressed and often eradicated. However, far too often the focus of that approach is on the disease or affected body part, usually requiring only passive compliance on the part of the patient, with little or no expectations that he or she take responsibility for the improvements. Compliance is usually defined as taking medications at the prescribed time, following a particular diet or undergoing some form of rehabilitation or therapy that is externally directed. Of course, such improvements in medicine are most beneficial to society, but they have also conditioned us to limit what we might believe we can improve through self-intervention or self-management approaches and techniques, therefore limiting our confidence in taking some degree of control of our own health state. Worse, it gradually continues to lower our own expectations of ourselves in the process of healing, rehabilitating and becoming whole.

This realization is not lost on Dr. Miller as he devotes a portion of his discussion to the concepts of wholeness and balance (homeostasis), emphasizing how awareness of holistic understanding of one's own state can be most beneficial. As Fritjof Capra so clearly illustrated in his seminal work, *The Tao of Physics* (1992), balance is illustrated in Taoism by the concept of yin and yang…that whole is comprised of opposing sides or forces. Miller applies that approach in his description of the processes that lead to the patient achieving wholeness…achieving wellness.

Understandably, as the individual undergoes this experience, he or she is ultimately provided an awareness that can be used actively to continue on the path to improvement or wholeness. This concept is also in concert with the fields found under the heading of "complementary and alternative medicine" (CAM), all of which recognize that when an individual is contending with a disease, condition or injury, the *whole person* is doing so! The condition may be physical, for instance, but the individual's psychological, cognitive, social and spiritual components are also greatly affected. Fortunately, the uncompromised functions can be marshaled to work toward the patient's needs with the proper approaches and interventions, to allow him or her an enhanced opportunity to understand the nature of the condition and ultimately restore functionality through guided, active involvement and awareness. This approach increases "patient efficacy", which offers a locus of control that is too often minimized if not eliminated in so much of traditional Western medical practice.

Locus of control, by contrast, is indeed central to how both biofeedback and music-therapy interventions are applied. As Dr. Miller describes, this is made possible by employing the techniques found in combining music and biofeedback to achieve and maintain balance through awareness, practice and self-improvement. Most importantly, the patient who experiences this process will also experience a *shift of attitude* to one of belief in his or her ability to effect these changes and improvements. The biofeedback technology offers another set of "eyes and ears" exploiting easily accessible senses to increase awareness and control of very small and otherwise imperceptible changes in physiology. Coincidentally, music provides alternate paths of self-understanding, awareness and affect that words alone so often fail to do. Success in applying these methods will result in permitting the patient the "right" to become increasingly acquainted with his or her physiological functions and operations, taking the most valuable step of *learning* how to manage and improve his or her own health and rehabilitation. There are few more important and exciting goals for a health professional to pursue and obtain!

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Foreword by C. Norman Shealy

The marriage of music and biofeedback is one "made in heaven." It represents the best integration of two powerful self-regulation approaches to health and illness. Although this wonderful book presents great details about the history of music therapy, I should like to start with my thoughts about music in general and why it is so important when combined with biofeedback training.

"Music has charms to soothe a savage breast." The phrase was coined by the playwright and poet William Congreve in *The Mourning Bride* in 1697, but, of course, the therapeutic use of music long preceded Congreve's play. It has been used since ancient times in Egyptian and Greek sleep temples. Indian *ragas* are part of Ayurvedic medicine. Over the past few decades, music has been shown to affect different portions of the brain, and we now know that individuals who have great musical talent have a larger right middle temporal gyrus. Modern research has demonstrated that music can improve motivation and positive emotion. I have demonstrated that music can increase beta endorphins, the natural narcotic produced in the brain. In addition, in many societies drumming has been used as a therapeutic approach and is well known for its trance-inducing effects. Modern adaptations of music therapy tend to take the form of what I call vibrational music or vibrational sound. The individual lies or sits on a bed or chair while sound transducers transmit the frequency of the music into the human body. I have found this to be exceptionally useful for deep relaxation. It can also be an adjunct in conducting past-life therapy and other psychotherapeutic approaches. The Sound Health Chair, a recent innovation developed by a Missouri businessman, Joseph Jenkins, produces by far the most significant and intense vibration that I have experienced after testing a number of devices. It produces the deepest possible state of relaxation. Also, Hemi-Sync, developed by Bob Monroe, has been used for a wide variety of therapeutic effects and even "out of body" experiences.

Some years ago one of our doctoral students conducted her dissertation research by having one group of patients listen to relaxing classical music and another group both listen to and feel the same classical vibrational

music. She used dark field microscopy on the blood and found that the vibratory music markedly decreased the rouleau formation, or adhesion of one red blood cell to another, in those who felt the music, but not in those who just heard the music. This suggests that at the very least vibrational music decreases the likelihood of blood clotting and problems with heart attack and stroke. Both groups of patients reported that they felt deeply relaxed.

Music therapy is actually one of the few elements of the broad field of Energy Medicine approaches that is widely accepted, at least as an adjunct to therapy. Another of our doctoral students used seven quartz crystal musical bowls tuned to the notes A, B, C, D, E, F and G. Playing these is said by some to balance the chakras associated with those notes. In our student's dissertation, she reported quite deep relaxation and overall improvement in the subjects with the playing of the fourth chakra bowl.

Music as an adjunct to enhance other therapies has become increasingly popular. It has long been used with hypnotherapy; appropriate music in the operating room reduces the amount of anesthetic needed; many acupuncturists use music as an adjunct for relaxation; and almost all massage therapists use music in the background. I have used music to evoke emotional catharsis and as a background in past-life therapy.

Self-regulation was born when Dr. Elmer Green introduced "autogenic feedback training" in the early 1970s. His demonstration that 84 percent of migraine patients could markedly reduce their headaches was the beginning of a tsunami of clinical triumphs with the use of biofeedback training. Even though autogenic training preceded biofeedback by 60 years, and by 1969 had almost 3000 scientific references supporting its therapeutic benefits in 80 percent of stress illnesses, it has never caught on in the United States. Biofeedback, as well documented in *Bio-Guided Music Therapy*, has had its own struggles in acceptance by the medical profession and insurance companies. Nevertheless, biofeedback training is, in my opinion, one of the greatest advances in therapy of the entire 20th century, and now that triumph has been optimized with the addition of appropriate music. I have used biofeedback and music in working with 30,000 chronic pain patients—they are indispensable for all modern psychospiritual therapy. Kudos to the author of this magnificent new book.

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I am deeply indebted to the late Sr. Jean Anthony Gileno, PhD, who to the best of my knowledge initiated the first university-based music therapy and biofeedback course in the nineties at Immaculata. It was a great honor to be asked by her to assume the teaching of that course for her in the year 2000, prior to her passing. Her vision has been a lasting inspiration over the years.

I give many thanks to my parents, Donald S. Berman and Felicia DeMay-Berman, for years of moral support, ongoing encouragement, editing expertise and for giving me a solid background in philosophical discourse. Thanks to Felicia for the expert preliminary review and formatting!

Thanks to my mother, Edith Miller, for conveying to me an interest in psychology at an early age and a passion for exploration. She would be most pleased to see this were she still alive.

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Eric B. Miller, 2011

About this Book

This book provides the practitioner with a rationale, historical context and detailed step-by-step, how-to instructions for utilizing real-time physiological data-driven music therapy. Interventions are outlined for various purposes and populations. Some of the target complaints discussed include stress, anxiety, high blood pressure, Raynaud's disease, neuromuscular deficiencies, attention-deficit hyperactivity disorder (ADHD), autism, depression, phobias and addictions.

The primary audience for this book is music therapists, with other interested readers being biofeedback practitioners, hypnotists, nurses, neurologists, social workers, sound healers, musicians, creative arts therapists, guided imagery and music (GIM) practitioners, psychologists, Yoga instructors, energy workers and other healing arts professionals (not necessarily in that order). Since I expect the majority of the book's readership to be music therapists, and for the sake of simplicity, I typically use the term *music therapist* to refer to the practitioner. In reality, the reader may feel free to substitute *sound healer*, *expressive therapist*, *nurse* or whatever title fits most appropriately.

The introduction provides an initial framework and brief overview of the book's contents. From there, the book is presented in four major sections: historical and theoretical background; physiological measures, assessment and digital music parameters; practicing bio-guided music therapy; and a glimpse of the future.

Chapter 1 gives a brief history relative to music therapy and biofeedback. Chapter 2 describes the shifting healthcare paradigm from which both modalities are derived. Chapter 3 traces the process of gaining professional legitimacy. Chapter 4 presents a case for the integration of music therapy and biofeedback, including the relevance of Yin and Yang in traditional Chinese medicine and Western homeostasis theory. A basis for neurofeedback in social learning theory is also presented. Chapter 5 details the history and development of a treatment for ADHD using EEG bio-guided music therapy. This is the basic model for the bio-guided approach to other disorders presented in Part 3.

Chapter 6 introduces biofeedback measures and accompanying musical strategies. Chapter 7 presents the addition of physiological measures to existing music-therapy assessments. Chapter 8 outlines the role of the music therapist in bio-guided music therapy. Chapter 9 presents a clinical how-to model for conducting bio-guided music therapy for stress reduction and meditation enhancement. The primary modalities utilized in this approach are galvanic skin response (GSR), also known as electrodermal activity (EDA), temperature (TEMP), heart rate (HR), heart rate variability (HRV) and electromyography (EMG). Bio-guided music and imagery is also presented. Chapter 10 presents a clinical how-to model for conducting bio-guided music therapy for ADHD. The primary modality utilized in this approach is EEG biofeedback, also known as neurofeedback (NF). Chapter 11 presents a clinical how-to model for conducting bio-guided music therapy for memory and executive function with an aging population. The primary modality utilized in this approach is hemoencephalography (HEG). Chapter 12 details a multi-modal approach, utilizing biofeedback and music therapy for the treatment of addictions. Chapter 13 describes the use of bio-guided music therapy for pain, specifically back, headache and functional abdominal pain. A brief section on Future Directions is followed by the appendices. Appendix A reviews pilot research, using bio-guided music therapy for ADHD children, while Appendix B looks at the contributors to this book. A glossary provides a quick reference for terms used throughout the text.

Throughout the book, we will hear directly from both clients and professionals about their personal experience at the juncture of music and physiology in their own words. The ages of these authors range from 13 to 70. Some have experienced bio-guided music therapy first hand, while others have gained profound insight from physiological experiences with music. One woman follows her son's dramatic success abating epileptic seizures with her own, learning how to lower her own high blood pressure via musical tones. A music-therapy professor has a vision of a research lab with music and physiological measurement devices. A young woman returns to college after she conquers her fear of returning to school as an adult learner through biofeedback training. We get a glimmer of the sublime with a Grammy-winning cellist's early memory of a transformative musical experience. The child of a biofeedback practitioner relates early memories of the sounds and images during early biofeedback experiences. For those academics among us, a music-therapy researcher and author from Finland shares his early hopes for the possibilities of neuroscience and music, as well as aspirations of

achieving multi-physiologically driven light-show environments. The sights and sounds in a biofeedback clinic are described by its director with compelling images and references to music and biofeedback clinical concepts in a friendly, easy-to-grasp style. And a computer programmer, musician and teacher creates physiologically driven sound environments for his students to learn scales. These testaments convey a broad range of experiences in the realm of music and physiology. I find them fascinating; I hope you will as well.

Introduction

The applications of biofeedback expanded rapidly in the 1990s due to the advent of the microcomputer and digital psycho-physiological data acquisition systems. Concurrently, biofeedback as a treatment modality gained increasing acceptance in the medical arena due to its ability to produce tangible evidence of effectiveness. Biofeedback machines could now render charts and graphs that provided clear indications of progress in the language of mainstream medicine. Audio tones that were part of the biofeedback process, however, were not particularly musical in the initial devices. The general population at this time was becoming more interested in holistic non-drug interventions and therapies that empower the patient, as opposed to leaving the locus of control (and responsibility for healing) in the hands of a doctor, drug or psychotherapist. These circumstances created an entrée for modern biofeedback with advanced musical capabilities.

Reports of voluntary control of single motor units date back to the early- and mid-20th century (Basmajian 1963; Marinacci and Horande 1960; Smith 1934) within the framework of the treatment of neuromuscular disorders. Since then, research has shown that voluntary control of the autonomic nervous system can be achieved to lower blood pressure, relax muscles not previously under conscious control, alter brainwave patterns, change heart rate and increase temperature in peripheral extremities such as raising finger temperature in some cases over ten degrees (Yucha and Montgomery 2008). Electromyography (EMG) muscular biofeedback is becoming standard procedure in certain rehabilitation treatments of neuromuscular disorders, and thermal training remains a treatment of choice for Raynaud's phenomenon in cases where new medication treatments are not effective. The term *Raynaud's phenomenon* includes both Raynaud's disease and Raynaud's syndrome. Other disorders for which biofeedback has demonstrated efficacy include general stress, anxiety, temporomandibular joint (TMJ) syndrome, low back pain, hypertension, attention deficit disorder, asthma and, particularly, migraine and muscle contraction headaches (Schwartz 1995; Yucha and Montgomery 2008).

Herbert Benson's continued investigation of an effect he called the *relaxation response* (Benson 1975; Wallace and Benson 1972) added to the credibility of associating biofeedback monitoring devices with diverse practices such as meditation and breathing techniques. By establishing a set of physiological changes related to relaxation—including reduced oxygen consumption, heart rate, arterial blood pressure and lactate, etc.—Benson set the stage for integrating biofeedback training with mainstream medical practice. Subsequent research by Benson and colleagues at the Deaconess Hospital and Harvard Medical School studied EEG response to the relaxation response (Jacobs, Benson and Friedman 1996), further contributing to the increased interest and prestige of this line of investigation.

A closer look at the actual training that occurs in a biofeedback session reveals that sound and imagery play an integral role in assisting the clients to achieve their physiological objectives. Audio feedback is a standard intervention that allows clients to hear the physiological changes they are making to help bring them under voluntary control. For example, when an audio signal that is triggered by the neuronal firing level of the trapezius muscle in the upper back ascends in pitch as the muscle tightens and descends in pitch as the muscle relaxes. Modern computerized systems can assign live-sounding digital representations of musical instruments and sounds to muscle groups of choice, for example an orchestral string section to the frontalis (forehead), a flute section to the latissimus dorsi (mid-back)…or even a Taiko drum to the heart area.

Music may also be used as a vehicle to assist in achieving a relaxed state. Spoken images of relaxation, light, color and beaches in conjunction with music are all typical in many guided-imagery interventions. The type of music that is best suited to a client, as observed by this author, is individual due to the client's particular associations with certain types of music. Some methods, such as Helen Bonny's Guided Imagery with Music, also known as GIM (Bonny 1978), prefer to utilize classical music only. Other systems of guided imagery use popular music, new age music or even music improvised in the moment. Generally, a person's individual musical preference plays a key role in treatment outcome (Aldridge 1993).

Other uses of music in biofeedback include the presentation of music as a reward for behavior modification in the desired direction. An example of this might be the automatic playing of a favorite Mozart symphony once a frontal EMG drops below a threshold such as 2.5 microvolts. The symphony only plays while the muscular tension remains below the threshold; once the EMG level increases above that threshold, the

music stops. The music in this situation serves the dual purposes of both a reward for muscular relaxation and a relaxing stimulus when playing.

Further use of musical intervention involves the active participation of the client in the music-making process to achieve the desired physiological goal. Some examples include vocal toning, chanting, melodic improvisation and drumming. Toning has been found to be effective for pain reduction during pregnancy and labor (Pierce 2001). Women and men in a childbirth education class were taught toning, with positive effects. The absence of chanting was reported to accompany debilitating fatigue when a Benedictine monastery changed their regime (Campbell 1991). The monks' health was restored when Dr. Tomatis had them return to their chanting and exposed them (electronically) to a full frequency spectrum. Drumming has been shown to potentially assist in recovery from addiction by increasing relaxation and EEG brainwave amplitudes in the Theta range (Winkelman 2003). Research by Dr. Barry Bitman focuses on the impact of recreational music-making on modulating killer cell (NK) levels and stress-induced cytokine IL-10, directly linking drumming to neuro-endocrine immune-system response (Bittman 2007). Much research into the effects of music on the body and brain is being conducted. As individuals have varied musical tastes, some interventions will feel more comfortable than others for particular clients.

Research at Beth Israel Deaconess Medical Center and Harvard Medical School (Hyde *et al.* 2009) demonstrated structural brain changes related to instrumental music practice over a 15-month period in 31 six-year-old children. The size of several brain areas increased relative to controls in portions of the corpus callosum, right primary auditory region (lateral aspect of Heschl's gyrus) and the pre-central gyrus. A review of brain plasticity in musicians from the University of Zurich (Jäncke 2009) found musical experience can change gray- and white-matter densities, as well as activation patterns in brain areas specific to a controlling task. Research points to the notion that music activities may not only be aesthetically pleasing and emotionally satisfying, but they can also lead to changes in the anatomy and physiology of the brain.

On a cautionary note, there may be rare instances when using music may produce adverse medical effects. Dr. Oliver Sacks (2007) recounts several fascinating vignettes of patients in whom music triggered seizure activity in consistent and predictable patterns. Some of these cases were from Macdonald Critchley's 1937 account entitled *Musicogenic Epilepsy*; other examples came from Sacks' own practice. One woman could not listen to Neapolitan music—either live or on CD—without

an accompanying seizure. In another case, music that a man found to be emotional provoked seizures at both loud and soft volumes. Other less neurologically originated dangers might include simply excessive volume of music or even torture by repeated exposure to distasteful music (Cusik 2006).

Since sounds and images are such key elements in biofeedback training, it seems logical that even more effective results could be obtained by clinicians dually trained in biofeedback as well as in the use of music and imagery as a therapeutic modality. With this notion in mind, it appears that biofeedback utilized in conjunction with music therapy provides a promising area for clinical development, exploration and research.

PART 1

Historical and Theoretical Background

PERSONAL EXPERIENCES AT THE JUNCTURE OF MUSIC AND PHYSIOLOGY

David Darling

The emotions that welled up in me as a child cellist playing Schubert's Unfinished Symphony in the opening cello passage have never left my physical and emotional self. When 12 or more cellists play this theme in unison, a mature musician is transformed from the daily life to the mystical life. One feels transformed to be part of a melody that is so profound. As the opening melody ends, the principal clarinetist comes in with one of the most divine melodies any of us have ever heard… and it takes the cellist in my case and the orchestra and the audience to an even deeper and more profound place that is physical and emotional transformation.

Jörg Fachner, music and brain researcher: Come to your senses—music and EEG

One day in our physiology lab, back in those days when you were happy to have an 8-track tape recorder for recording physiological measures simultaneously, a bagman from the lab equipment trade lent one of

those fancy EEG brain imagers that were becoming popular in the late eighties. I had to do my civil service duties, and instead of learning how to kill somebody, I was serving the music therapists and their clients while at the same time doing my educationalist's research internship in the therapy field. The music therapists and the physiologists shared an old hut beneath the Witten/Herdecke University Clinic that housed the physio-lab, a small lecture room of the medical faculty, a lively coffee table and the music-therapy research and training unit.

Youngster that I was, I became immediately fascinated with those colored brain maps that popped up on the screen every 2.5 seconds during EEG measurements. Within this "short" timeframe, the high-end bed-side manner EEG machine, worth half a million German marks (around $250,000 U.S. dollars), sampled all 28 EEG traces at 12 bit, did a fast Fourier transformation, produced EEG maps showing the relative percentage of (interpolated) amplitude means within the known alpha, beta, etc., ranges and mapped the corresponding topographic spectrum of the peak frequencies. Further, it allowed you to create your own frequency ranges and different montage sets; it recorded the sampled EEG on an optical Winchester disk, stored the averaged maps on a floppy and had four parallel Motorola chips running the EEG recording, all while sampling and analyzing the data… Wow! That was a stunning technique. It made me believe in human progress and offered to "witness" the time course of brain changes in our hypnotized subjects beyond the shielded door.

The visual information for the time-locked changes of the brain obviously seemed to correlate with the behavioral and state changes of the persons under the ECI-cap. Being naïve on these techniques, this correlation suggested me to have a direct measure of certain brain areas in charge, and, once having this information, it might be easy to know what is happening in the brain; it might even be possible to read the thoughts of those guinea pigs, if more about the meaning of the traces and the areas involved was known. So, as an educationalist and social scientist interested in mind-body approaches and aiming to bring "sick" persons "back to their senses" with meaningful sensual experiences—there is a vast tradition of body centered approaches in education and philosophy (see Fraser and Greco 2005; Meyer-Drawe 1984)—in order to understand all those colored pictures that the mapper was spitting out, I started to read neuroscience and electrophysiology textbooks that I borrowed from the physiologists.

Nowadays, the techniques described above are easy to start from your laptop with a more or less cheap break-in box. And of course all my initial phrenologist hopes vanished during my readings, when I realized that it is all much more complex than I had thought, and that most experimental paradigms, and, accordingly, their results, may vary from lab to machine to persons involved, and that no meanings are certain, no matter which technique you are using. Nevertheless, still I am amazed how obvious but lively and self-determined brain functions can be, and still I am convinced that a locationalist's approach to brain activity makes sense. At least Brodmann's areas have very early suggested that there are functional neuro-anatomic wirings that have straight and distinct connections to sensual modalities (Brodmann 1909). Nowadays we may benefit more from diffusion tensor imaging (DTI), functional magnetic resonance imaging (fMRI) or positron emission tomography (PET) to get those locations in more detail than you can achieve with an EEG.

Anyhow, when it comes to time-locked psycho-physiological co-relations of external and internal events, the EEG is still the easiest and most directly accessible measure of nervous activity. Since Hans Berger discovered the EEG and his hope that those "brain vibrations" visible in the EEG traces might have been the physical reason for telepathy between his sister and himself during an accident (see Mühlau and Both 1991, p.15), we can benefit from the vast number of studies and evidence from the oscillations seen in the ongoing and evoked EEG patterns. The EEG correlates with personality, is sensitive to state changes and shows coherence of oscillations over the cortex as well as phase-locking and reset of oscillations in areas which process the most current activity and function (Niedermeyer and Lopes da Silva 1993).

Feed back your sound and vision

As music is a time process, the most interesting results may come from those research approaches that are able to record and analyze physiological and behavioral data time-locked to the music-listening or production process. And that was another thing that brought me to the EEG: Having jammed with many musicians that, like me, enjoyed "getting lost" in the music while improvising in our free jazz staging communities in Wuppertal, I was really curious to learn more about this mapper. "It would be nice to wire up some of them while getting lost," I thought, and wondered what would happen in the brain and in the music when using the 16 color-scale of the BrainImager (relative color codings of scaled

amplitude activity within a chosen frequency range, most likely the alpha range) as a trigger for a light show while performing on stage! The colors of the brain maps of a performer or a listener would change according to the state of the person and the parts of the music performed; for example, if there is low or no alpha activity, the stage would be illuminated with a bluish light; red or yellow might dominate if higher activity came up.

Further, if it would be possible to set the stage lights equivalent to, for example, frontal left and right (front of the stage) and parietal or occipital left and right EEG leads (in the back of the stage), it would be nearly a Ned Herrmann personality assessment show! I have seen Herrmann performing at a conference on cerebral dominances in Munich where he suggested that there are easy ways to have a fast assessment of personality and thinking styles just by looking at those four EEG quarters of the brain (Herrmann 1996). However, I discussed this brain circus lightshow idea in a statewide music magazine while being interviewed about our music project, and later on with the manufacturer of the EEG machine while on a conference trip during the mid-nineties in the U.S. The technician was looking at me as if I came straight from a disco planet and could not be serious… Even when describing that in a clinical setting this setup would not be that much different from biofeedback but utilized here for primarily aesthetic ends, his only view was the technical conundrum this application would be. And of course he was right. After buying another more detailed technical manual and looking at some of the latest machines, I went away without any success. But finally, all this led this music lover and social scientist to do his PhD in medicine (Doktor rerum medicinalium) because I wanted to see how brain states change in a naturalistic setting when listening to music and being in an altered state of consciousness (Aldridge and Fachner 2006). For all this, the mapper was perfect.

Nowadays you can find a lot of the above scribbled ideas and applications in the arts world (for example, Burton 2010), using cheap or self-made EEG sets. I am still curious what would happen to an improvisation in which the performers, ideally each of them, are hooked to such devices. How would the stage look? Which kind of synchronization of sound and vision would occur, and which entrainment processes between the players might come up? What kind of color would it be when you cross-fade the parietal right of the saxophone player with the frontal left of the drummer and the central leads of the vibraphone? What if you pump up the volume of the low fronto-polar delta coming in from the bass player and mix it with the frontal midline theta of the

singer when he tries to remember his words? Well, all this sound and vision cacophony might be a nice endeavor of art for art's sake, but now we already see applications that make the EEG audible (Baier, Hermann and Stephani 2007) and offer clinicians a different angle on the idea of normality and abnormality, of what a healthy brain may sound like. There is EEG research that records the performance of two guitar players simultaneously (Lindenberger *et al.* 2009). Some EEG research discusses the simultaneous activation of mirror neurons while performing a saxophone quartet (Vecchio 2009). Further, there are EEG devices that control external objects just by steering them with mind control (Mind Update 2007).

In any case, doing biofeedback and doing music therapy means that people learn to perform with their bodies in certain timeframes according to rules that put the music and the body in a harmonic relationship. Sensuality and the need to "come to your senses" was my educationalist's credo, and I still follow that while now doing EEG research on depressed and stroke clients or after music therapy (Erkkila *et al.* 2008).

CHAPTER 1

Historical Background

The integration of biofeedback in music therapy has come a long way since Scartelli (1989) described computerized biofeedback tones that were, in reality, more annoying than musical. At that time, however, there was much excitement around the beginnings of synthesized musical sounds that may be considered crude and rudimentary by today's standards. However primitive, it was those sounds that paved the way for music to be utilized as physiological feedback. Early DOS operating system sounds become the early vehicles to represent the direction of physiological measures, such as muscle tension and galvanic skin response, in the first computerized biofeedback software programs.

There are a number of theories that help inform the clinical use of sound and biofeedback. Taylor (1997) presents an elegant model for biomedical music therapy, and Thaut (2002, 2008, 2010) details specific activities designed to elicit neurological responses; however, neither tackle the use of real-time data in guiding a session toward a therapeutic outcome. Traditional Chinese medicine (TCM) offers concepts of balance through Yin and Yang classification (Bowker 2000). The psychological theories of behaviorism and operant conditioning also play a role in training physiological response (Schwartz 1979; Schwartz and Andrasik 2005; Sterman 2000; Yucha and Montgomery 2008).

The first wave of dramatic improvements in musical delivery appeared in the mid nineties with the widespread adoption of the computerized musical instrument digital interface (MIDI). MIDI tones in popular biofeedback software. MIDI allows for the choice of a wide variety of musical instrument tones and some special effects. These MIDI instruments, when combined with a high-quality sound card, rendered much more pleasing musical tonalities than the previous operating system generated tones. Pitch, timbre and scale suddenly became easy to modify and customize. MIDI is also attractive for its efficient use of computer memory. MIDI files are extremely small and can contain information to replay lengthy songs using the MIDI computer tones.

By the early 2000s, portable laptop computers were becoming fast enough and loaded with enough memory to render real audio as both feedback and background. The combination of MIDI and real audio made it possible to utilize the advantages of each. Real audio files consume much more computer memory than MIDI files and offer the ability to render high-quality reproductions of live and recorded music. MIDI, however, makes an ideal delivery system for tones triggered by physiology due to its flexible instrument patches and variety of instrument choices.

By the mid 2000s, digital technology had advanced to the point where video footage could be displayed on a portable laptop without much difficulty. The implications for biofeedback were that now clips from both commercial and homemade movies could be triggered and viewed upon activation of a threshold switch in a training software program. The accompanying audio could be maintained at a high level of quality. This technological advance allowed me to create a Star Wars design for kids that showed a popular sequence from Anakin Skywalker's dramatic pod race to a background music track of Vivaldi. A child training with the protocol could actually choose from a menu of background music selections that also included Talking Heads, Usher, Bob Marley and Bach. The pod-race clip would continue to play as long as the child maintained their Theta below a threshold level; otherwise the action would automatically be paused. With faster CPUs and more internal RAM, the newer computers could also operate high-resolution DVDs in real time as an alternative to stored video clips.

Some promising technology that the future may bring includes real-time biofeedback monitoring remotely over the Internet, transmission of physiological data by cell phone and ability for doctors and healthcare professionals to access real-time patient data remotely, collaborate with other colleagues involved with the patient and add notes to existing medical documents via cyber connection.

REFLECTIONS

1. Describe a therapeutic principle that remains intact despite technological advancement. How has the implementation of that principle shifted?
2. Hypothesize what a visit to a healthcare professional might look like in ten years.
3. What diverse philosophies or theories inform our understanding of the therapeutic use of sound?

CHAPTER 2

Shifting Healthcare Paradigms

In discussing the development of the biomedical model, David Byrne asserts that "medicine, which is considerably older as an organized intellectual activity than post-Newtonian science, had, at least formally if not in clinical practice, abandoned its old holistic approach and made a commitment to the reductionist biomechanical, 'scientific' programme" (Byrne 1998, p.3). He goes on to posit that, while the result has led to gains in curing individual cases, it has had minimal overall impact on mortality. Furthermore, drawing on McKeown (1979), he states that the most substantial contribution of medical science to the improvement of health was from public health programming, based on the understanding of the complex ecological relationships among people, disease and lifestyle, which was incorrect in underlying medical assumptions but positive in its effect. "Holism means that a system's capacity for action exceeds the individual or summed capabilities of its parts" (Marion 1999, p.64).

Pharmacological treatment is fraught with complexity. Some of the variables involved include drug interactions and side effects, toxic qualities and addictive potential (Bütz and Chamberlain 1998). The number and nature of these variables present ample opportunity for difficulties to surface.

Some of the problems presented by psychopharmacological treatment include:

- a biological organism's ability to self-organize as a reaction to biological interventions
- historic misuses and abuses of psychopharmacological methods
- motivation for the increase in psychopharmacological treatment

- the potential for large-scale social impact if the pursuit of medical treatment is not questioned and monitored.

(Bütz and Chamberlain 1998)

The allopathic paradigm comes from a tradition of viewing reality as the result of unbiased empirical discovery, while the holistic model—which includes the scientific reductionist tradition as a piece of the entire picture—also includes social constructionist and symbolic interactionist stances. This emphasis on the importance of how people perceive and define their reality is, perhaps, most succinctly posited by W.I. Thomas: "If humans define situations as real, the situations are real in their consequences" (Borgatta and Borgatta 1992, p.2130).

HOLISTIC/REDUCTIONIST SPLIT

The notion of contrasting the reductionist science paradigm with a holistic paradigm is well illustrated by Gleick (1987) in treating Feigenbaum's consideration of Goethe's approach, in contrast to Newton's optics, to understanding color. Both Newton and Goethe started with a prism, but where Newton's placement of the prism led to the division of the beam into color on a white surface, Goethe's placement found uniformity of white except when interrupted by a spot, leading him to consider color as a product of the interaction of light and shadow. "Where Newton was reductionist, Goethe was holistic… It was the perception of color, to Goethe, that was universal and objective. What scientific evidence was there for a definable real-world quality of redness independent of our perception?" (Gleick 1987, p.165). It was this revisiting of a prior time's paradigm that led Feigenbaum to his theory of universality which provides a tool for expressing the behavior of systems in transition from order to turbulence. "Because it demands large-scale paradigm destruction and major shifts in the problems and techniques of normal science, the emergence of new theories is generally preceded by a period of pronounced professional insecurity" (Kuhn 1962, p.67).

Concepts from the paradigm shift of reductionist to holistic have been adopted by the Complementary and Alternative Medicine (CAM) movement and have impacted music therapy. In writing his second edition of *Defining Music Therapy*, Kenneth Bruscia (1998) changed the phrase "the therapist helps the client to achieve health" to "the therapist helps the client to promote health" signifying a shift toward the holistic model (Bonde 1999). Bonde acknowledges inspiration from the works of Wilber and Antonovsky in Bruscia's reformulated concept

of health—"Health is the process of becoming one's fullest potential for individual and ecological wholeness" (Bruscia 1998, p.84)—and references David Aldridge and Even Ruud for their contribution to the concepts of ecology and quality of life (Bonde 1999). The key shift here is that health is now placed on a continuum of potential that is in part dependent on the individual's outlook and perception of the experience of quality in his or her life.

MUSIC THERAPY FROM THE HOLISTIC PERSPECTIVE

From the inception of biofeedback, its proponents have traditionally sported an affinity for Eastern meditation traditions, Yoga and non-Western mind/body approaches to health and wellness while using advances in physiological data monitoring as an integral component of the treatment process. This area of study has been dubbed *psychophysiology*, which John Andreassi defines as "the study of relations between psychological manipulations and resulting physiological responses, measured in the living organism, to promote understanding of the relation between mental and bodily processes" (Andreassi 1995, p.1). In all practicality, biofeedback practitioners utilize a variety of allied therapies in conjunction with biofeedback and tend to espouse an integrative or holistic philosophy of treatment that views biofeedback as one piece of a whole program of potentially impacting agents. These agents may include attitude, diet, expectations, exercise, relationships, therapy and even medication. Biofeedback therapy often assumes more of a teaching model than a medical model in that the biofeedback therapist will act like a coach rather than doctor; the client participates more like a student than as a patient. As biofeedback training progresses, homework is often assigned and progress is evaluated much the same as in an educational setting. Given that the subject being studied is self-regulation of physiological response, the result of this kind of learning is often characterized by feelings of empowerment and increased self-confidence.

Music therapy has roots in traditional mystical and healing practices of cultures throughout the world. It has continually aspired to attain legitimacy as a profession, in large part by adopting the medical model as a guide to inform practice, research and public interface. There are dissenters within the field, however, who disagree and argue that empirical, reductionist research methods are not equipped to capture the rich, human experience of music that can impact a person on multiple levels.

Music has been used as a therapeutic tool in educational settings, cancer wards, hospitals, clinics and in other settings with children, adolescents and adults with a variety of complaints. Music has shown to be effective in assisting patients with Alzheimer's and with Parkinson's disease. The highly publicized work of neurologist Oliver Sacks, MD—via the movie *Awakenings*—has demonstrated examples of abatement of Parkinsonian symptoms of muscle paralysis for up to 30 minutes following introduction of a musical stimulus. Other areas in which music therapy has been used include addictions treatment, acute and chronic pain, childbirth, brain injury and learning disabilities. Music can be considered a holistic approach. It is thought to simultaneously affect people on physical, emotional and spiritual levels.

The American Music Therapy Association (AMTA) is now more than ten years post-unification. In music-therapy circles, the term *unification* refers to the 1998 joining of the two existing U.S. music-therapy associations. The American Association for Music Therapy (AAMT) has typically been characterized as "holistic" and phenomenological, while the National Association for Music Therapy (NAMT) has been characterized as "biomedical" and more clinical. With the larger NAMT (having approximately 3,000 members) absorbing the smaller AAMT (approximately 300), the new AMTA purports to speak for U.S. music therapists with one voice. According to the AMTA:

> The idea of music as a healing influence which could affect health and behavior is at least as old as the writings of Aristotle and Plato. The 20th century discipline began after World War I and World War II, when community musicians of all types, both amateur and professional, went to veterans hospitals around the country to play for the thousands of veterans suffering both physical and emotional trauma from the wars. The patients' notable physical and emotional responses to music led the doctors and nurses to request the hiring of musicians by the hospitals. It was so evident that the hospital musicians needed some prior training before entering the facility and so the demand grew for a college curriculum. The first music-therapy degree program in the world, founded at Michigan State University in 1944, just celebrated its 50th anniversary last September. The American Music Therapy Association was founded in 1998 as a union of the National Association for Music Therapy and the American Association for Music Therapy. (AMTA 2000)

Music therapy is a growing profession and attracts people with holistic philosophical tendencies. The professional associations have vehemently encouraged research in the field of music therapy. This research has taken many forms, from phenomenological inquiries, case studies and anecdotal collections to surveys and controlled group experiments.

REFLECTIONS

1. Describe how the treatment of some disorder might be approached from the holistic paradigm compared to the reductionist paradigm.
2. What are some advantages of each model?
3. What is the relevance of Thomas Kuhn?

CHAPTER 3

The Process of Gaining Legitimacy

WHAT CONSTITUTES LEGITIMACY?

Is bio-guided music therapy a legitimate treatment? It would seem intuitively reasonable that legitimate treatments would emerge from legitimate professions. Wilensky (1964) proposed five essential attributes of a profession that tend to follow in sequential order:

1. The work or service is being done full-time.
2. Training schools, along with university affiliation, are established.
3. A professional association or organization is formed.
4. Political sanction is attained by law, typically recognizing certification or establishing licensure.
5. A code of ethics is adopted.

Acceptance of a particular treatment would follow intuitively from some established sense of legitimacy. There are a number of ways that a treatment can earn legitimacy; the first, and likely the most compelling, is endorsement by a legitimate profession. Greenwood asserts that professions "seem to possess: 1) systematic theory, 2) authority, 3) community sanction, 4) ethical codes, and 5) a culture" (Greenwood 1957, p.45).

Both fields of music therapy and biofeedback have full-time workers, academic-based training (surprisingly, however, music therapy has many more university-based training programs than biofeedback), active national professional associations and academic research journals, a rigorous certification process (though not usually state licensure specific to the profession) and a professional code of ethics. The question remains: Why

are these professions only partially accepted by mainstream healthcare? One possibility is that, from a reductionist biomedical paradigm, they may seem to overlap on medical territory or infringe on the jurisdiction of the medical physician. In many cases, physicians in positions of dictating treatment or—in the case of HMOs—authorizing payment for treatments, physicians' views of music therapy and biofeedback may have a significant effect on how well they are utilized by the consuming public.

Can a legitimate treatment emerge from a non-accepted profession?

The issues of acceptance are pertinent here, since it is most likely that adherents of one paradigm will most easily accept results, either positive or negative, that support that paradigm. Questions are: How does it happen that people change models? Is there a correlation between the empirical data and the perceived outcomes? What is credible evidence? Does the format make a treatment legitimate? Where is the source of the problem?

If we are indeed on the cusp of a Kuhnian paradigm shift in our understanding of medicine and healthcare, it may be possible that consumer beliefs and spending patterns may help direct which treatments physicians recognize. The National Center for Complementary and Alternative Medicine (NCCAM), a federal agency, concludes that Americans are dissatisfied with mainstream healthcare and spend billions on alternative and complementary medicine. "People want relief from symptoms and will use therapies they believe can provide it. An estimated 60 million adults used at least one alternative medical therapy in 1990, compared with approximately 83 million adults in 1997 (when Americans spent $27 billion on alternative therapies)" (NCCAM 2000, p.2).

There are several vehicles, such as individual persistence, grassroots organization and convincing medical research, by which biofeedback has achieved acceptance and reimbursement by insurance for a few specific diagnoses. Also, a combination of these factors may be at play in any one bid for coverage. Music therapy, in contrast, achieved being written into the Older Americans Act of 1991 through delivery of congressional testimony by famous people holding almost iconic status in American society.

INDIVIDUAL PERSISTENCE

In early 1990 in Jacksonville, Florida, Jack Hartje, PhD, completed biofeedback treatment of a patient referred to him by a local cardiologist, upon failure of conventional treatments, for excessive muscle contractions

and pain (Hartje 1995). Dr. Hartje expected to be paid by Medicare, having reviewed Section 35-27 of the Medicare coverage manual, which indicated that biofeedback was covered for organic muscular disorder under certain conditions. Only one of the following conditions needs to be met, as outlined by the Health Care Financing Administration (HCFA), in order for biofeedback to be covered:

- reasonable and necessary for the individual patient for muscle re-education of specific muscle groups
- treating pathological muscle abnormalities of spasticity
- incapacitating muscle spasm or weakness
- when more conventional treatments (heat, cold, massage, exercise, support) have not been successful.

(HCFA 2000)

When Hartje's claim was rejected for failure to demonstrate medical necessity, he requested a fair hearing. The hearing officer concurred with Dr. Hartje that the biofeedback therapy complied with Medicare Code Section 35-27. The hearing officer proceeded to deny coverage, however, on the grounds that the treatment was not rendered by a Doctor of Medicine. Hartje then requested a hearing with an administrative law judge, on the grounds that published Medicare guidelines do not require a medical doctor to render biofeedback. Although the hearing was requested in November 1990, it did not occur until February 1992. Present at this hearing were Dr. Hartje, his attorney, the administrative law judge and a local physician acting as medical consultant to the judge. Hartje presented his credentials to perform biofeedback and testified about his disagreement with the prior decision requiring a medical doctor to perform biofeedback. Following Hartje's testimony, the medical advisor concurred with Dr. Hartje that rendering of biofeedback services need not be performed by a doctor of medicine and that, indeed, Dr. Hartje's specialized training made him more of an expert provider in biofeedback and behavior modification therapies than many doctors who were not so trained in those areas. In the ruling, the administrative law judge ordered the carrier to set a reasonable fee for biofeedback therapy and to make such payment to Dr. Hartje.

In discussing the process by which biofeedback gains coverage by insurance companies, Hartje emphasizes the presentation of convincing data to the doctors involved and the insurance company decision maker or arbitrator (Hartje 1995). Dr. Hartje has conducted courses

in psychophysiology and biofeedback for more than 20 years at the University of Florida. He relates a story of finally having an opportunity to present data before the decision makers of a major Florida insurance company, upon the event of one of his students taking a job in that agency and promotion to a level of authority sufficient to grant him the critical interview.

In another example of individual persistence, Dr. Mary Ann Keatly self-funded an electromyographic (EMG) outcome study that she subsequently used with great success in presentations to insurance companies to justify claims for payment for biofeedback treatment.

Prior to starting her private practice, Dr. Keatly worked for the Outcome Data Corporation, a firm that conducted outcome studies for corporate clients. She was well acquainted with the techniques for sound methodological research as well as with the style for generating convincing reports on the findings. In her own self-funded study, she looked at six diagnostic groups of 30 subjects each for:

- tension headaches
- migraine
- low back pain
- temporomandibular joint syndrome (TMJ)
- cumulative training injury (e.g., carpal tunnel syndrome)
- cervical pain.

Biofeedback modalities were EMG, temperature and galvanic skin response (GSR). She plotted the mean number of sessions, mean session cost and mean percentage change in pain. Also, she looked at each type of adjunctive therapy used, such as autogenics or guided imagery, as well as additional variables (e.g., sleep problems and alcohol or drug use).

Although she never published this retrospective outcome study, Dr. Keatly explains that she has used the results from this research to win coverage for difficult cases and has reversed unfavorable decisions regarding coverage. To date, she says that she has yet to be denied payment upon presentation of this data.

GRASSROOTS ORGANIZATION

On April 19, 2001, the president of the Texas Biofeedback Society, Lynda Kirk, sent an e-mail to the professional biofeedback listservs, a site where practitioners discuss clinical issues, philosophical differences

and the latest protocols. A bill was coming before the Texas legislature that would allow for a number of therapies—including both biofeedback and neurofeedback (NF)—to be covered by insurance for many types of head- and brain-injury patients.

Lynda began: "Dear Colleagues, we desperately need your help in getting Texas HB1676 passed" (Kirk 2001). She went on to explain that the testimony that she and Sara Harper had previously delivered had assisted the bill, against all expectations, to pass the House Insurance Committee by a vote of 7 to 1. The next step, however, was its appearance before the Calendar Committee. Apparently, according to Lynda, "most Bills are voted out of committees with the understanding that they will be killed in Calendar. The bottom line is, unless we can convince the committee to get it on the floor for a vote, they will ignore HB 1676. There will be no general coverage for biofeedback, neurofeedback, cognitive therapy, etc., for the majority of our brain/head injury survivors." She implored the members of the biofeedback community who lived in Texas or who had friends that lived in Texas to call, e-mail and write the members of the Calendar Committee (whom she identified at the bottom of the letter) and deliver a brief personal message of support for the bill on behalf of either themselves, family members or friends who were brain injured and who would benefit from the passage of this bill.

Following an update that explained that an AFL-CIO contact was assisting, Lynda issued a final request for help on April 26, 2001. The bill was being voted on later that day. Later that evening a joyful message came through: the bill had passed without argument and with no dissenting votes. Lynda wrote, "According to Representative Ehrhardt, 'That's a miracle.' We truly did not expect it to get out of the Insurance Committee—much less get it out of the Calendar Committee—and onto the floor for a vote." Then the process starts all over again. She urged everyone to start contacting the senators from states where the bill was headed next.

CONVINCING MEDICAL RESEARCH

AETNA U.S. Healthcare is one of the major insurance companies that sets trends in coverage for the industry, according to Bob Whitehouse, former AAPB Insurance Committee Chair. As of March 2001, the AETNA-published policy regarding biofeedback read as follows.

AETNA U.S. Healthcare covers biofeedback for the following conditions in which it has been documented in the medical literature to be of value:

1. Urinary incontinence
2. Migraine and tension headaches
3. Temporomandibular Joint Syndrome (TMJ)
4. Electromyographic (EMG) biofeedback for neuromuscular rehabilitation of stroke
5. Fecal incontinence
6. Raynaud's disease
7. Chronic constipation
8. Irritable bowel syndrome
9. Refractory severe subjective tinnitus
10. Chronic pain.

(AETNA Insurance 2001, p.1)

Disorders they identified as not being covered—due to insufficient evidence of effectiveness in the medical literature—included:

1. Treatment of ordinary muscle tension states, psychosomatic conditions, visual disorders
2. Essential hypertension
3. Anterior shoulder instability or pain
4. Attention deficit hyperactivity disorder
5. Anxiety disorders
6. Fibromyalgia
7. Intractable seizures
8. EMG biofeedback as a rehabilitation modality for spinal cord injury, spasmodic torticollis, or following knee surgeries
9. Myoexerciser 3 ambulatory EMG device for diagnosis or monitoring nocturnal bruxism in the treatment of TMJ.

(AETNA Insurance 2001, pp.1–2)

These AETNA criteria are influential. Smaller insurance companies that may not have the resources to do their own evaluations of innovative treatments may use AETNA's or another major insurance company's

guidelines. Given the lack of any universal policy in the U.S. regarding what treatments may be covered by insurance for what diagnoses and for whom, there is a consequent diversity of policies, plans, prices and coverage options available to the public. For those with extremely limited resources, Medicare may be the only option.

In an October 2000 decision regarding biofeedback coverage for urinary incontinence, the HCFA took many factors into account, ostensibly giving primary consideration to quality medical research studies. Beginning in March 1991, as a result of the Technology Advisory Group (TAG) meeting, biofeedback was covered for urinary incontinence at contractor discretion. Two years later, the Technology Advisory Committee (TAC)—successor to TAG—did not recommend biofeedback coverage as policy, despite an endorsement by the Agency for Healthcare Policy and Research (AHCPR). Since the AHCPR report stated only that biofeedback "can be useful"—without specifying in what percentage of cases or its degree of usefulness—the TAC allowed the status of biofeedback to remain unchanged at contractor discretion.

Although a 1997 study by the Blue Cross/Blue Shield Technology Evaluation Center (TEC) concluded that there was no benefit to using biofeedback *in addition to* pelvic muscle exercises (PME), the former director of the Coverage and Analysis Group, Grant Bagley, MD JD, was instrumental in generating an internal request for a national coverage decision to the Medicare Coverage Advisory Committee (MCAC).

In 2000, the HCFA committee considered six relatively small studies that met their criteria for review. The selection criteria for the articles to be reviewed were:

- full-length, peer-reviewed articles
- documented stress, urge, mixed or post-prostatectomy incontinence by physician diagnosis and/or urodynamic testing
- concurrent comparison group of patients treated with pelvic floor muscle exercises without biofeedback
- objective measures of health outcome
- adequate description of the patient population
- adequate description of course and treatment delivery.

Three studies reported no significant differences between PME and biofeedback-assisted PME groups, while three studies reported greater improvement for the biofeedback-assisted PME group; two of those

three were statistically significant. Particular attention was paid to the study by Burns (1993) that reported no significant difference in the percentage of improvement for biofeedback-assisted PME versus PME alone—61 percent and 54 percent, respectively. The HCFA decision did acknowledge the study by Burgio (1998), which reported 76 percent improvement vs. 51 percent, $p<0.05$ for the biofeedback-assisted PME versus PME-only groups. The Burgio study was criticized by HCFA for not being randomized. Upon review of the article, however, this criticism appears wrong. In fact, the Burgio study not only randomized subjects but also stratified subjects within groups to ensure comparability between experimental and control groups.

Within each stratum, randomization was performed with computer-generated random numbers, using a block size of six to avoid inequity in group size. Subjects were randomly assigned to behavioral treatment, drug treatment or a placebo control condition (Burgio 1998).

An error of this nature by HCFA is curious and may point toward bias or careless reading of the relevant studies. It is most baffling, since the word *random* is, in fact, included in the title of this JAMA article: "Behavioral vs. Drug Treatment for Urge Urinary Incontinence in Older Women: A Randomized Controlled Trial."

The panel of experts in healthcare research, incontinence, urogynecology and urology was asked to vote specifically on whether the scientific evidence is adequate to draw conclusions about the effectiveness of biofeedback, in addition to PME, in routine clinical use in the Medicare populations for the following three indications: 1) stress incontinence (SI), 2) urge incontinence (UI) and 3) post-prostatectomy incontinence. If they voted positively, they were to proceed to a second question that asked about the level of the effect. The panel voted eight to two that there was insufficient evidence to determine the effectiveness of biofeedback as an adjunct to PME in routine clinical use in the Medicare populations for SI, ten to zero in the case of UI and zero to zero in the case of post-prostatectomy incontinence.

The nature of the question clearly elicited a controversial response. The HCFA report acknowledged that:

> Since the panel found that there was insufficient evidence to determine the effectiveness of biofeedback, they did not proceed to the second question. However, several panel members commented that if they were to vote specifically on coverage, they would have voted yes. Some panel members noted that they felt the testimony

> of professional societies and experts could support a positive coverage decision. (HCFA 2000)

In a section presenting statements from professional societies, the decision also reported on the recommendations for covering biofeedback from a number of groups. Included were statements from the American College of Obstetricians and Gynecologists (ACOG); American Physical Therapy Association (APTA); American Urologic Association (AUA); American Urogynecologic Society (AUGS); Association for Applied Psychophysiology and Biofeedback (AAPB); Society of Urologic Nurses and Associates (SUNA); the Wound, Ostomy, and Continence Nurses Society (WOCN) Continence Coalition; and the National Association for Continence (NAFC).

The AAPB statement provided strong support for biofeedback treatment and addressed some methodological issues:

> The AAPB supports the use of biofeedback in the treatment of urinary incontinence for men and women. They also note that most male incontinence is secondary to prostate surgery and may require about twice the number of therapy sessions as female patients for stress and urge incontinence. They also expressed concern that PMEs and biofeedback were being viewed as equal topics. The Association pointed out that there are fundamental differences between the two, including the mechanisms of operation, clinician education and training required, and relevant clinical outcomes. (HCFA 2000)

As a whole, the report is remarkable for its presentation of opposing opinions to its seemingly biased scientific position.

> The MCAC was unable to draw conclusions about the effectiveness of biofeedback from the scientific evidence presented. Conversely, the general consensus of the medical professional societies, clinical experts, consumers and others was that biofeedback adds significant benefit to patients learning to execute PMEs, and should be a covered treatment option. (HCFA 2000)

The final result is a surprise, since the scientific evidence for the effectiveness of biofeedback as an adjunct to PME was inconclusive.

> DECISION:
>
> Amend *Coverage Issues Manual 35-27* to include the following:

> "Biofeedback therapy is covered for the treatment of stress and/or urge incontinence in patients who failed a documented trial of pelvic muscle exercise training or who are unable to perform pelvic muscle exercises. Contractors may decide whether or not to cover biofeedback as an initial treatment modality." (HCFA 2000)

The rationale is interesting.

> There is limited direct empirical evidence on whether biofeedback improves outcomes in patients who have failed PME or are unable to perform PME. Despite this, we felt that coverage in this situation was warranted, given the combination of suggestive scientific evidence and broad positive expert testimony. Further controlled clinical studies of this application of biofeedback would be of considerable value in clinical practice, and would confirm the appropriateness of this coverage policy. (HCFA 2000)

This intriguing result caught the attention of a listserv for prescribing psychologists, one of whom asked Dr. Perry of the Psychophysiology (Psy-Phy) listserv why HCFA agreed to mandate payment for biofeedback when the evidence appeared inconclusive. Perry responded with three major points.

1. The new BC/BS TEC report had serious flaws. They conceptually disadvantaged biofeedback by treating it as a subset of physical therapy and then, posing the question of whether biofeedback enhanced PME alone, allowed them to dismiss the JAMA study by Burgio (1998). They were unable, however, to find any studies that met their own criteria of "PME alone" and, so, ended up actually comparing biofeedback to "various forms of verbally mediated biofeedback and incidental pelvic muscle EMG monitoring." By contrast, they compared electrical stimulation to all forms of alternative therapy.
2. HCFA failed to follow its own announced procedures by not announcing the existence of the TEC report to the public until after the deadline for requesting the opportunity to present verbal testimony on it had passed. The new HCFA practice of not announcing the posting dates of such documents required that interested parties—and even those who would be presenting before the HCFA—needed to check the website daily, giving presenters little time to adapt their presentations in response to the report. Perry notes in his post to the listserv, "Especially grievous

> was HCFA's failure to obtain their own recommended independent review by technical experts PRIOR to the panel meeting"
>
> (Perry 2000, pp.3–4)

Perry's third point speaks to the power of clinical wisdom from practicing professionals in contrast to politically based scientific findings.

> 3. But by far the most compelling reason why HCFA mandated coverage was the unprecedented and unanimous testimony of virtually every related medical and health organization involved, from the giant AMA, AUGS and ACOG to the nurses, physical therapists and biofeedback people. This cooperation was not a chance event—tens of thousands of e-mails were exchanged by the various organizations' representatives and members throughout the entire process (which began, by the way, in the spring of 1999, and shifted focus dramatically in the spring of 2000 when the TEC report was revealed).
>
> (Perry 2000, p.5)

The role of new communications technology played an important part in enabling the various professional associations to communicate, organize and respond to the HCFA process and findings.

Perry footnotes that HCFA originated as a physicians' organization with objectives of securing payments for physicians rather than for patients. An alternative interpretation of the HCFA process could have little to do with the studies or the testimony but could be related to an internal struggle between the old-school urologists (who make their living performing surgery) and the younger doctors (who favor incontinence clinics). By running a clinic, they own the means of production, so to speak. They may employ technicians to conduct behavioral therapists at reduced rates and funnel the difficult cases into surgery, thereby generating a profit from services that were competitive in the previous model.

Indeed, doctors' wages are decreasing, and standard treatments and diagnostic procedures are being questioned. Mammograms provide an interesting example.

The existing allopathic medical model is based on mechanistic physics, which—in the sciences—is being augmented or replaced by quantum physics and chaos and complexity theories in mathematics. People are becoming more dissatisfied with certain aspects of modern medicine and are looking toward alternative paradigms.

In 2000, National Public Radio's Patricia Neighmond reported that deaths due to medical errors may number in the tens of thousands. Independent reports place the number between 44,000 (Nursing Spectrum) and 98,000 (Institute of Medicine), with medical errors leading mortality tallies ahead of motor vehicle accidents (43,458), breast cancer (42,297) and AIDS (16,516).

The British medical journal *Lancet* confirmed that the radiation caused by mammograms has almost doubled the incidence of ductal carcinoma in situ (DCIS), representing about 12 percent of all breast cancer cases, and drastically increased the incidence of breast cancer in women under 40. The journal *Archives of Internal Medicine* published results showing that radiologists, given a set of 79 mammograms, missed cancer in 21 percent of the cases, concluded that 10 percent of the women with no breast disease had cancer, and diagnosed 42 percent of benign lesions as cancerous. The result of our acceptance of this kind of margin for error is not only increased risk of cancer but also subjecting women who do not have cancer to unnecessary biopsies. Alternative diagnostic methods such as thermography—in addition to self-examination—were suggested as being just as accurate but definitely less invasive. Alternative Medicine (2000) suggests, "Why, then, does mainstream medicine keep recommending mammograms? Do the math. A $100 mammogram for all 62 million U.S. women over 40, and a $1,000+ biopsy for one to two million women, is an $8 billion per year industry."

HMOs have strict mandates regarding inpatient stay lengths and accessibility to specialists, with decisions conducted by medical managers. Critics charge that treatment has become driven by cost concerns rather than by medical imperative. The medical system's original intent was to heal the sick. The structure, however, demands that people conform to it, whether it is really the healthiest of choices or in their best interests.

GRANDSTANDING WITH MUSIC THERAPY

In August 1991, music therapy took center stage before the Senate Special Committee on Aging in Washington, D.C. In addition to testimony from satisfied patients, prominent practitioners and grateful family members, several high-profile figures representing different strata of American culture made appearances, as well. Theodore Bikel, American-Israeli folklore hero, songster and star in the original Broadway production of *Fiddler on the Roof,* told the Senate Committee that humans need music and the arts as basic necessities rather than as luxuries (Reuters 1991). Mickey

Hart, drummer for the legendary rock band The Grateful Dead, put his tie-dyed t-shirts away in favor of a suit and tie to deliver his message to the Senate. He talked about the rhythms present in the seasons, in nature, birds and animals, and the potential of rhythm to prevent illness and maintain physical, mental and spiritual well-being (Reuters 1991). Neurologist Oliver Sacks, MD, familiar to the public through the movie *Awakenings*, discussed the mechanisms by which music can show dramatic effects in patients with Parkinson's disease, whereby symptoms can completely abate—following music-therapy intervention—for periods of up to 30 minutes.

The result of the hearings was that music therapy was written into the Older Americans Act as an entitlement for seniors to improve their quality of life. Given this 1991 revision of the Older Americans Act, music therapy subsequently became a Medicare-reimbursable procedure. On a practical level, getting actual payment for music-therapy services remains difficult and inconsistent from one location to another. In Pennsylvania, for example, music therapy is routinely provided to homebound seniors under the state Medicaid waiver program in Philadelphia county. In Montgomery county, however—despite approving a music-therapy provider under the same statute—the care managers who make the budgetary/treatment decisions refuse to authorize music-therapy services for the elderly on their caseloads.

MUSIC THERAPY AND EEG FROM THE BIOMEDICAL PERSPECTIVE

There is a growing body of research showing that music may impact brain activity. Some of the research includes Altenmüller, Gruhn and Parlitz (1997); Barber, McKenzie and Helme (1997); Beisteiner, Altenmüller and Deecke (1994); Field, Martinez and Schanberg (1998); Iwaki, Hayashi and Hori (1997); Leaver *et al.* (2009); Ogata (1995); Panksepp and Bekkedal (1997); Petsche, Lindner and Rappelsberger (1988); Pratt, Abel and Skidmore (1995); and Hyde *et al.* (2009). A study of EEG responses of musicians and non-musicians to two kinds of musical stimuli—classical and rock music (Barber *et al.* 1997)—yielded some interesting results. First, Barber *et al.* noted the inter-subject variability of response to EEG. In the case of one musician, Theta activity markedly decreased in both the classical and rock music conditions, compared with pre-intervention baseline, mid-intervention baseline and post-intervention baseline data. A second musician with a similar profile (age, gender, performance ability

and year in music degree program) showed an opposite—though more diffuse—response in the same measure of Theta activity. Overall, data from 21 musicians and 25 non-musicians over 19 scalp electrode sites show that, in the Theta band, musicians decreased Theta activation during both music conditions—primarily in the left frontal region during classical music and in the central frontal regions during rock music. The non-musicians displayed a more geographically dominant Theta activation to classical music, occurring in all regions except for the left frontal. This condition, however, was followed by a mid-baseline period of even higher Theta activation, followed by a reversible Theta decrease during the rock music condition (which followed the mid-baseline) and preceded a Theta increase during the final post-baseline trial. In the Beta 2 condition (18–24.75 Hz), both musicians and non-musicians decreased Beta levels until the rock music condition, during which period both groups increased bilateral Beta production prior to a Beta decrease in the post-baseline condition.

These results strongly indicate the possibility of music-induced Theta decrease accompanied by Beta increase. Note that while sensorimotor rhythm (SMR) remained relatively stable in this study, SMR is a low Beta frequency and is often replaced by Beta training in adult attention-deficit hyperactivity disorder (ADHD) cases (Axelton undated).

In a study that compared experimental groups of attention deficit disorder (ADD) and ADHD children undergoing NF with background music against a control group that did not have the background music (Pratt *et al.* 1995), results were inconclusive regarding the effects of music and actual EEG bandpass ratio gains. Parent reports across four targeted behavior areas, however, showed improvement for all groups. The small sample size of this study (n=19) contributed to the lack of statistically significant results. Of note was an observation initially made by a parental observer that three of the children reduced their Theta bars in exact rhythm to the underlying beat of the background music of Mozart (Pratt *et al.* 1995, p.26). Six months following the study, 70 percent of the subjects reported maintenance of the improvements in targeted behavior.

One factor that the investigators did not discuss in detail was the possibility that exposure to Mozart might function to increase Theta, rather than to reduce it, whereas the presentation of a different musical form—rock or fast-beat music—might serve to reduce Theta and increase Beta.

The noted neuroscientist Karl Pribram (1981) proposed a model of brain processing of music which distinguishes the evocative nature of music from the referential nature of language, while both share syntactic structuring. Of relevance here is the theory's prediction that the frontal and limbic regions of the brain process the experiential aspect of music, while the posterior cortex processes the symbolic components of music. Should this in fact be the case, it is even more incumbent on researchers to take into account the subjects' own experience of the presented music (in contrast to the content nature of the music itself—Mozart, Bach, Rolling Stones, etc.), much as Bronfenbrenner has forewarned regarding the importance of the ecological context within which the experience occurs. Since low arousal levels of the frontal and prefrontal cortex regions are associated with ADHD, it would reasonably follow that music that activates these areas may also assist in remediating ADHD symptoms, similar to the way Ritalin increases dopamine levels of the basal ganglia in these same regions.

There may also be cases in which there is no perception of change, yet physiological monitoring is able to detect shifts in body functioning. One study (Field *et al.* 1998) indicated that right frontal EEG activation, as well as cortisol levels, decreased in depressed subjects upon presentation of music versus a control group. There was no significant difference, however, in reported subjective perception of change in mood.

Although not directly related to EEG, this discussion of music and the brain would be remiss without addressing the controversial and well-publicized studies by Rauscher, Shaw and Ky (1993) and Rauscher *et al.* (1997), reporting a Mozart effect. The Mozart effect was postulated by results showing temporary enhancement of temporal-spatial IQ from the Stanford-Binet Intelligence Scale-IV (Rauscher and Shaw 1998; Rauscher, Shaw and Ky 1993; Rauscher *et al.* 1997) upon listening to Mozart, compared with control subjects. The effects lasted for approximately 10 minutes in the first study and 30 minutes in the second. While some findings have been able to replicate these findings (Rideout and Taylor 1997), others have not (Steele, Ball and Runk 1997). A meta-analysis of research on Mozart vs. silence over 16 studies and 714 subjects reports mixed findings (Chabris *et al.* 1999). One study first replicated the Mozart effect (Nantais and Schellenberg 1999) and then demonstrated that the effect vanished when a narrated story was substituted in place of silence as the control condition. The authors conclude that performance was a function of the listener's preference for either story or music. Rauscher and Shaw (1998) reply that key components of the Mozart effect must

be considered in attempts to replicate it and suggest that researchers must pay particular attention to choice of dependent measures, order of presented conditions, musical composition selection, and distractor tasks, all of which may impact the experiment's results.

The idea that music can enhance learning in young children based on EEG findings is presented in a review of music and EEG studies in the *Music Educators Journal* (Flohr, Miller and deBeus 2000). The authors argue that the impact of music education may be dramatic and may affect neurological circuitry in the brain. Specifically, they report on a music training group of 22 four- to six-year-old children showing cortical activation pattern changes versus controls in the brain area related to spatio-temporal reasoning. They also point to EEG coherence, which refers to the strength and number of neural connections between brain locations, noting "increased connectivity" (Flohr *et al.* 2000, p.30) for the children that had the music training as opposed to those that did not. This article makes a strong case for music educators to include music training in programs for children younger than six years of age.

REFLECTIONS

1. Describe how the treatment of some disorder might be approached from a music-therapy model.
2. Describe how the treatment of some disorder might be approached from a biofeedback model.
3. How may these two approaches be integrated?
4. Make a case either for or against the existence of a Mozart effect.

CHAPTER 4

A Case for Integrating Music Therapy and Biofeedback

Traditionalists within the field of music therapy may balk at the notion that tones produced by the body's physiology may truly be considered "music" within the context of music therapy. It is true that we typically imagine a person playing music by means of striking a drum or bell with a mallet in hand, or vocalizing a pitch or rhythm, or plucking a string. Unfortunately, this image limits our view of how music may be created, and it constructs an unconscious prejudice that affects our work with those persons who have severely limited physical abilities. Imagine a child without the fine motor skills to move his or her hand and fingers at will. If we cling to our concepts of music playing through striking, plucking and vocalizing, we may deny this child the experience of music playing along with the accompanying therapeutic benefits. Luckily, recent technologies have expanded our ability to bring musical experiences to those who do not have use of their arms, fingers or voice. We can trigger beautiful and powerful synthesized sounds from changes in physiology that are much more subtle than the gross movements of hands and feet. Granted, it may not be possible with subtle physiological changes to replicate the precision of musical execution that the fingers can be trained to achieve. However, directional changes in heart rate variability, galvanic skin response and EEG brainwaves can be trained through biofeedback and offer a true ability to vary a musical pitch and "play" a digital instrument. Infrared beams can now sense body motion, and lasers can track minute shifts in pupil movement controlled by ciliary muscles. Both measures may be adapted to trigger synthesized musical instruments, making a world of difference to the physically challenged.

WHAT IS MUSIC THERAPY?

According to the American Music Therapy Association (2005), "Music therapy is the clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional who has completed an approved music-therapy program."

Alternatively, Dr. Kenneth Bruscia, in his book *Defining Music Therapy* (1998), offers the following definition: "Music therapy is a systematic process of intervention wherein the therapist helps the client to promote health, using music experiences and the relationships that develop through them as dynamic forces of change."

Both of these definitions include not only the use of music as a therapeutic tool but also identify the therapeutic relationship with the practitioner as an essential component of the process. Of note is that neither definition requires the client to be able to play a musical instrument in the fashion that we normally conceive of as playing music. In the case of the former, the term *music intervention* is broad and allows for a wide range of activities that may be included in the music-therapy process. In the case of the latter, the term *music experiences* is also wide-ranging and encompasses many diverse possibilities for activities that may fall under this umbrella. In fact, both terms are broad and seem to include almost any activity that is music related, so it would appear that the mitigating factor is that the activity is conducted by the music therapist or within the context of the therapeutic relationship. This is a key point, because it would indicate that the music or musical experience in and of itself is not enough to be considered music therapy without the context of the relationship with a practitioner or music therapist. What is left open to the music therapist is the way music can be used as an intervention, or the way to use music in the music experience. Both of these definitions clearly allow for the inclusion of biology-guided or physiology-driven music in the music intervention or experience, if conducted within the context of the relationship with a therapist.

Biofeedback has been developing as a clinical modality since the 1960s. In 1998, three associations related to the field agreed upon the following definition:

> Biofeedback is a process that enables an individual to learn how to change physiological activity for the purposes of improving health and performance. Precise instruments measure physiological activity such as brainwaves, heart function, breathing, muscle