Dr. Mozart:

Music and its Physical and Intellectual Impacts

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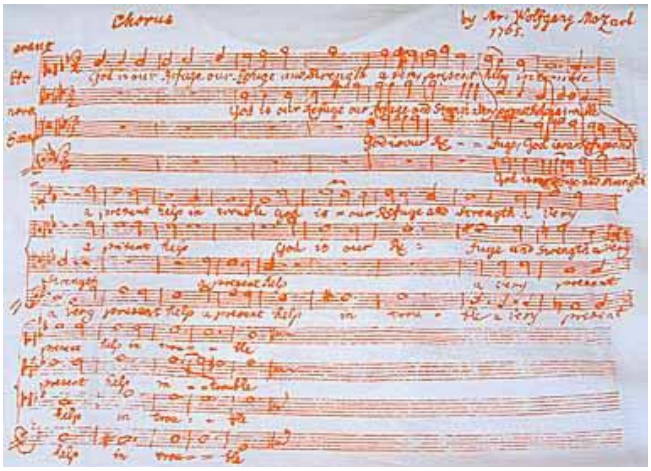
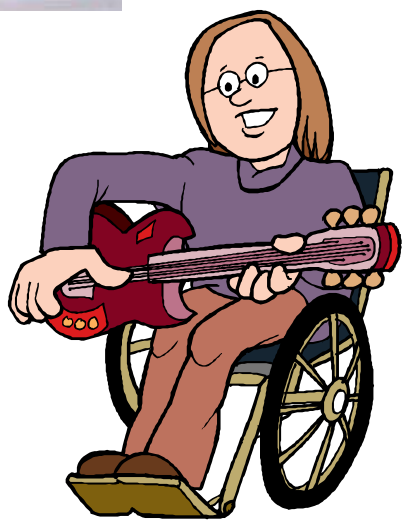




Music has been around as long as all of humankind. Ancient Neanderthals created simple flutes and primitive societies have been singing since tribes first banded together. That music has healing and mind-stimulating powers is not a novel idea, but only recently has it become a science. Music has always been an innate part of human life that it is not surprising that it might have such large implications. Plato insists, **"music is a moral law. It gives soul to the universe, wings to the mind, flight to the imagination, a charm to sadness, gaiety and life to everything. It is the essence of order and lends to all that is good and just and beautiful"** (Brainy Quote). Music is a power that everyone relates to from birth, and from birth, people are constantly surrounded by it. Everyone who turns on a computer hears a startup tune, while background melodies accompany any television show or commercial. All around the world, lullabies share the same general structure and produce the same calming effect for fussy infants. In addition, most infants have an innate ability to identify incorrect notes in songs that they have never heard before. (Browning, 273) *Music does not merely entertain, but this powerful force drastically affects us both physically and intellectually.*

Every culture in the world can be identified by its own specific kind of music. Upon hearing a Mariachi band, one immediately feels the Mexican influence and toes seem to tap almost involuntarily. The Nazis played harsh military music to their soldiers and citizens in order to **"stir their psyches into a frenzy of hate"** (Campbell, 18). In department stores, classical music creates an atmosphere in which customers feel luxurious and they are more likely to spend their money than if they were listening to something else or nothing at all. Without music, customers soon become bored and move on. Music innervates our world so much that ethnomusicologist John Blackin says, **"it is reasonable to suppose that music, like language and possibly religion, is a species-specific trait of man,"** (qtd. in Demorest, et al. 39).

Unquestionably human, music 'speaks' to us in ways which words are incapable. "**Undeniably, there is a biology of music,"** declares Dr. Mark Jude Tramo, a neurobiologist at Harvard University Medical School (Allen). Although many animals produce melodies, none are so developed as to take noticeable pleasure from their music nor do they develop it to a level beyond basic communication. Animals can be trained to recognize songs, but their recognition is solely based on frequency, not on pitch. If the song is transposed it becomes completely foreign to them. Most children will recognize the 'Happy Birthday' song no matter in which key it is sung. Dolphins can recognize and repeat songs with ABA pattern (verse, chorus, verse), but only if the 'A' portion is less than two seconds long. By contrast, conductors can easily listen to an unfamiliar piece by Bach and be able to point out even slight errors in rhythm, harmony and melody.

Humans relate to music because it has the power to change emotions. Music can be uplifting and moving and a sad minor melodic part can move one to tears. Physical changes occur when listening to various types of music. Listening to melancholy music actually **"produces decreases in heart rate and skin-conductance level but increases in blood pressure; listening to frightening music leads to increases in pulse transmission time and decreases pulse amplitude"** (Husain et al. 153). This is not simply a product of over-dramatized movie scores affecting how society reacts to otherwise neutral melodies. There is strong evidence that these reactions occur from birth. Newborn babies **"responded with differentiated changes in heart rate, blood pressure and respiration when listening to contrasting music styles"** (Fox, 24). Further studies show music that babies hear in the womb has a calming effect for them once in the crib, which demonstrates heightened synaptic connections developed from pregnancy.

Composers throughout the ages have used music's universally expressive characteristics to communicate complex ideas through their music. The harsh, clashing half steps in the fourth movement of Henry Purcell's '*Funeral Music for Queen Mary'* contains the words **"deliver us not in to the *bitter* pains of death [emphasis added]"** (Purcell). Purcell graphically illustrates the struggle and pains of death by allowing the melody to take several bitter measures to reach a mere third interval. (See Appendix fig. 1) One *feels* the bitter anguish of death, though one is truly only hearing a melody.

Music tampers with our innermost being as noted at the Montreal Neurological Institute where a team of researchers mapping the brain found that **"the same neural clusters that process the seductive pleasures of sex, chocolate and even hard drugs also fire up for music"** (McKay). Through music, everyone can understand what is being said no matter what language he or she speaks. Because music is so universal, it can be used in meaningful ways to improve quality of life. The Ancient Greeks made this connection through their god Apollo, with his melodious lyre, having a son Asclepius, who was a physician and god of healing. In the Bible, King Saul calls young David to play his harp to ease physical and mental torments. Dr. Samuel Wong believes that this is **"an early example of music's phenomenal power."** He adds, "**Today we all need that power, with so many deadlines, pressures, attacks on our character and insecurities about all aspects of life"** (qtd. in McLean).

It is not surprising, therefore, that music has a long history as a healing tool. In medieval times, when medics still believed in the four bodily humors, **"it was felt that performing or simply listening to music provided therapeutic effects against 'passions' or disorders of the mind"** and "**the common understanding was that music created a harmony between body, soul and mind"** (Lund, 77). Kings Philip V of Spain, George II of England and

Ludwig of Bavaria overcame their bouts of severe depression through the aide of music. After World War II, Dr. Thayer Gaston noticed that although veterans recovered physically, many did not so readily recover psychologically. He noted that music played through intercom systems in veteran's hospitals seemed to help a great deal (Karr).

Music, however, did not become professionally recognized as a means for healing until 1950 with the establishment of the National Association of Music Therapy (NAMT). The organization's founding followed the establishment of the first program offering a bachelor's degree in music therapy in 1948 at Michigan State University. In 1971 another organization, the American Association of Music Therapy (AAMT), was establish and in 1998, the two groups merged to become the American Music Therapy Association (AMTA). (Lindberg) Their mission was **"to advance public awareness of the benefits of music therapy and increase access to quality music therapy services in a rapidly changing world"** (qtd. in Lindberg). Since then, music therapy has developed into a widely acknowledged and accepted form of psychology with which thousands of patients are currently counseled.

The American Music Therapy Association is responsible for setting the standards for board certification, which is a requirement for any professional position as a music therapist. In 1983, the NAMT established the Music Therapy Board Certification. In order to be considered for certification one must obtain a degree from one of 52 board-approved collages (Lindberg). Required courses include typical music major courses, biological and behavior studies and courses specializing in music therapy. (Harper) Six months of clinical internship under a registered music therapist are also required. (Certification Board) After obtaining a collage degree and board certification, therapist have a wide variety of ways to practice. Many music therapists get jobs in hospitals or hospices, while some go into private practice. Nursing homes and schools often higher music therapists to offer continual support for their patients and students. (Harper)

The main goal of music therapy is to improve the quality of life in patients who are have a need or disability, whether mentally or physically. For Mr. David Harper of Hospice Savannah, music therapy is **"the perfect blend of music (performance & education) and medicine (psychology, medical issues, and counseling)**" (Harper). Music therapy is promising for many people. In a presentation to the United States Senate, Senator Harry Reid of Nevada stated **"simply put, music can heal people"** (Music Therapy). A typical session may involve a client's composing a song to express deeper feelings or playing instruments to improvise on unspoken emotions. Physically disabled patients might learn to play piano to improve the fine motor skills. However, one need not be musically trained to benefit from music therapy. Specially selected and modified instruments can be used that are gratifying to play, yet require no special skills. A simple example may be drums, which are often used in sessions to allow a client to release

pent up tension and emotions. Various percussion instruments may be used to produce a wide variety of tones, dynamics and tambour. Music encourages the uncovering of hidden emotional responses to everyday life. On the most basic level, it accomplishes this effect by distracting clients from everyday problems and irritations. But the principles of healing with music go way beyond distraction. According to the Nordoff-Robbins Method of Music Therapy, **"there is an inborn musicality in every human being that can be activated in the service of personal growth and development"** and "**an individual's innate creativity is used to overcome emotional, physical and cognitive difficulties"** (Nordoff-Robbins Center). Through music and music-related activities, patients can achieve important physical and psychological goals.

Certain characteristics of music make it particularly effective in rehabilitation. It captivates and maintains one's attention, therefore providing a more meaningful experience that promotes continuation of therapy. Attracting the brain's attention with pleasurable music **"will induce the brain to produce serotonin, which causes pleasure, and melatonin, which affects sleep"** (Bakker). Music also causes the release of endorphins, the body's natural anesthetic. Music is easily adapted to fit the specific needs of each individual. It acts as an effective memory aid and structures time in a way that everyone can understand. For patients, seemingly endless exercises are put into perspective when practiced with music. They can gauge the amount of time left by the part of music playing.

The type of music selected for therapy is of great importance. (See fig. 2) **"The most effective type of music seems to have a tempo of around 70-80 beats per minute, which is almost the same as the average pulse rate"** and "**studies have shown that when you listen to this type of music, your heart rate will eventually synchronize itself with the musical beat and relaxation will occur"** (Elking). For older clients with failing memories, music will often be selected from the patients 'prime' in life as this is most likely to inspire and stimulate aging minds. Therapists in nursing homes often use music to make a connection or to awaken memories in Alzheimer's patients. This produces both positive and negative effects. In one instance, a therapist played waltz music for his patient only to have her begin to sob uncontrollably (Bakker). Through the counseling sessions, the therapist discovered that his patient had been a victim in the Nazi concentration camps and had never told anyone until that point.

The genre of music selected for therapy has an effect in physical counseling as well as psychological. Stroke victims learning to regain muscle control may be prescribed disco music to re-train the brain on rapid movement with rhythmic and propulsive marches to initiate it. Physicians may use waltz music to promote fluid movement, stride, cadence, and foot placement. Music is very important for promoting movement. People everywhere have an inclination to get up and dance to a good beat.

That music bridges the chasm between the isolated words of the mentally ill and that of reality is clear. Residents in a home for the mentally retarded gather weekly for a group therapy session involving music. Sitting in a circle and staring with unfocused eyes, participants seem lost in their own worlds and seem unaware of reality, or even of themselves. (Humphrey) A man with a guitar, standing in the middle of the circle, begins to play. He maintains eye contact while moving around, smiling broadly at each patient in front of him. Presently, his audience becomes more animated and begin clapping, nodding, and smiling with the music. Those who a few moments before were completely withdrawn, **"appear more aware of themselves and their surroundings"** (Humphrey). They are more focused and display new interest in what is going on.

Music especially connects with mentally handicapped children, particularly those with Down syndrome. It is also effective when counseling abused children or children with family problems because music helps children express feelings or experiences that they might not be able to articulate with words (See fig. 3). A child's short attention span often poses difficulties in an hour-long therapy session in which a therapist must make careful observations of the child's mood and behavior. Most children are unable to simply lie on the stereotypical therapist's couch and talk about their mother. Music provides common ground for the client and therapist to get to know one another and to develop a sense of security to allow the child to open up to their therapist. Playful tunes encourage a free flow of thoughts and colorful drums attract expressive freedom, all under the camouflage of play. (Nordoff-Robbins Center)

Another use of music is for during and after surgery. Often a physician or brain surgeon may be reluctant to prescribe pain medication for certain surgical patients. Instead, they suggest listening to certain music to ease the pain. This method is very effective because the body's limbic system controls the emotional outputs for both pain and music. Studies researching the limbic system suggest, **"the perception of both pain and music travel along similar neural pathways, each affecting the other"** (Browning, 272). Even with the use of anesthetics during surgery, listening to music in post-surgical recovery reduces the amount of painkiller needed afterward. This is because music **"significantly decreases the psychological and somatic stress response to acute stressors and acute pain in various medical settings… and significantly decreases chronic pain in patients such as musculoskeletal pain, low back pain, head ache and rheumatic pain"** (Hodges, Virtual Panel, 42). Dr. Ralph Spintage, an anesthesiologist in Lüdenscheid, Germany and executive director of the International Society for Music in Medicine explains that music stimulates the release of endorphins and other pain-killing hormones. **"By using music in theses ways,"** Dr. Spintage says, **"we have observed a reduction of costs associated with the length of treatment in intensive care units (ICUs) and general hospital stays, a decrease in the quantity of drugs needed, and improved patient**

compliance in following the treatment plan" (Hodges, Virtual Panel, 42). The director of Baltimore Hospital's coronary care unit asserts that half an hour of listening to classical music has the same effect as ten milligrams of valium. (McLean) In the University of Massachusetts Memorial Health Care, harp music is prescribed in lieu of tranquillizers for cancer patients (McLean) and doctors in other facilities may recommend music for childbirth because it has been shown to reduce the amount of epidural and sedatives needed and to calm the mother. In addition, babies in a hospital in Prove, Utah who regularly heard live singing gained more weight than those who did not. (McLean) This may be evidence for the adaptive befits of lullabies and motherly 'baby-talk,' which parents have used all over the world since the dawning of man.

Music also has a powerful calming effect on schizophrenics. A recent study at the University of California **"showed a fifty-nine percent reduction in auditory hallucinations in hospitalized schizophrenics who listened to music"** (McLean). This is useful information to the many institutions worldwide that deal with delusional and insecure patients everyday. Music has helped many desperate patients make meaningful progress towards a healthy life and has been **"used to draw those with autism and schizophrenia out of their private worlds"** (Elking). Many momentous breakthroughs are accomplished with the aid of music. For example a psychologist **"who was treating a cationic schizophrenic boy reported that the eleven-year-old cried on hearing Bach's '*Jesu, Joy of Man's Desiring*' and spoke for the first time in seven years to comment on the music"** (qtd. in Karr). Through further research, more will be learned about music and the schizophrenic mind.

Music has a great impact in diminishing the potency of other devastating genetic diseases. Performing exercises involving music, victims of Parkinson's disease begin to regain walking and motor skills. In 1994, a representative of Colorado State University said that, after three weeks, patients who participated in music-related exercises **"demonstrated longer stride length and improved gait velocity by an average of twenty-five percent"** (Bakker). Additionally, epileptics can reduce the extent of damage during a seizure if music is played for the period of its occurrence. This has been proven through experiments in which **"EEG [electroencephalogram] measurements taken while patients were having seizures have shown as much as a forty-one percent reduction in epileptic events while Mozart's k448 was being played"** (Simpson). An even greater effect is seen when patients with various ailments actively participate in music making. Sung music, **"has the potential to help rehabilitate the speech of people with neurological impairments, including people with aptaxia, dysarthria and expressive (Broca's) aphasia"** (Paul et al., 114) Music is versatile in that it helps to heal all of these neurological disorders.

Although the benefits of music in these situations are magnificent, stroke victims have probably benefited the most from music therapy and have experienced amazing break-throughs and development in their recovery to a healthy and wholesome life. Dr. Samuel Wong in 1990 gave up medicine to conduct and now directs various orchestras including the Hong Kong Symphony, the Honolulu Orchestra and the Mannes Orchestra in New York City. (McLean) As a physician, Dr. Wong worked at a veteran's hospital where he took care of many stoke victims. He recalls one particular man, age 65 and formerly brilliant, **"whose reason and memory were drowned in a river of blood during a stroke a decade ago"** (McLean). The patient barely moved, ate little and never spoke. He recognized no one. One day, Dr. Wong tried singing to the man an old Anglican hymn 'Come Down O Love Devine.' **"His faces stirs with recognition, his eyes begin searching, his breath quickens, his right hand twitches,"** Wong recalls. **"I sing another verse, and another…his breath has become irregular, his face human, his mouth tenses in an effort to speak; warm tears soak his eyes"** (qtd. in McLean). After that, Dr. Wong would sing every week, each time see remarkable improvement and **"awakening."** Although never speaking, the patient would often join in song with his **"feeble, egg shell voice."** Dr. Wong observes, **"through music, a ray of light seems to shine into his soul."** He accredits the exceptional influence of sound to the reality that **"when in the womb, unborn babies are in total darkness with nothing to do except listen."** Before birth, babies are unable to smell, touch, taste or see, but they are able to hear sounds from the outside world as soon as five months into pregnancy. During this time, the importance of sound is magnified and given special attention.

As mentioned before, marches and waltzes can be used to promote movement and, as with the genetic disorders, music helps stroke victims regain their speech and allows for communication. This specific branch of music therapy is called melodic intonation therapy. In this method, singing training is used **"to improve the respiration capacity of the lung, speech clarity, and coordination of speech muscles in clients with neuromuscular defects"** (Paul et al., 114). An example of how music can help a patient with communication is a man left completely paralyzed on his left side by a stroke. He rarely is able to speak and when he does, his speech is halting and he becomes frustrated with the effort. It is maddening for him **because "he can see the words, as if on a page, but he cannot release them into fluent speech"** (McLean). But the situation is completely different when he sings. In song, **"the lyrics come effortlessly,"** and he enjoys a **"delirious freedom"** as he communicates all of the thought and feeling he has been unable to express for the past days. Trying again to speak without the music, **"he wrings his hands, and sighs, 'I c-c-c-can't, c-c-c-can't g-g-g-get…Ach!'"** He is stuck again. A theory explaining why music allows patients to regain their use of words while singing suggests that, while language is only developed in the left portion of the

brain, music stimulates a wide area on both halves. (Elking) Therefore, if patients are paralyzed on one side, they may still be able to use their intact half to create meaningful words to use in dialogue. This concept works both ways and doctors have encouraged family members of patients to sing to their loved ones when trying to communicate as it is easier for the patient to understand.

It is important that the music used to treat stroke victims, as well as all patients treated with music therapy, be familiar and particularly enjoyed by each specific patient. The familiarity of the music provides a sense of security. In ideal situations, patients are given choices of what music they would prefer to use, so long as the rhythm, volume and tone of music match the exercises or activities they will perform. Researchers Miller, Thaut, McIntoch and Rice **"concluded that auditory cues enabled people to achieve a rhythmic, walking gait, and lead to stabilization of their posture and improvement in their reflexes"** (Paul et al. 114). However, this improvement is only possible if the patient is motivated and interested. Motivation is only accomplished by using music that is suitable for the individual, regardless of the therapist's personal preferences. The use of individualized music has led to the development of many variations on the general practice of music therapy to include such things as 'rap therapy' and even 'disco therapy.'

In recent years, researchers have developed new and technologically advanced ways of using music in physical therapy. Electronic musical instruments are now used because they can be attached to a computer to monitor the force with which the patient strikes it, allowing the therapist to have quantitative measurements of the patient's strength improvement. Electronic instruments can also be programmed to respond to very light touches, but still produce loud sounds, and with tones of virtually any instrument imaginable. This technology, used by professional musicians, is known as MIDI, or Musical Instrument Digital Information. Computer cables connected to an electronic instrument, commonly a keyboard or percussion set, run to a computer. When a patient strikes the instrument, it sends an electronic impulse to the computer, which interprets the stimuli and projects it as a note of the appropriate volume, length, pitch, and tambour. This highly developed technology has become quite popular in the treatment of stroke victims. This is because **"clients with limited physical ability often express anger, frustration and sadness because they are not able to control their environment."** Therefore, "**by providing clients with the ability to create sounds that are powerful and expressive, the clients can experience control and have a say or voice in their environment"** (Paul et al., 116). Further advances in technology have allowed therapists to attach the MIDI devices to electrocardiograms (ECGs), which then send electromagnetic signals to the sound computer at the patient's slightest movement. Through this technique, a therapist provides exhilarating hope for stoke victims who see **"that**

they are able to produce sounds even with their weak body movements and muscle contractions" (Paul et al., 115). This invaluable discovery motivates an often depressed patient to continue to endeavor in their rehabilitation. The more the patients succeed, the more movement they gain and the more varying sounds and patterns they are able to produce on the instruments. By slowly decreasing the sensitivity of an instrument or adding more components to the ensemble, an interesting and inspiring enjoyment is created of mundane exercises and patients are soon on their way to recovery.

That the medical community, including music therapist, understand the brain and the effect that music has on it is extremely important. In 1995, Dr. Frances Rauscher PHD, a psychologist from the University of Wisconsin, and neurologist Dr. Gordon Shaw, from the University of California, revolutionized music therapy and music education with the publication of their research on what is known today as the 'Mozart Effect.' (Demorest et al., 24) Their findings are important to advances in music therapy because understanding why music heals helps it become more effective. In their initial experiment, seventy-nine college students took a preliminary spatial intelligence test based on the Stanford Binet Intelligence Scale consisting of sixteen different exercises. (See example problem fig. 4) Then over the next three days, the researchers split the group into three smaller units. The first group of twenty-six listened to ten minutes of silence each day and then repeated the special reasoning test with different questions. The second group of twenty-seven listened to ten minuets of Mozart before retaking the test and the last group of twenty-six listened to ten minutes of minimalist music, dance music, and spoken text. In group two, there was a significant improvement from day one to day two as well as from day two to day three. The first group, which which listened to silence only, improved only from day two to day three. This would account for the effects of a learning curve. Despite any such curve, no difference at all was found in the third group's scores. (Demorest et al., 24)

In 1999, Dr. Shaw and Dr. Rauscher designed a follow up experiment in which they tested fifty-one preschool students over an eight-month period. (Morrison) Again, the students split into three groups after taking the initial test. The first group of nineteen received private piano/keyboard and singing lessons, the second group of seventeen received private computer lessons, and the third received no special training at all. By the end, the researchers found that **"music training—specifically piano instruction—is far superior to computer instruction in dramatically enhancing childrens' abstract reasoning skills necessary for learning math and science"** (Morrison). Students who had the private music lessons scored an average of thirty-four percent higher on the test. The researchers suggested schools spend more of their budgets augmenting music departments before spending it on the now popular technology campaigns.

After Dr. Rauscher and Dr. Shaw published their results, many other scientists, hoping to advance the field of medicinal music, were quick to follow with their own experiments. Published in 1997, Don Campbell's book Mozart Effect quickly made Dr. Rauscher's work popular and a massive revival of music-related studies developed nation-wide and around the world. Campbell trained as a classical musician with Nadia Boulanger in France and went on to found the Institute of Music, Health and Education in 1988. (Campbell, vi) He branched off original studies to find many new uses for music in the medical field. In his book, Campbell asserts that **"listening to Baroque music while studying can enhance one's ability to memorize spelling, poetry and foreign words"** (Campbell, 143). He also suggests that music helps the immune system by increasing **"levels of interleukin-1 (IL-1) in the blood from 12.7 to 14%."** Through further research scientists found that music did such wonders because **"it literally electrifies, at lightning speed, a web of nerve paths in both hemispheres of our cerebral cortex that connect the neural clusters processing musical pitch, harmony, melody, short-term memory, long term memory, and emotions"** (McKay). In addition, Dr. Gottfried of Beth Israel Deaconess Medical Center in Boston found that the cerebral cortex of a musician is larger, on average, than that of someone who has never played a musical instrument. (Allen) Confirming this information, Donald Hodges states, **"the auditory cortex, which responds to piano tones, was twenty-five percent larger among experienced musicians; the effect was greater for those who started playing at an early age"** (Hodges, Implications, 19). Many researchers discovered that the longer one is involved in music the greater impact it has on the individual and the greater impact it may have in healing.

Another attractive discovery was that different components of music are processed by various areas of the brain. There is no one specific 'music section' of the cortex, proving the wide range of areas that therapists can treat with music. David Breitling and his colleagues found that there is **"a predominance of left mid-temporal activation during the processing of a note and scale, whereas melody processing evoked a predominant right mid-temporal activation"** (Flohr, et al., 29). Although most of the components of music have their own specific regions of the brain, the area for detecting musical rhythm is the same as that for visual light impulses and rhythmic touch stimuli. In comparing the brain's reaction to playing scales to the reaction to one's playing Bach's Italian Concerto, researchers observes that **"certain brain areas are active specifically for musical performance"** (Hodges, Virtual Panel, 40). Simple listening stimulated the auditory association area in the right temporal cortex, while music performance used the left lateral cerebellum and the supplementary right motor area required for the finger movements of playing. Therefore, for music to have its full effect, therapist must actively engage their patients in the *creation* of

music. Knowing exactly where and how music acts on the brain helps scientists and doctors develop better methods of healing

During music performance there is a deactivation of other parts of the brain that the musician is not directly using. This demonstrates the state of extreme concentration musicians use in performance and is typically associated with the processes of self-consciousness, judgment, goal setting and rationality, which are major focal points in therapeutic sessions. On a general basis, musicians use less mental energy for ordinary mental tasks, so in fact, they need less brainpower and complete mental processes more effectively. (Hodges, Virtual Panel, 40) Andrea Halpern, cognitive psychologist and Bucknell University, along with her colleague Robert Zatorre showed that areas active in the brain while listening to music are also active when imagining it played. This includes areas responsible for auditory information. Therefore, in a sense, one truly does 'hear' songs in one's head. (Hodges, Virtual Panel, 40) If needing immediate support when not in scheduled sessions, patients may simply imagine the music that helped them in therapy and, to some extent, obtain the same desired effect.

Education Secretary Richard Riley followed 25,000 students over ten years and found that those students with high levels of participation in instrumental music scored higher on math tests by twelfth grade. Results were regardless of parents' income or occupation, although logically more available money leads to more numerous and higher-quality opportunities for children. Neurologist Franck Wilson says that he is **"convinced that all of us have a biologic guaranty of musicianship"** (Campbell, 51) and for this reason music therapy has the potential to help everyone whether or not they have studied it in the past.

Music seems to be closely associated with learning curves. In preliminary studies, **"rats exposed to Mozart in the uterus have shown improved aptitude for navigation around a t-maze"** (Simpson). The pattern holds true for students. In 1990, the National Education Longitudinal Study conducted by the National Center for Education Statistics in Washington D.C. discovered that **"music participants received more academic honors and awards than non-music students, and the percentage of music participants receiving A's, A's/B's and B's was higher than the percentage of non-participants receiving those grades"** (Simpson). These were a tremendous discovery for the music educators of the world. For the therapist, the discovery meant the potential to create more efficient sessions and gain quicker results.

Soon after their publications, the new theories were being put to use. Music educators now use the finding to vie for extra funding for their programs and **"AT&T and Dupont have cut training time in half by using creative music programs"** (Campbell, 50). After hearing the findings, Governor Zell Miller, a devoted country music fan,

decided he wanted **"all Georgia newborns to have the chance to listen to soothing classical music"** (Demorest et al., 34). His ambition was to enhance the brainpower of his state. On January 13, 1998, he asked the legislature to pass a bill that would appropriate $105,000 in tax dollars to buy CDs or cassettes of specially selected classical music. His intent was eventually to have every child in Georgia have access to and listen to classical music on a regular basis. Most importantly, therapist began to use the 'Mozart effect' as a foundation for clinical treatment.

The question became whether these new findings meant every mother should rush out to the store to purchase one of the many 'Baby Mozart' CDs that were now readily found on the market. Dr. Rauscher and Dr. Shaw's discoveries met as much opposition as they gained publicity. Although listening to the music of a genius certainly never hurts, some researchers have their doubts if it is really worth all the excitement. Music is one of the *many* things that are beneficial to a newborn baby's life. The issue on many skeptics' minds was whether all of these wonderful 'intelligence boosts' were really a result of music study or if the situation were really the reverse. They pointed out that students who make the effort to volunteer for these studies may be more motivated to do their schoolwork anyway. (Demorest et al., 33)

Researchers opposing the Mozart Effect also point out that, in previous studies, participants volunteered and wanted to take part and therefore were more willing to work hard. The studies may "tell us more about our students than about the effects of music" (Demorest et al., 36). Students who are the strongest academically will be more likely to remain participants of music because it will have less of a chance of lowering their grades. Students who struggle in school cannot afford to have other endeavors to distract them. It may be that music does not improve the student, but rather the improved student enjoys more musical activities. However, this does not explain the result Dr. Rauscher found in preschool children who would not be greatly affected by the pressures of academics.

No one disputed that 'music makes you smarter.' Undoubtedly, when one learns music one gains knowledge in that area and thus will be considered smarter, but **"there is an implicit assumption that 'smarter,' means 'smarter at something else'"** (Demorest et al., 33). Although many have repeated Dr. Rauscher and Dr. Shaw's experiments with success, many have also failed. It is true that music students scored higher of the standardized tests and **"it is tempting to conclude that music must be a consequential variable in elevating student achievement"** (Demorest et al., 36). However, other arts may be just as valuable in raising students' test scores. In studies, drama proved very effective in this way (See fig. 5) and although music studied over the course of four high-school years improved SAT scores, continuous foreign language study made an even bigger impact. (See fig. 6)

The biggest opposition to Mozart effect findings came from Christopher Chabris from Harvard Medical School. He conducted a study of elementary students in which one group elected to begin fifth-grade instrumental music and the other did not. Using the Comprehensive Test of Basic Skills (CTBS) he found that **"music participants did, indeed, score higher as sixth grade students"** (Demorest et al., 38), but the same students also scored higher as fourth graders before entering the band program. He concluded that those that score higher, join band and not the other way around. Chabris conducted sixteen other experiments and studies and when he analyzed the results involving 714 people he found that **"any rise in IQ after listening to classical music was statistically insignificant"** (Chabris et al., 827). He avidly challenged Dr. Rauscher and Dr. Shaw, and accused them of having defective practices and prejudiced results.

Other experiments were performed by cognitive neuroscientist Dr. Lawrence Parson from the Research Imaging Center at the University of Texas Health Science Center in San Antonio. He worked to find the exact neurological reasons for Dr. Rauscher and Dr. Shaw's results. He wanted to know if **"enhancement of special ability is caused by music as a whole or if it is primarily due to one or more musical components (tone melody or rhythm)"** (Hodges, Virtual Panel, 44). He and his colleagues content that **"only rhythm and not melody or tone produced enhancement. In addition, enhancement was found for the rhythmically patterned visual stimulus suggesting that the effect is not limited to tonal stimuli"** (Hodges, Virtual Panel, 44). These findings, if correct, would affect the results of research performed by most of the earlier scientists.

Criticism regarding the methods used in the original 1999 studies was very concerning. Rival researchers considered mothers who signed up their preschoolers for studies more likely to encourage their child to do well in school and practice their instruments. There were complaints that the researchers conducted their studies with no report of subjects' musical background or previous training and that they only used one musical composition by Mozart, rather than many compositions

Despite all of the accusations, Dr. Rauscher and Dr. Shaw **"defend their results, claiming that their study has been misinterpreted"** (Chabris et al., 828). The say they never implied that listening to music would raise IQ scores or even SAT scores. Their research only concerned the results of the special reasoning test and any additional hypothesis are yet to be tested. The phrase 'music makes you smarter' is in fact not their own and comes from record companies' desires to increase their revenue by appealing to new mothers. (Campbell, 275) In response to complaints about their method, Dr. Rauscher and Dr. Shaw insisted that, in fact, they did test other assorted compositions as represented in the third experimental group that listened to minimalist music, pop, and speech. The findings from this

group also contradict Dr. Laurence's statement that only rhythm had any influence in improving scores because the music listened to by the third group was rich in rhythmic qualities. Despite this fact, their scores on the tests did not significantly improve like those of the group that listened to classical music. (Campbell, 275)

In addition, if parents who enroll their children in studies give more encouragement, then how does one account for the group of children that did not receive music training and did not improve on tests? Their parents were just as likely to encourage them, and yet they showed no marked improvement. Dr. Rauscher and Dr. Shaw were also careful to test participants before continuing the experiment to get a baseline for score improvement. The students they used all had roughly the same scores on the initial test. This would prevent the effect that Chabris spoke of in his more advanced elementary students' electing to take instrumental music. Through many pressures, the research of Dr. Frances Rauscher and Dr. Gordon Shaw has persevered. Many questions remain unanswered, but more research is yet to take place. For now, their discoveries have proved to be of great value to the music therapy community.

One last concern remains in the music world concerning all recent finding about the Mozart effect and other advances in music therapy. Many music educators would rather have students study music for the sake of the music itself, regardless of the effects it may have in other studies. Studying music for its benefits in math makes music education appear second rate, but many musicians want to stress that music is just as important when taken alone. Musicians are worried about over-enthusiastic conclusions being used to pull for better music education, when the real reason should be the music itself. If the only important thing is academic advancement, and listening to music is all one must do to advance spatial reasoning, then a school need only pump in music over the intercom and their educational obligation would be filled. This is simply not the case. The purpose of music education is the musical experience itself, and musicians complain that music as medicine takes away from its purity as an art form. (Marguis)

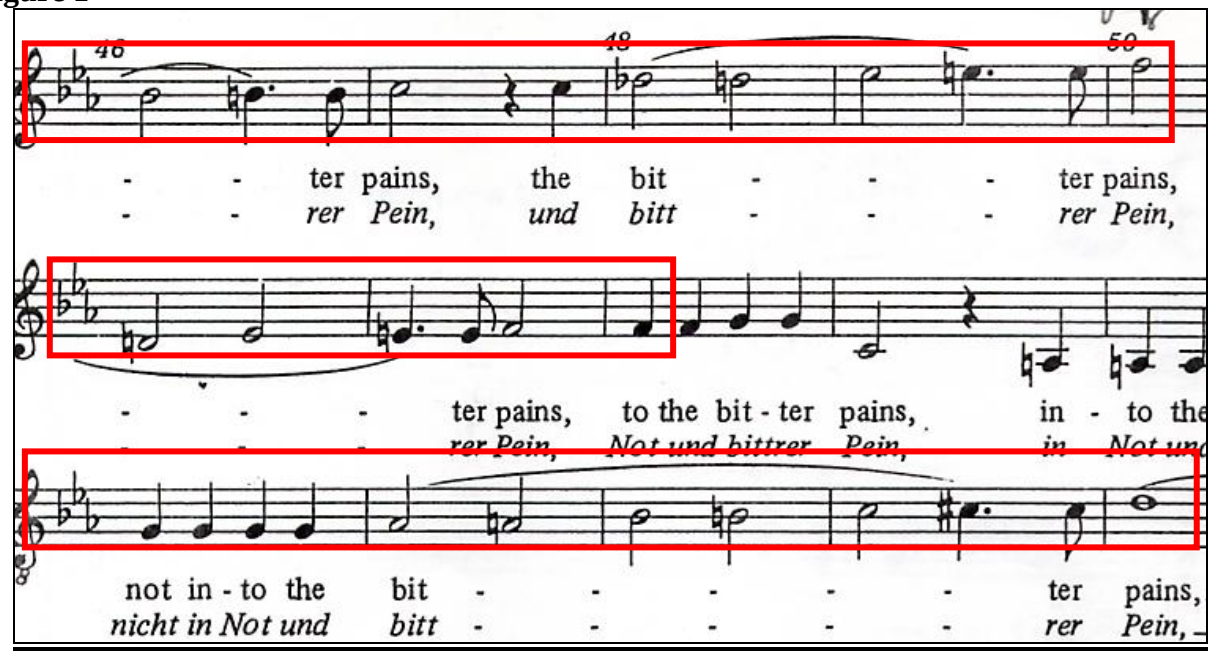
As exciting as musical discoveries about our psyche are, one must not lose sight of the value that music has of its own merit. It is important to note, following Chabris's discoveries, that indeed **"academically successful students value music education and choose to spend their time making music"** (Demorest et al., 38). These students do not care if music will improve their test scores, but participate merely for the enjoyment of it. In high schools, music participation has a steadily declined as the emphasis shifts to academic advancement and collage admission. Less than three percent of seniors take music lessons outside of school compared to eleven percent of sophomores. (Hartman) Only twenty-nine states require music and other arts for graduation and of those **"twenty five allow requirements to be met with fewer than two units"** (Hartman). But students are being denied the opportunities they desire and need in order to have the well-rounded and healthy life achieved through music. In

contrast, Japan's Ministry of Education **"mandates that every child, grades one through nine, receives two hours per week of sequential music instruction"** (Hartman). Their reasoning is that music is a staple part of all people's lives and is a necessity for their children.

Despite all of the controversy, certain facts remain. Humans are intensely musical and have an innate affinity towards it. This attraction makes music beneficial when dealing with mental and bodily ailments and promoting intellectual advancement. The more students are involved in music, the more future musicians we will have and the more highly trained therapist there will be for desperate patients who depend on music therapy to keep living. Although the amount of neuromusical research **"is still a small amount compared to the study of language, for example,**" (Hodges, Implications, 22) continued research and efforts will bring innumerous benefits. Neuromusical research is essential and **"supports the notion that music is a unique mode of knowing…and is disassociated from linguistic or other types of cognitive processes"** (Hodges, Implications, 22). Using music in research, scientist can learn exclusive information about the brain because of its unique interactions in the cerebral cortex. It is important that educators develop the skills and interests needed for these studies while children are at an early age so that lessons learned will stay with them to adulthood. The music students of today will be the physicians saving the world tomorrow and come exam time, I will definitely be listening to a whole lot of Mozart.

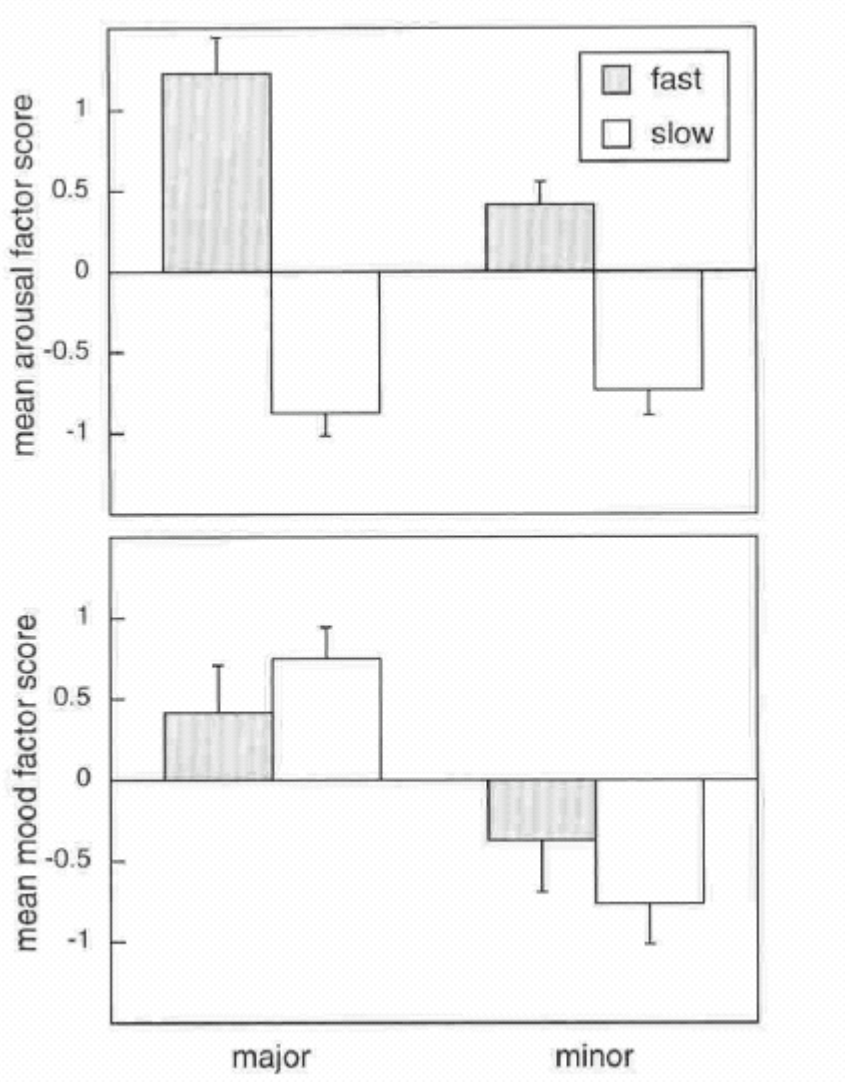
Appendix

Figure 1



Measures forty-six through fifty of 'In the midst of life' from Henry Purcell's *Funeral music for Queen Mary*. The progression is a slow rising phrase in half-step increments over the word 'bitter' (noted by red outlining).

Figure 2



2

Charts showing the mean arousal (above) and mood (below) as a function of manipulations of tempo and mode. Positive scores indicate above average increases in arousal or improvement in mood after listening to the music. Negative scores indicate intensified depressions. Error bars represent standard errors. (Husain, 163)

Figure 2.1

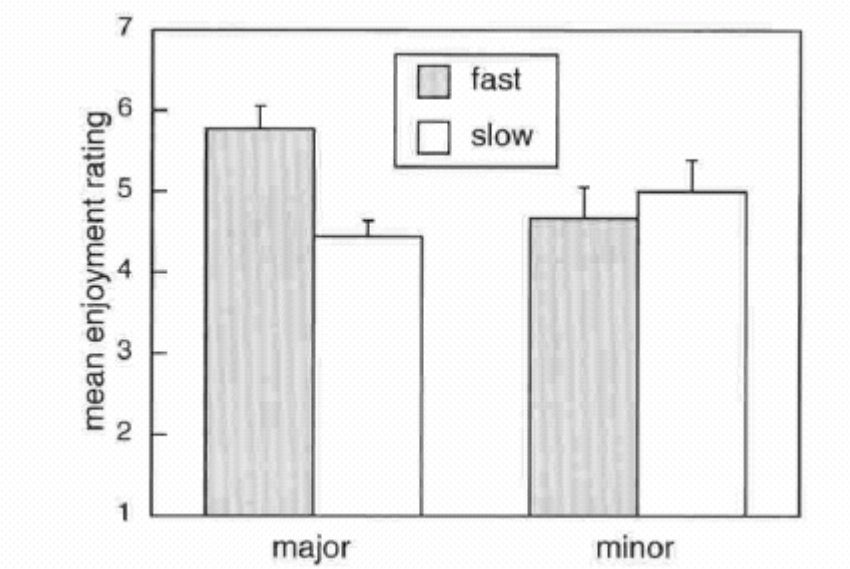
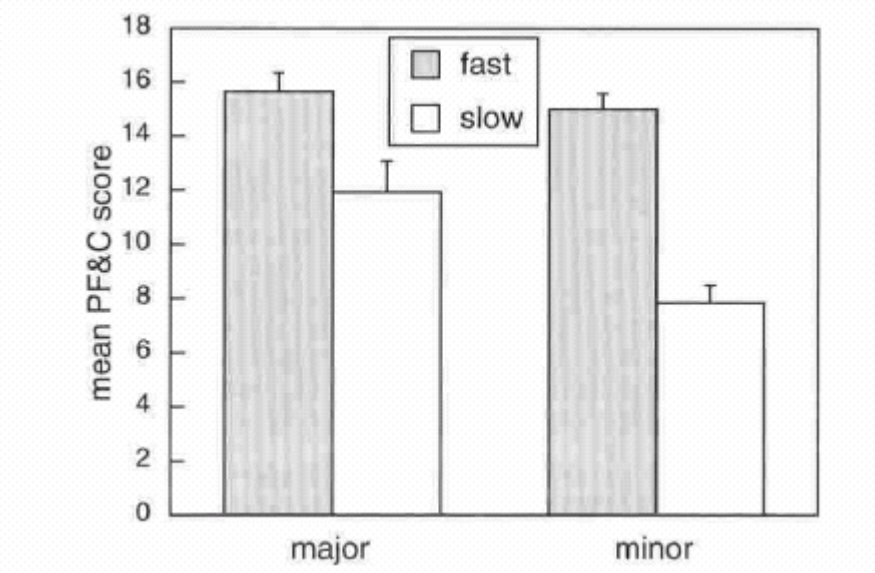


Chart showing mean enjoyment rating as function of the tempo and mode manipulations. Error bars represent standard errors. (Husain, 164)

Figure 2.2



Mean scores on spatial reasoning test as a function of tempo and mode. Error bars represent standard errors. (Husain et al. 160)

Figure 3

A scene from a therapy session at the Nordoff-Robbins Center for Music Therapy **(Nordoff-Robbins Center)**

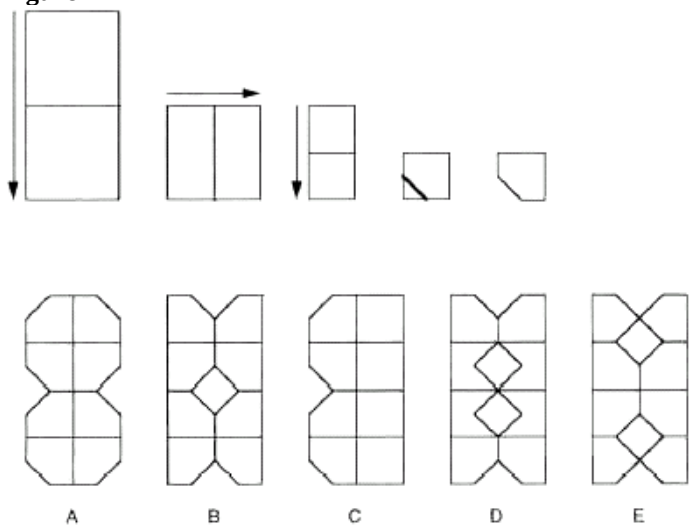
Figure 3.1

Children discovering music with their therapist (O'Neill)

Figure 3.2

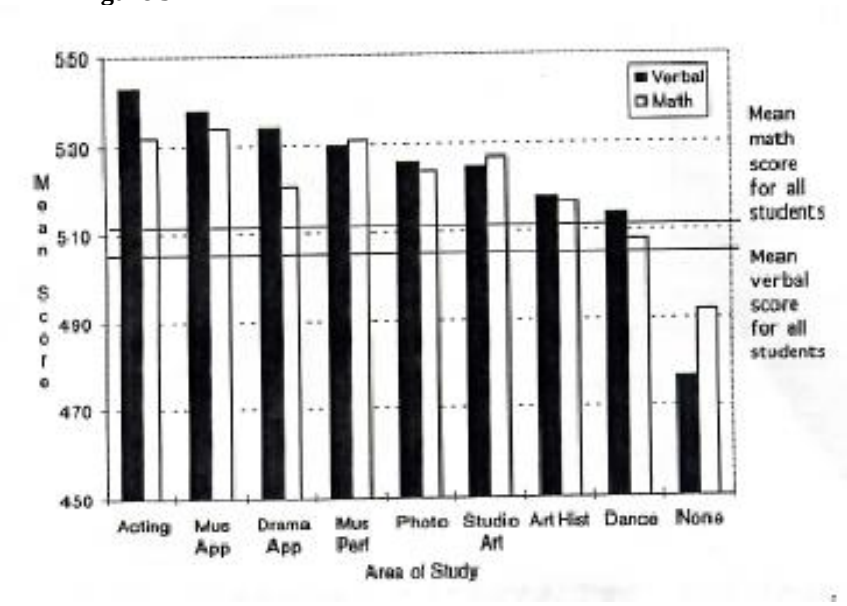
Teacher Hoelzley with student Mitchell—He caught her attention with simple tunes. (O'Neill)

Figure 4



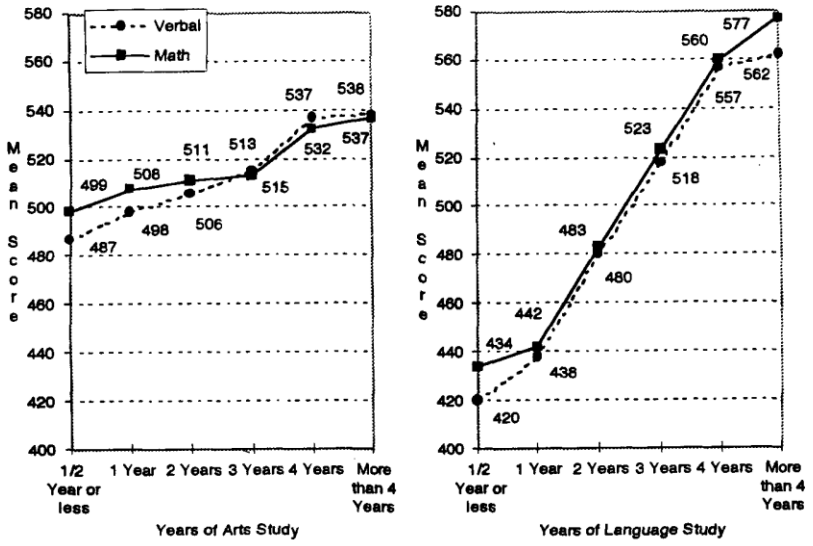
Multiple choice paper folding and cutting (PF&C) task—a typical problem on a spatial reasoning test. Correct answer: B. (Husain, 158)

Figure 5



Average SAT scores for fine arts students in 1999 (Demorest et al., 36)

Figure 6



Average SAT scores over a four year period of students of fine arts (left) and foreign language (right) in 1999 (Demorest et al., 37)

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