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1) PILOT STUDY INVESTIGATING THE ROLE OF TEMPO IN MUSIC THERAPY INTERVENTIONS TO REGULATE AND PACE THE SYSTEM AND REDIRECT REPETITIVE BEHAVIORS IN AUTISM

Dorita S. Berger¹ and Matthew Goodwin²

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Many behaviors in children on the Autism spectrum resemble fight-or-flight avoidance responses as a result of habitual states of fear, possibly induced by sensory integration issues causing on-going stress and deregulation of systemic pacing.

HYPOTHESIS: Structured tempo-based rhythm interventions at 60-beats per minute, designed to address systemic deregulation in autism can serve to regulate and/or induce systemic pacing, reducing repetitive anxiety behaviors and enabling focus and calm in persons on the Autism spectrum. Eight-week pilot study investigated whether (and how) the role of tempo in activity-based music therapy treatment could influence habituation (entrainment) to regulated systemic inner rhythms, coordinating pacing, reducing stress, anxiety, and repetitive behaviors and yielding eye-contact, attention, motor-planning, and memory. Six young subjects ages 8-12 with minimal expressive language, and diagnosed with Autism were selected to undertake four structured interventions including breath control, regulation of arm movements, upper-lower body coordination, and drumming, each task repeated four times to a rhythmic pattern at 60-beats per minute tempo, during each 45-minute individual music therapy session per week, for eight weeks. A rating scale sheet was devised to rate performance ability and progress in vivo, during each session. Sessions were also video-taped for follow-up ratings to confirm or modify in-vivo rates. In addition, a Lifeshirt heart-monitor vest with embedded wireless sensors was worn by each subject in the first, fifth and eight session, to monitor heart-rate data during those sessions.

Results show excellent progress and regulation in task undertaking by each of the six subjects, with increases in motor planning, visual contact, attention and reduction of repetitive behaviors. Heart Rate data over the three sessions in which the vest was worn, indicate that a level of entrainment and regulation was taking place. Results tend to lend support to the hypothesis that highly structured, tempo-specific rhythmic activities at a slow tempo (60 beats per minute in this case) can bring about systemic pacing to reduce anxiety behaviors and yield functional adaptation.

2) AUDIO THERAPY SIGNIFICANTLY ATTENUATES ABERANT MOOD IN RESIDENTIAL PATIENT ADDICTION TREATMENT: PUTATIVE ACTIVATION OF DOPAMINERGIC PATHWAYS IN THE MESO-LIMBIC REWARD CIRCUITRY OF HUMANS

Kenneth Blum⁴, Siohban Morse⁵, John Giordano⁶, B. William Downs⁷, Roger L. Waite⁷, Margaret Madigan⁷, John Bailey⁸, Kenneth Perrine⁹, Eric R. Braverman⁴, Uma Damle⁵, Monty D. Moeller⁷, and Thomas Simpatico⁸

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Using fMRI, Menon and Levitin clearly found for the first time that listening to music strongly modulates activity in a network of mesolimbic structures involved in reward processing including the nucleus accumbens (NAc) and the ventral tegmental area (VTA), as well as the hypothalamus, and insula, which are thought to be involved in regulating autonomic and physiological responses to rewarding and emotional stimuli. Importantly, responses in the NAc and VTA were strongly correlated pointing to an association between dopamine (DA) release and NAc response to music. Listing to pleasant music induced a strong response and significant activation of the VTA-mediated interaction of the NAc with the hypothalamus, insula, and orbitofrontal cortex. Using the neurochemical specificity of [(11)C] raclopride positron emission tomography scanning, combined with psychophysiological measures of autonomic nervous system activity, Salimpoor et al. found endogenous dopamine release in the striatum at peak emotional arousal during music listening. The caudate was more involved during the anticipation and the nucleus accumbens was more involved during the experience of peak emotional responses to music. These results indicate that intense pleasure in response to music can lead to DA release in the striatal system at approximately 9% over rest. Notably, the anticipation of an abstract reward can result in DA release in an anatomical pathway distinct from that associated with the peak pleasure itself. It is of interest that food increase DA...
release in the NAc at 6% whereas cocaine increases DA release at approximately 22%. Blum et al. provided the first evidence that the dopamine D2 receptor gene (DRD2) Taq 1 A1 allele significantly associated with severe alcoholism whereby the author's suggested that they found the first "reward gene" located in the mesolimbic system. The enhanced functional and effective connectivity between brain regions mediating reward, autonomic, and cognitive processing provides insight into understanding why listening to music is one of the most rewarding and pleasurable human experiences. However, little is known about why some people have a more or less powerful mesolimbic experience when they are listening to music or possibly sound therapy (audio). It is well-known from the work of Goldstein that music may induce an endorphinergic response that is blocked by naloxone, a known opioid antagonist. Opioid transmission in the NAc is associated with DA release in the VTA. Our laboratory embarked on the evaluation of pleasant audio therapy in addicted patients undergoing recovery in our in-patient facility. A program known as Chill uses vibrational sounds to gradually guide brainwave states to deeper levels of relaxation, where the neural chemicals that help heal stress-related damage are released, and the mind can enter a meditative state. We found significant improvements in the following behaviors and physical ailments: cravings; stress; depression; mood swing; anxious; resentful; anger; fearful; body aches and headaches. This analysis was obtained one-hour half after the audio therapy and was compared to the initial Pre-score. Moreover, DA release in the VTA is linked to polymorphisms of the DRD2 gene whereby carriers of the DRD2 A1 allele show a reduced NAc release of dopamine (DA). Thus it is conjectured that similar mechanisms in terms of adequate dopamine release and subsequent activation of reward circuitry by listening to music might also be affected by an individual's D2 density in the VTA mediated interaction of the NAc. Subsequent genotyping these participants and others for the presence of the DRD2 A1 allele is on-going. This will provide important specific genetic information as to the benefits of music/audio therapy as function of genomics rather than simple guessing. Positive outcome of this work will unequivocally support our earlier hypothesis that carriers of DRD2 A1 allele may respond significantly differently to carriers of the DRD2 A2 genotype. If music/audio causes a powerful activation in spite of the DRD2 A1 allele due to a strong DA neuronal release which subsequently impinges on existing D2 receptors, then it is reasonable to assume that music is a strong indirect D2 agonist (by virtue of DA neuronal release in the NAc) and may have important therapeutic applicability in Reward Deficiency Syndrome (RDS) related behaviors including Substance Use Disorder (SUD). Ross et al. found that music therapy appears to be a novel motivational tool in a severely impaired inpatient sample of patients with co-occurring mental illness and addiction. Our initial findings support their concept.

3) EVALUATING THE BENEFITS OF PERSONALIZED MUSIC LISTENING PROGRAMS VIA MP3 PLAYERS FOR NURSING HOME RESIDENTS AND THEIR CAREGIVERS

Dan Cohen and Concetta Tomaino

Institute for Music and Neurologic Function, Bronx, NY
Music & Memory, Mineola, NY

Pilot study to evaluate the impact of MP3 players on the burden of caregiving for nursing home residents 25% (50) of whom had Alzheimer's and other forms of dementia; plus 150 non-dementia residents. Age range 28-92. All 33 professional staff across four New York metropolitan area facilities noted improvements in mood and behavior of residents. Survey addressed following questions from those residents who were able to self-report and staff: importance to residents of listening to music on their iPod, improvement in the way residents think or feel, likelihood residents would recommend fellow residents had similar iPod access, and most frequent therapeutic outcomes reported by staff. As a result, because of the positive outcomes of this approach, the Institute for Music and Neurologic Function (imnf.org) and Music & Memory (musicandmemory.org) are collaborating to facilitate usage of digital music players via Well-Tuned: Music Players for Health.

4) MUSIC THERAPY AS AN EARLY INTERVENTION IN PATIENTS WITH FRAGILE X SYNDROME

Isabel Fernandez-Carvajal and David Aldridge

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Nordoff-Robbins Zentrum, Witten, Germany

Fragile X syndrome (FXS) is the most common form of inherited intellectual disability. The syndrome is caused by a mutation in the Fmr-1 gene on the X chromosome that is unable to synthesize fragile X mental retardation protein (FMRP) with special consequences for the development of the central nervous system (brain and spinal cord). The FXS phenotype usually appears as developmental delay, ranging from learning disabilities to more severe intellectual disabilities and delays in speech and language development. Symptoms also can include characteristic physical (large
ears, narrow jaw, connective tissue problems and macroorchidism) and behavioral disorders: hyperactivity, attention deficit, anxiety and autistic behaviors (poor eye contact, hand flapping, and poor social skills) and delays in speech and language development. Only about 30% females have cognitive delay, usually to a lesser degree than males. Although no cure is yet available, an early diagnosis is essential for prevention, genetic counseling, and an individually based integrated therapeutic program including a range of therapeutic interventions (speech therapy, music therapy) is proposed. These programs should begin early. Music, through singing and play-songs promotes communication, particularly verbal skills through social interaction. Musical resources promote attention and encourage interpersonal sequences of structured activity. These resources also concentrate upon sensory integration and an understanding of arousal levels and fine motor needs. Music therapy emphasizes active listening and performing. Musical playing demands the skill of hand-eye co-ordination that has a significant role in developmental changes and is a suitable integrative psychosocial treatment for children with fragile X syndrome.

5) CHANGES IN BRAIN FUNCTION AFTER MUSIC-SUPPORTED STROKE REHABILITATION FOR UPPER LIMB

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²University of Toronto, Toronto, Ontario, Canada

Our magnetoencephalography (MEG) research show that musical timing processing such as meter and beat activates motor and memory systems even in passive listening. In music playing, timed action planning guided by musical memory plays a crucial role. Thus we hypothesize that neural mechanisms underlying such multimodal neural activity encourages multimodal cortical reorganization in damaged brain by stroke. We have examined the effects of music-supported motor rehabilitation for the affected upper limb in chronic patients in our case-based study. Specifically we probed somatosensory, motor, and auditory memory functions using various MEG mapping techniques. Results show an improvement in the arm and hand movement as well as massive multimodal shifts from abnormal to normal response patterns at post-intervention in the single case.

6) EMOTION RECOGNITION IN MUSIC: A DAT CASE STUDY

Lise Gagnon¹, Véronique Provencher², Nathalie Gosselin³, and Nathalie Bier²

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Some studies have demonstrated deficits affecting emotional judgments of facial expression and prosody in Dementia of the Alzheimer Type (DAT; e.g. Kohler et al., 2005). We already observed spared emotional judgments of music with a group of early DAT participants (Gagnon et al., 2009). The case study of EN (Cuddy & Duffin, 2005) showed relatively spared perception and memory for music. Through the early DAT case study of M.D., we addressed here again the question of whether DAT might leave music perception as well as emotional judgements intact. M.D.’s perception and memory for music were assessed through the Montreal Battery of Evaluation of Amusia. Her music emotional judgments were specifically examined for the happy-sad distinction on the basis of mode and tempo manipulations. Finally, we examined M.D.’s recognition of music emotional expressions of happiness and sadness, but also of fear and peace. M.D. preserved music perception and memory. She employed tempo better than mode as a cue for the happy-sad distinction, and preserved overall recognition of musical expression, including the one of fear. However, M.D. and healthy elderly controls recognition of sadness has been more easily confused with peacefulness (for M.D.) and/or fear (for healthy elderly). Results of this case study add to other empirical demonstrations that, in early DAT, music emotional judgments, as well as music perception and memory may be relatively preserved. Difficulties observed with specific emotions even in healthy elderly suggest that further studies should examine if changes in music emotional judgements may appear in normal aging.
7) MUSIC INTEGRATIVE NEUROTHERAPY™ IN MOOD, PERSONALITY, AND SLEEP

Alexander J. Graur
Medicamus Italiana Torino, Turin, Italy

Music Integrative Neurotherapy™ is an applied Neuroscience therapy, an interdisciplinary method including Music (as a science), Medicine (Human Anatomy and Physiology, Neuropsychiatry, Neuropharmacology), Molecular Biology and a Quantum Mechanics model to design the therapy. The method use the Brain-Mind-Brain-Organism system’s proprieties as the mechanics of feed-forward and feedback of the information. The method is multimedia (Audio and Visual); the therapeutically material is presented in a Virtual Reality-like form (with interactive visual technology). Music Integrative Neurotherapy™ is not the usual “relaxing” music. It is not a music made for entertainment and used incidentally as a therapy. It combines the rules of music science with the medical data of each patient, to create music related to the patient’s unique condition. A personalized therapy, based on the fact that each disturb has three main aspects: the general (for example: Anxiety Disorder), the specific (for example: Anxiety Disorder- General Anxiety Disorder (Panic Attack), and a personal aspect (the way the disease acts in each patient according to her/his specific physiological and psychological data). Music Integrative Neurotherapy™ is a complementary therapy, not an alternative therapy. It helps to reduce and eliminate the side effects of many medications; it helps to speed up the action of the drug, while reducing its side effects. It is applied in Psychiatry (Mood and Personality Disorders), Neurology (Sleep Disorders and rehabilitation post-cerebral palsy), Dental Anesthesia and post-stroke rehabilitation. The poster session will present the applications and effects of the method in some psychiatric and neurological disturbs, the specific clinical assessment, the structure of the material and the results of the therapy.

8) MUSICAL TRAINING AND THE AGING AUDITORY SYSTEM: IMPLICATIONS FOR COGNITIVE ABILITIES AND HEARING SPEECH IN NOISE.

Alexandra Parbery-Clark, Emily Hittner, Dana Strait, Samira Anderson, and Nina Kraus
Northwestern University, Evanston, IL

Human communication rarely occurs in optimal environments; rather, we are often surrounded by background noise. Understanding speech in noise is a challenge for everyone and it becomes increasingly difficult as we age. This age-related decline in speech-in-noise perception cannot be fully accounted for by peripheral hearing ability; biological aging of the central auditory system and decreased cognitive skills also contribute to the difficulty older adults experience when listening in noise. Musical training strengthens the perception of speech in noise in young adult musicians, but it has not yet been determined if these benefits extend across the life span. Here, we investigated the effects of musical training on speech-in-noise perception in middle-aged adults by comparing the performance of musicians and nonmusicians between the ages of 45-65 years. Consistent with the findings in young adults, middle-aged adult musicians demonstrated better behavioural speech-in-noise performance, more acute temporal resolution skills and higher auditory working memory ability. Our results indicate that musical training may mitigate the impact of the age-related cognitive and perceptual decline, specifically for the perception of speech in background noise.

9) ALTERED FMRI BRAIN ACTIVATION WITH MUSIC MEMORY IN ALZHEIMER DISEASE

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Musical Memory is relatively preserved in patients with Alzheimer Disease (AD). The neural substrates involved in musical memory are not well understood. In the current study, we investigated the brain regions involved in music processing and recognition in AD compared to normal controls with functional MRI imaging. Five patients with mild to moderate AD (MMSE 9-26) and 5 age-matched controls were studied. We used a block design paradigm with 45s of familiar music excerpts followed by 30s of silence vs. the same excerpts consisting of randomly scrambled 300-500ms segments concatenated back to 45s. A mixed-model 2X2 ANOVA was used to compare group (controls vs. AD) and stimulus
(familiar melodies vs. scrambled) differences using a p-value of 0.01 and minimum cluster size of 200 μL. We found significant interaction effects in fMRI activation patterns in AD subjects vs. controls in several areas during passive listening, with the largest differences in the right middle and superior temporal gyrus, left cerebellar declive, and left superior and medial temporal gyrus. AD subjects showed a significantly decreased activation in these areas in response to familiar intact vs. scrambled melodies, whereas controls showed a significantly increased activation in the same areas in response to these listening conditions. AD subjects and normal controls showed different brain activation while listening to familiar melodies. This may suggest recruitment of novel brain areas for music processing in AD. Further exploration of brain response to music in AD may allow utilization of music as a diagnostic and therapeutic tool in AD.

10) A COMPARISON OF MUSIC THERAPY AND PLAY INTERVENTIONS FOR INCREASING ON TASK AND REQUESTING BEHAVIORS IN YOUNG CHILDREN WITH AUTISM

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In 1999, music therapy was excluded from state recommended interventions for young children with autism in New York. The State cited a lack of defined procedures used in music therapy and absence of efficacy in research using generally accepted scientific methodology as rationale. In response to that report and subsequent loss of funding for early intervention music therapy, this study was completed. This single-subject alternating treatments design investigated on-task behavior and requesting behavior in six children, ages 2- and 3-years-old and diagnosed with autism spectrum disorder, comparing music therapy interventions to play. Prior to the first session, music instrument preference and toy preference assessments were administered. Subjects were videotaped during twelve 30-minute one-to-one sessions led by one of the principal investigators. In each session the subject was engaged in 15 minutes of music therapy and 15 minutes of playtime. Playtime was defined as attempts to interact with the child using toys and verbally responding to the child's non-verbal or verbal interactions. Music therapy was defined as using songs, instruments, vocal sounds and movement to interact with the child and musically or verbally responding to the child's verbal or non-verbal participation. The order was randomized and counterbalanced. Both individual and group data analysis indicated that the children were on task for significantly more time during music therapy than in play time. No significant difference was found in rate of requesting behaviors. One possible explanation is that the longer lengths of engagement in music therapy reduced the children's need for new requests.

11) NEURAL DYNAMICS OF BEAT PERCEPTION

John R. Iversen and Aniruddh D. Patel

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Humans possess the unusual ability to move in time with rhythmic sound. This ability is increasingly being used successfully in gait therapy for individuals with movement disorders, such as Parkinson's disease or stroke. However, the mechanisms underlying this fundamental form of sensorimotor interaction are poorly understood. The goal of our research is to determine the neural mechanisms underlying human ability to synchronize their movements with sound, knowledge that is hoped will enhance the therapeutic use of music to treat movement disorders. To study the detailed temporal dynamics of the brain network involved in beat perception (a necessary precursor to motor synchronization) we measured brain responses as participants listened to a repeating rhythmic phrase, using magnetoencephalography. The beat that the listener feels is endogenously generated, and is hypothesized to arise in the motor system, based on prior fMRI imaging studies. In separate trials, listeners were instructed to impose a beat at one of three different phases in the rhythm. The endogenous beat could coincide with a note, or with a silent position (yielding a syncopated rhythm). Since the stimulus was unchanged, observed differences in brain activity between the conditions should relate to the active generation of the beat. Using independent component analysis, we identified responses that tracked the endogenous beat, and those that instead tracked sound. Preliminary analysis of evoked responses (n=4) revealed beat-related activity in premotor cortex and sound-related activity in temporal cortex in all cases, consistent with the involvement of the motor system in beat perception.

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MUSIC-BASED SOUND STIMULATION IN PEDIATRIC ACQUIRED BRAIN INJURY REHABILITATION: A PRELIMINARY CASE STUDY

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Sensory input is used in rehabilitation to stimulate subcortical and cortical activity in patients with acquired brain injury (ABI). Recent studies have shown that patients in minimally conscious and persistent vegetative states show neural activity in auditory and prefrontal cortices, and auditory association areas in response to auditory stimulation (Baker 2001, Boly 2005, Bradt 2010). Research supports the connection between music and sensory, emotional, motor and cognitive functions in higher level patients with ABI (Boly 2004). Increased research into the delivery of systematic, complex and meaningful sound stimulation is needed (Boly 2004). At Children’s Specialized Hospital, progressive music-based sound stimulation protocols in association with Rancho Los Amigos/Levels of Coma Recovery have been developed to support the healing process. Children’s Specialized Hospital is conducting limited clinical trials using The Listening Program™ and enhanced bone conducted sound. JP, a 9-year-old girl diagnosed two weeks post Bickerstaff Brainstem Encephalitis (Ranchos Level IV), began her 31-day listening protocol 12 days post admission. Parents and therapists observed decreased nystagmus, dizziness, and vomiting and an increased tolerance to movement, improved visual fixation, improved sleep/wake cycle, and decreased agitation which resulted in a decrease in medication. Both relate the changes in the rate of her recovery to her music-based sound stimulation program. Clinical findings suggest that listening with enhanced bone conduction may support neural activity associated with the vestibular system and assist the recovery of patients with ABI. Further research, with a feasibility pilot study and randomized clinical trials for both inpatients and outpatients, is warranted.

THE GAMELAN PROJECT

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Of all the world’s musical cultures, that of the Balinese—featuring a variety of pitched percussion orchestras known as “gamelan”—seems to value and emphasize ensemble synchrony most highly. Teaching this music to American elementary school children for ten years, ethnomusicologist Alexander Khalil observed that ability to synchronize in an ensemble setting—regardless of other musical abilities—seemed to correlate strongly with ability to “pay attention” or maintain focus not only in music class but in other activities as well. The present study was conducted with children between the ages of 7 and 12. 150 children were recorded playing specially designed pitched-percussion instruments in like-aged groups of 10-12. Each child’s ability to maintain synchrony with his/her group was measured and compared against their performance on computerized psychometric tests of attention and their teacher-assigned rating on the Swan Scale of attention. Subjects’ synchrony rankings correlated significantly with performance on both the psychometric tasks and teacher ratings as measured by the Swan Rating Scale of attention. These results indicate a connection between ability to synchronize with a group and aspects of attention.
14) NEURAL SYSTEMS FOR SPEECH AND SONG IN AUTISM

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While music and language are known to recruit overlapping neural systems in healthy subjects, music processing is often preserved and may even be enhanced in autism despite impairments in language. This divergence raises the question of how these two systems are organized in autism. Neural systems sensitive to speech and song were compared in minimally-verbal autistic and age-matched control children using functional MRI and diffusion tensor imaging. During speech presentation, autistic children showed decreased activation in left inferior frontal gyrus (IFG, Broca’s area) relative to control children. In contrast, song stimuli engaged left IFG in autistic children corresponding to regions activated for speech in controls. Functional connectivity between left IFG and superior temporal gyrus (STG, Wernicke’s area) also increased during song relative to speech stimulation in autistic subjects. Furthermore, anatomical terminations of the arcuate fasciculus in IFG were indistinguishable between autistic and control groups, and fractional anisotropy (FA) of the arcuate co-varied with activity in left IFG during both song and speech stimulation. However, average FA of the left arcuate was decreased in the autistic relative to control group. These findings indicate that although frontal-posterior pathways involved in speech and song are attenuated in autism, they are relatively intact and are utilized to a greater degree during song stimulation. Confirmation that structural pathways in autistic and typically developing children do not differ, even though in autism their functions favor music, suggests the possibility that music may have a role for treatment of language disability in autism.

15) PERCEPTUAL DETERMINANTS OF EMOTIONAL RESPONSES TO SOUND IN DEMENTIA PATIENTS: TOWARDS A SOUND-BASED DIAGNOSIS.

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Although music is widely used in therapeutic settings, the precise relationship between musical parameters and affective states is not clear. To address this issue in the context of dementia and Alzheimer Disease (AD), we developed an automated test procedure that assesses the correlation between the sound source, brightness, sound level, tempo and consonance of a set of parameterized sound samples with the self-reported emotional state of dementia patients on the scale of arousal, valence, dominance and pleasantness. Sound is processed by both cortical and subcortical areas. One could thus expect that in a disconnection syndrome such as AD, the experience of the quality of sound sources will change. A total of 77 dementia patients and 19 age-matched controls participated in the experiment. We found that the source of a sound (Natural, Synthetic or Voice) had a direct impact on the reported emotional state of the patients. This suggests that a rational approach to the design of soundscapes for sonic therapy is possible. Moreover, our results show that the control and patient groups had significantly different emotional reactions to sound features such as loudness, consonance and tempo, suggesting possible applications in automatic diagnosis of dementia. We also found that the stage of the disease influenced the ratings of dementia and AD patients for features such as source, loudness, tempo, and brightness. This increased sensitivity to sound stimuli with the decrease of cognitive abilities puts into evidence the importance of subcortical processes in the perception of sound-based emotions.

16) COMPOSING AND TESTING FOR PRESCRIPTIVE MUSIC

Michael Legge
Five Notes Therapy, Levittown, PA

Many years of research to combine Classical Chinese Medicine (CCM) with western music composition has resulted in a fascinating approach to wellness via musical treatments composed according to eastern healing principles. There is an amazing correlation between western music theory and CCM. It is the circle of fifths that provides not only the Chinese pentatonic scale with its multiple layers of meaning ranging from emotional and physical implications to seasonal correspondences, but also the diatonic scale which sets up an interplay between the two. The twelve branches of CCM designate the twelve main organ-meridian systems. Each of the twelve keys of music has a direct impact on each of the twelve branches. Organs can be targeted with musical treatment once the patient’s energetic system is mapped,
correlating keys to organs. The mapping is based on one of the twelve voice tones. The voice does oscillate but there is a primary tone that can be isolated. Modes, key signatures, transpositions, time signatures, beats per minute, non-harmonic tones and two-part counterpoint are used for constructing 384 healing music compositions (12 keys X 32 core templates = 384 prescriptions); 2 of the templates are used for prenatal and postnatal care of infants to about 6 months of age. Muscle-response testing is used in order to prescribe the correct remedy from the 384 musical prescriptions. Listening to the correct prescriptive music can address the energetic imbalances that lie beneath the dysfunction or disease, lessening or eliminating physical and emotional distress.

17) EFFECTS OF MUSIC ON PHYSIOLOGICAL INDICES OF ACUTE PAIN IN PREMATURE INFANTS

Miriam Lense1,2, Caitlin Van Ness1, Jerome Kagan3, Margaret Doyle Settle1,4, Jonathan Cronin4, and Mark Tramo1,5

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Infants in intensive care units often undergo medically-necessary heel-stick procedures. Because the risks of administering analgesics and anesthetics are often thought to outweigh the benefits, there remain no proven means of ameliorating the pain and stress these infants suffer, particularly during procedures. This study examined the controlled use of recorded vocal music to attenuate physiological and behavioral responses to heel-stick in 13 premature infants via an experimental design. In both instances, infants exposed to music and infants in the control group, heart rate and respiration rate increased during the heel-stick procedure (p's=.02) and nearly all infants cried. During a 10-minute recovery following the heel-stick, heart rate and crying significantly decreased in infants exposed to music (p=.02) but not in unexposed infants. Controlled music stimulation appears to be a safe and effective way to ameliorate pain and stress in premature infants following heel-sticks.

18) AWAKEN YOUR INACTIVE BRAIN

Joyce Leung Tsun-Wing

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Music plays an important role to individual and human relationships. Each single pitch represents a unique code and group of pitches form the language of music. Pitch originated as a musical term and has become a psychological term used to designate a perceived quality of sound. Deaf people can speak a word in correct tone and pronunciation with the learning assistant of a computer system, and also the way they change their own facial expressions. Through evidence and practice based research studies. I have grouped people into different categories regarding their interest in music and the consequence. First, music can be part of the life of healthy people and music students. Music is a language for them to communicate with each others. Second, patients with addicted problems such as overdose of drugs, alcohols, smokers, eating disorder, and problem gambling and sexual addition. To learn musical instruments help them in acting a better behavior and generate a proper thought and emotion. Third, patients with borderline personality disorder, dialectic behavior therapy and cognitive behavior therapy provides new thoughts to improve the level of happiness through five senses of human such as sight, hearing, touch, smell and taste. Fourth, patients with no music background will ask questions, imitate and create, listen and accept, learn and appreciate, awaken the inactive brain.

19) MUSIC THERAPY AND MINIMALLY CONSCIOUS STATE: PROVIDING CLINICAL DATA FOR A DIFFERENTIAL DIAGNOSIS

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Music therapy can provide significant information for a differential diagnosis within an interdisciplinary assessment in patients suffering of an altered state of consciousness such as minimally conscious state. Applying a specific approach during the music therapy assessment through personalized interventions the music therapist can facilitate patient's purposeful responses. This poster includes a case report of a 22 year-old male with minimally conscious state secondary to traumatic brain injury in which music therapy provided clinical data for the differential diagnosis between vegetative
state and minimally conscious state. The Wessex Head Injury Matrix – WHIM was used to compare the patient’s responses in each of the interdisciplinary settings: neuropsychology, occupational therapy, speech therapy as well as for music therapy assessment and treatment. The poster includes examples of music therapy interventions and the achievements within an intensive short-term treatment compared to standard care in working with the population. Video excerpts will be available during the poster session.

**20) MUSIC THERAPY FOR ADULTS WITH ACQUIRED BRAIN INJURY: RESULTS OF A COCHRANE SYSTEMATIC REVIEW**

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Music therapy is used in rehabilitation following acquired brain injury (ABI) to stimulate brain functions involved in movement, cognition, speech, emotions and sensory perceptions. However, a systematic review is needed to gauge the efficacy of music therapy as a rehabilitation intervention for people with ABI. A Cochrane review examined the effects of music therapy with standard care versus standard care alone or standard care combined with other therapies on gait, upper extremity function, communication, mood and emotions, social skills, pain, behavioral outcomes, activities of daily living and adverse events. There was no language restriction. Randomized and quasi-randomized controlled trials were selected that compared music therapy interventions and standard care with standard care alone or combined with other therapies for adults with ABI. Two review authors independently assessed methodological quality and extracted data. We present results using mean differences (post-test scores) as all outcomes were measured with the same scale. Seven studies were included with 184 participants. The results suggest that rhythmic auditory stimulation (RAS) may be beneficial for improving gait parameters in stroke patients. These results were based on two studies that received a low risk of bias score. There were insufficient data to examine the effect of music therapy on other outcomes. RAS may be beneficial for gait improvement in people with stroke. These results are encouraging, but more RCTs are needed before recommendations can be made for clinical practice. More research is needed to examine the effects of music therapy on other outcomes in people with ABI.

**21) IMPROVEMENT OF DEPRESSED SYMPTOMS THROUGH MUSIC COMPARED WITH SINGLE PSYCHOTHERAPY**

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We designed a study testing the effects of music and compared it with the effects of psychotherapy in low and medium grade of depression. There are three mainly conventional treatments for depression: psychotherapy, pharmaceutical treatments, and electroconvulsive therapy. Because conventional treatment is not a guaranty for successful improvement, new means of treatment must be found that might improve depression when used together with any other of those therapies. In order to this, we performed a randomized controlled trial with a convenience sample of 79 patients aged 25-60 years with a psychological diagnosis of low- and medium-grade depression. We employ the Zung depression scale for selection purposes. Patients were randomly assigned to the music therapy group (classical Music of Mozart, and baroque music of Corelli and Bach) (n=41), or the psychotherapy group based on conductive-behavioral therapy (n=38). The music therapy was applied for 50 min a day, every day, for eight weeks. At the end, the music-therapy group had less depressive symptoms than the psychotherapy group, and this was proven to be statistically significant with the Friedman test. We propose that patients with low- and medium-grade depression can use music to enhance the effects of other therapies support.
22) MUSIC AND THE HUMAN ELECTROMAGNETIC FIELD

David J. Mirayes
West Seneca, NY

The human electromagnetic (EM) field instantly dances to the beat of audible music, regardless of heart rate in beats per minute or level of mental concentration. Music can be used to bring order to the body's electricity, with significant coherence measured at between 4Hz and 16Hz. This increased coherence within the EM field leads to concentrated electromagnetic discharges of significant amplitude and duration, indicating peak experience.

23) MUSICAL TRAINING PROMOTES DEVELOPMENT OF ATTENTION ABILITIES: EVIDENCE IN CHILDREN AND ADULTS

Samantha O'Connell, Dana L. Strait, Alexandra Parbery-Clark, and Nina Kraus

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Increasing effort is being expended to define activities that strengthen what might be considered the cornerstone of human perception: attention. While musical training is known to bolster auditory-specific cognitive skills, such as auditory short-term memory, little is known about how musical training strengthens attention – especially during developmental years. We aimed to determine the impact musical training on auditory and visual attention abilities in 7-13 year old children (N=30) and young adults (N=29) using The Integrated Visual and Auditory Plus Continuous Performance Test. Musician and non-musician groups did not differ according to age, sex, or IQ. Outcomes reveal that, compared to non-musicians, musician adults demonstrate enhanced sustained auditory attention. Children with musical training, however, possess a more global attention advantage, with enhanced sustained attention in both auditory and visual domains. Attention performance in both children and adults correlates with musical practice histories, with more years of musical practice relating to increased attention ability in the auditory domain. Taken together, these results suggest that musical training promotes the development of global attention mechanisms but that these advantages become constrained to the auditory domain with maturation. Given the high prevalence of developmental attention disorders and their detrimental impacts on educational performance, outcomes should inform educators, scientists, and clinicians involved in the assessment and remediation of learning deficits.

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24) THE MUSIC & MEDICINE INITIATIVE: A WEILL CORNELL MEDICAL COLLEGE AND JUILLIARD SCHOOL COLLABORATION

Curtis O’Neal, Jenna Devare, Emi Ferguson, Ted Goldman, Allison Job, Lee Kiang, Isaac Klein, Raymond Lustig, Melissa Odens, and Ankit Patel

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The interconnection between music and medicine has been well acknowledged throughout history. To ancient Greeks, Apollo, the patron god of healing and music, is also the father of Asclepius and the muses. In various tribal cultures music is essential to healing rituals that drive out illness-causing agents. Modern research demonstrates a correlation between music as a supportive treatment and positive therapeutic outcomes. Expanding upon rich historical precedent and scientific evidence, Weill Cornell Medical College and The Juilliard School established “The Music & Medicine Initiative.” The initiative serves to promote institutional collaboration by providing opportunities for interdisciplinary cooperation, facilitate academic excellence through exploration of the relationship between music and medicine for each school's students, and to offer health and educational services valuable to affiliates and students. Sponsored activities include the
salon series, which combines performance with discussion of topics ranging from synesthesia, Greek modal theory, and the genetics of absolute pitch, formal “Grand Rounds” medical lectures related to music and health sciences, and “A Tribute to Haiti” benefit concert to celebrate Haitian culture while honoring the efforts of Weill Cornell’s Gheskio clinic. The program is currently working to support student-led master classes for medical students interested in improving their instrumental proficiency and to provide Juilliard students access to Masters-level courses in therapy techniques offered by partner institutions. As the Music & Medicine Initiative marks its one-year anniversary, we aim to highlight our efforts, report the general reception and outcomes of our events, and gain ideas for future projects.

25) A RANDOMIZED CONTROLLED STUDY: CONTROLLING MEMORY IMPAIRMENT IN ELDERLY ADULTS USING VIRTUAL REALITY MEMORY TRAINING

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Background: Memory deficits become increasingly physiologically prevalent with age but may also be the first signs of cognitive impairment. Only clinical/diagnostic monitoring can help us understand their development. A Rest-Care Home is an ideal environment for such evaluatory monitoring. Objective: to intercept these deficits and suggest new treatment which might slow down their development. “Virtual Reality” (VR) using immersion and interaction is already employed in many rehabilitative and therapeutic fields. This technology was applied to elderly residents in a Rest-Care Home (median age 80) suffering from memory impairment. Methods: 18 randomized elderly residents underwent “virtual reality memory-training”, which involved certain auditory experiences and certain VR experiences: an initial three-month-long phase (3 audio and 3 VR sessions every two weeks) and a booster training phase in the course of the following 6 months (1 audio and 1 VR session per week). The control group underwent equivalent “face to face” training sessions with music therapy and recreational-expressive activities. Both groups participated in recreational-expressive and assisted-mobility activities. Clinical and neuro-diagnostic evaluation was performed at baseline, after the initial training phase, and a follow-up period. Results: The results highlight significant improvement in the experimental group in mnemonic tests and in overall cognitive state. In contrast, the control group showed progressive decline. Conclusions: Virtual Reality Memory Training may improve memory function in elderly adults by placing unusual and repeated demands on the participants’ selective attention abilities.

26) EFFECTS OF MUSIC THERAPY IN THE TREATMENT OF CHILDREN WITH DELAYED SPEECH DEVELOPMENT: RESULTS OF A PILOT STUDY

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Background: Children with delayed speech development are more at risk of acquiring cognitive, social-emotional, and school-related problems. Music therapy appears to facilitate speech development in children, even within a short period of time. The aim of this pilot study is to explore the effects of music therapy in children with delayed speech development. Methods: A total of 18 children aged 3.5 to 6 years with delayed speech development took part in this observational study. An ABAB reversal design with alternations between music therapy and no treatment with an interval of approximately eight weeks between the blocks was chosen. Before and after each study period, a speech development test, a non-verbal intelligence test, and music therapy assessment scales were used to evaluate the speech development of the children. Results: We found a positive development in the study group after receiving music therapy. Phonological capacity and understanding of speech increased under treatment, as well as the children’s cognitive structures, action patterns, and level of intelligence. Throughout the study period, developmental age converged with their biological age. Ratings according to the Nordoff-Robbins scales showed significant changes in the children, namely in the areas of client-therapist relationship and communication. Conclusions: This study suggests that music therapy has a measurable effect.
27) THE EFFECTS OF TEMPO AND LYRICAL CONTENT OF MUSIC ON THE LARGE-SCALE FUNCTIONAL CONNECTIVITY AND ORGANIZATION OF THE BRAIN

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Tempo and lyrics are two features of music that can drive a listener's affective and attentional response to music. The neural processing of these features has been previously examined using univariate parametric mapping of auditory stimuli with relatively short durations. However, the effects of these features on the large-scale connectivity pattern and organization of the brain during a sustained period of passive listening remain to be elucidated. We applied graph theory to fMRI data acquired while subjects performed a verbal memory-encoding and math performance task and listened to background music which varied according to tempo and whether it contained lyrical content. Pair-wise partial-correlations in BOLD signal between hundreds of regions (nodes) throughout the whole-brain were computed and used to construct and compare graphical brain networks across each musical condition. We examined differences in the pattern (i.e. modularity and local community centrality) and the degree of connectivity for individual nodes. The above measures were submitted to a 2 (Slow - Fast) x 2 (Lyrics – No lyrics) repeated-measures ANOVA. Main effects of tempo included higher degree in crus 1 of the cerebellum and increased local community centrality in the right planum temporale during fast music stimulation. We also observed higher degree in the right anterior middle temporal gyrus and decreased local community centrality in left Heschl’s gyrus and right parietal operculum in the presence of lyrics. These preliminary and exploratory results suggest that tempo and lyric content may modulate the functional connectivity patterns of specific brain regions during sustained music stimulation.

28) MUSICAL TRAINING OFFSETS AGE-RELATED DECLINES IN NEURAL TIMING

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Aging negatively impacts neural timing. Precise neural timing is imperative for the accurate encoding of sound. Indeed, the age-related decline in neural precision is thought to be a contributing factor to the deficits observed in speech understanding in older adults. Given that musical training strengthens the brain’s temporal representation of important acoustic features in young adults, here we asked whether musical training would offset age-related declines in neural timing. To this aim, we examined subcortical encoding of speech in younger (18-30 years) and older (45-65 years) groups of normal hearing musicians and nonmusicians. Results revealed that neural response timing in older nonmusicians is delayed relative to younger nonmusicians. Older musicians, however, did not demonstrate this shift and had equivalent response timing to younger musicians. As such, we provide the first evidence that life-long musical training offsets the negative effects of aging on subcortical encoding of sound.
29) MUSIC: SOOTHING AUTONOMIC STATE AND IMPROVING SOCIAL ATTENTION IN CHILDREN WITH AUTISM SPECTRUM DISORDERS

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Music therapy, listening to music, and playing music have been shown to lead to increased vocalization, eye contact, head orienting, and to decreased aggressive behaviors, self-injury, and stereotypical behaviors in individuals with ASD (e.g., Whipple, 2004). Yet how does music, a relatively simple medium, generate these complex behavioral changes? We conceptualized social behavior through the Polyvagal Theory (e.g., Porges, 2007) to understand the physiological mechanisms that may underlie these behavioral changes. The Polyvagal Theory indicates that a soothed autonomic state promotes social communication. Heart rate (HR) and respiratory sinus arrhythmia (RSA) were used to assess physiological response to music (i.e., lullabies). We measured social attention via the Social Interaction Coding Scale (Bazhenova, 2006). This study recruited participants ($N = 23$) between 4-7 years old with a previously diagnosed ASD. Participants were assigned to two groups: music ($n = 11$), audiobook ($n = 12$). The experimental session included psychophysiological monitoring during baseline, listening, and recovery. A soothed autonomic state was measured by increased RSA and decreased HR. Results indicated a significant soothing effect for the music group, $HR \ (F(1, 19) = 3.82, p = .03)$ and a trend for RSA ($F(1, 18) = 1.87, p = .09$). The music group evidenced a significant increase in social attention, $F(1, 21) = 6.43, p = .01$, relative to the audiobook group. Our results suggest a relationship between the soothing effects of music and social attention improvements. Future studies will need to recruit a larger sample size to examine mediation effects.

30) AUDITORY DISCRIMINATION IN DYSLEXIA – IMPLICATIONS FOR MUSIC IN LITERACY ACQUISITION

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Most people with dyslexia have poor phonological skills. It is still unresolved whether these difficulties are due to basic auditory processing deficits, in particular poor tonal resolution or memory that might be improved by musical training. Therefore we have been investigating the musicality and reading abilities of dyslexics and good readers by comparing with their musical experience their ability to discriminate pure tones and remember sequences of tones or digits. Their musicality proved to be a strong predictor of their literacy skills, independently of their IQ. In addition, particularly in dyslexics who hadn't attended University, frequency recognition tasks were strong predictors of their literacy ability. These findings suggest that tonal tests may be useful adjuncts to diagnose auditorily based phonological problems, and they support the reintroduction of music teaching into the classroom, as this should enhance children’s development of literacy skills, hence help them to achieve their full academic potential.

31) THE EFFECTS OF MUSICAL TRAINING ON MUSICAL MEMORY SKILLS IN SCHOOL-AGE CHILDREN

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Adult musicians show superior auditory discrimination skills when compared to non-musicians. The enhanced auditory skills of musically trained adults are reflected in augmented amplitudes of their mismatch negativity (MMN)—an event-related potential (ERP) response that is thought to reflect memory-based auditory change detection. In the current study, we investigated the development of the differences between musically trained and musically naïve subjects in the ability to detect changes in musical features by comparing the MMNs of school-aged children who play a musical instrument and attend a school that emphasizes music in its curriculum to MMNs of age-matched children who have other, non-musical hobbies. Four age-groups were studied cross-sectionally at the age of 7, 9, 11, and 13 years. We used a recently developed fast paradigm for recording MMNs to six types of changes in short melodies. These included changes in the rhythm and key of the melody and changes in the pitch, tuning, timbre, and timing of single tones within the melody. Our preliminary analyses revealed no clear differences in MMN amplitude between the musician and non-musician children at
the age of 7 when the musician children had just started taking music lessons. By the age of 13, in contrast, the musician children displayed larger MMNs to the changes in pitch, rhythm, and tuning. These results are compatible with the augmented MMN response seen in adult musicians being a consequence of accumulated musical training and not pre-existing differences between musicians and non-musicians.

32) PHYSIOLOGICALLY INTERACTIVE MUSIC: APPLICATIONS OF EMERGING MUSIC TECHNOLOGIES IN MEDICINE

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Because music is a highly complex stimulus, comprised of various and ever changing elements (e.g., rhythm, tempo, etc.) and instrumental combinations, it is often difficult to present the most effective musical stimuli in a systematic manner in meeting the unique physical, mental, and emotional needs of individual patients. However, newly emerging music technologies will transform the ways in which music can be presented in achieving specific therapeutic effects and in studying human response to musical stimuli. This presentation will provide an overview of patented and patent pending interactive music technologies, including those developed by the author, with descriptions of how these technologies will enable new music-based clinical treatments based on current research findings from multiple disciplines (e.g., cognitive neuroscience, music perception, music therapy, medicine, experimental psychology, etc.). These technologies will make it possible to present synthesized or prerecorded music, in which the tempi, rhythms, or other music elements are provided directly in conjunction with the ongoing and changing tempi (paces, rates) of an individual’s various physical movements and/or physiological responses, in order to support, entrain and/or modify those responses. In addition, specific music elements may be added or modified to enhance patient perception and improve motor synchronization. Automated music entrainment/ iso-moodic systems for patients undergoing a variety of medical interventions and procedures will be presented, including music listening interventions in reducing patient stress, anxiety and pain, musical mood induction procedures, gait training, and interactive music for respiratory control during mechanical ventilation, and 4D CT scanning procedures.

33) THERAPEUTIC MUSIC INTERVENTION: A PROMISING AND NOVELTREATMENT INTERVENTION FOR CO-OCCURRING CHRONIC PAIN AND OPIOID ADDICTION

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Therapeutic Music Intervention (TMI) has been used to treat a variety of chronic medical conditions, including chronic pain and addictions. Research suggests that TMI decreases pain perception and negative affect in chronic pain patients and improves negative affect and treatment engagement in patients being treated for substance abuse. Co-occurring chronic pain and opioid addiction is highly prevalent in primary care, specialty pain, and opioid addiction treatment settings; is related to poor treatment outcomes; and is a major clinical challenge for providers given the absence of empirically-supported treatment approaches. TMI represents a cost-effective, readily transportable, promising, and novel treatment intervention for co-occurring chronic pain and opioid addiction. It provides clinicians a non-drug-related method of targeting key treatment foci, including enhancing behavioral activation, pleasure, relaxation, and socialization, and shifting focus from pain and drug cravings. The aim of this poster presentation is to 1) review the literature on TMI to treat (a) chronic pain and (b) addictions, 2) provide the rationale and hypothesized mechanisms for the potential benefits of TMI to treat co-occurring chronic pain and opioid addiction, and 3) to suggest future areas of research.
34) MUSIC LESSONS IN EARLY CHILDHOOD PROMOTE SPEECH PERCEPTION IN BACKGROUND NOISE

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The ability to process a target signal and suppress competing noise is a primary concern for child educators and clinicians given its primacy in everyday learning and communication. Recent evidence indicates that musical training may benefit speech-in-noise processing, with adult musicians demonstrating enhanced speech perception in noise compared with non-musicians. We aimed to determine the impact of musical training during early childhood on the perception of speech in noise (\textit{Hearing-In-Noise Test}, Biologic Systems Corp.) and potentially related cognitive abilities (i.e., working memory, attention, I.Q.). Subjects included 31 children ages 7-13, 15 of whom were musicians. 16 non-musician children reported spending an equivalent amount of hours engaged in alternate extracurricular activities. Musician and non-musician groups did not differ according to age, sex, I.Q. or socioeconomic status. Outcomes reveal that musical training contributes to enhanced speech in noise perception during elementary school years and that practicing more hours each week leads to a greater improvement. This speech-in-noise perceptual enhancement may be driven by auditory cognitive enhancements, with musicians outperforming non-musicians on auditory working memory and attention. Auditory cognitive performance positively correlated with the age of onset of musical practice, with children who had undergone more years of practice demonstrating more of an enhancement relative to their peers. Taken together, these results indicate that musical training provides benefits for speech-in-noise perception and related cognitive abilities during pivotal learning years. Outcomes may be considered by educators, scientists and clinicians involved in the assessment and remediation of language-based learning deficits.

35) THE PIT QUESTIONNAIRE: A NEW PSYCHOMETRIC TOOL TO EVALUATE MUSICAL "INTOUCHNESS"

Tomaso Vecchi, Enzo Emanuele, Silvia Cucchi, Marcella Cambianica, Umberto Provenzani, Mario Grassi, and Pierluigi Politi

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Although persons with autism do not readily engage in positive affective exchanges with others, recent evidence suggests that music represents a form of communication that may be of special importance for the autistics. Here we present the "Playing-in-Touch" (PIT) questionnaire as an objective measure of musical intouchness defined as the degree of engagement in creative exchange through ensemble music pieces in persons with autism. The criteria of the Rasch measurement model were applied to control for the objective measurement of the questionnaire. By means of Principal Component Analysis (PCA)/Multiple Correspondence Analysis (MCA), we identified 10 essential key items to be tested in the Rasch model. The output of three-facet (videotapes, raters and items) Rasch analysis showed that the raters' agreement consistently assessed the underlying construct of the PIT questionnaire. The items verified a one-dimensional model, and were hierarchical. On this ground, we believe that the PIT may be considered a simple and convenient complement to other research methodologies exploring the musical attitudes of people with autism.
36) RECOGNITION OF FAMILIAR MUSIC ACTIVATES AUDITORY-MOTOR REGIONS IN DOWN SYNDROME

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There has recently been a great deal of interest in studying coupling between the auditory and motor systems. During music performance, sounds are linked with the motor system, activating the posterior superior temporal gyrus (STG) and the premotor cortex. During passive perception, musical rhythm also recruits the motor system (Chen et al, 2009), suggesting that a learned mapping between movement and sound can elicit auditory-motor activations. We investigated whether adults with Down syndrome (DS), with known impairments in the mirror neuron system (Virji-Babul et al 2010), would show auditory-motor activations when listening to familiar music to which they had previously learned to sing and dance. 8 right-handed adults listened to two different instrumental melodies: a familiar melody called “Mamma mia” and an unfamiliar piece by Bach called “Musette”. Each melody was played by a professional pianist in D major at the same tempo. Cortical responses were recorded with a 151 channel MEG system (VSM MedTech). Listening to familiar music relative to unfamiliar music, revealed stronger activations in three significant locations: the left primary auditory cortex and the left STG at 300 msec, and the right premotor cortex beginning at 1 second after the onset of the music. For unfamiliar vs familiar music, stronger activations were observed in the left STG beginning at 400 msec and the left prefrontal cortex at approximately 1.4 seconds. These data suggest that previous movement related musical experiences leads to auditory-motor coupling in adults with DS and may have implications for intervention.

37) MUSIC & ACOUSTIC AWARENESS: INTEGRAL TO BENEFICIAL INPATIENT PSYCHIATRIC INTERVENTION

Susan B. Wesley
Husson University, Bangor, ME

An over-stimulated auditory system negatively impacts patient treatment particularly when cranial nerve 10 or the vagal nerve is understood in its afferent role in the auditory system. Hospital environments, built and natural, are sources of auditory stimulation. Music therapy informed by acoustical information has been shown to enhance treatment of inpatient children in psychiatric care. This poster provides an overview of five years of evidence influenced investigation at an acute care psychiatric hospital in Maine. From early 2001 through the summer of 2005, this series of investigations provided useful insights related to the influence of the unit’s acoustics, patient behavior and specific music interventions used to lower aggressive behavior particularly at the bed-time hour and over night.

38) DANCE FOR PARKINSON’S DISEASE: A PILOT INVESTIGATION OF EFFECTS ON MOTOR IMPAIRMENTS AND QUALITY OF LIFE AMONG PERSONS WITH PARKINSON’S DISEASE

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Objective: To assess effects of dance taught by professional dancers with live music accompaniment on motor and quality of life aspects of Parkinson’s disease (PD) following 16 sessions (8 weeks; 20 hours). Background: In 2001 Brooklyn Parkinson Group and Mark Morris Dance Group developed Dance for PD (DFPD) classes. During class initial warm up movements are incorporated in longer dance sequences performed while seated and standing. Live music is at the core of our classes. Over 40 DFPD classes based on this model currently exist. Methods: Twelve patients with
idiopathic PD (6 M, 6F) attended the class. Ages ranged from 55 – 82; Hoehn & Yahr scores ranged from 1 – 3/4. Assessment at baseline and post-intervention included UPDRS (parts 2 & 3), Berg Balance Scale, Beck Depression Inventory, and PDQ-39. A qualitative interview was conducted after the last class. Results: Gait and Resting Tremor ($P < .05$) improved without significant changes in other measures. Interviews were strongly positive and indicated benefits of social contact, camaraderie, caring teachers, the supportive, nurturing environment, and commitment. After 1 year, 6 participants are still regularly attending DFPD classes. Reasons for the dropouts are unrelated to DFPD. Conclusions: Gait and Resting Tremor improved and interview results indicated substantial behavioral improvement following DFPD. These improvements were not matched by PDQ-39 data. Future research might assess specific aspects of the DFPD class that make it beneficial, and whether the PDQ-39 is the most sensitive measure of improvements which apparently motivate participants to return to classes.

39) THE EFFECTS OF MUSIC ON THE BRAIN: INVESTIGATING MUSIC PREFERENCE USING NETWORK SCIENCE METHODS

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Network science is a rapidly emerging and promising analysis method for investigating complex systems in terms of their components and the interactions between them. Embracing the brain as a complex network offers a fuller understanding of how structural connectivity leads to dynamic function. Within the brain, music affects an intricate set of complex neural processing systems. These include structural components associated with sensory processing as well as emotional and functional elements implicated in memory, cognition and mood fluctuation. Because music affects such diverse systems in the brain, it is an ideal candidate for analysis of unique individual responses using network science methods. Using as realistic an approach as possible, we investigated whether listening to individually preferred music elicited network responses associated with introspective thought, emotion, and autobiographic memory. This is the first study to use both complete songs and network methods in an attempt to fully capture individual responses in the brain. In addition, this study investigated how the brain processes genres of varying musical complexity. Results from this study indicate that music preference does change connectivity within the brain. This study also reveals that different genres including classical, country, rock, and rap affect connectivity metrics. These results suggest that network science offers a promising new method to study the dynamic impact of music on the brain.

40) BRAIN-JAMMING FOR FOCUS: HELPING ADHD CHILDREN WITH MUSIC & NEUROFEEDBACK

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Within the backdrop of a societal healthcare paradigm swing, this study of EEG neurofeedback (NF) with music therapy protocols added an experimental group (NF-MUSIC) to an existing Philadelphia Office for Mental Health multi-site study of two traditional NF protocols. Thirty-eight subjects completed the pre and post intervention assessment comprised of the Stroop, Toni-3, NEPSY Attention/Executive core domain, Conners CPT and ADHD Parent and Teacher Rating Scales Revised (S). NF-MUSIC subjects also received pre- and post-quantitative EEG (QEEG) topographical brain-mapping. NF-MUSIC utilized a Theta/Beta protocol variation, incorporating brain-triggered musical tones assigned to Theta amplitude in key with background musical selections. Individual results within the NF-MUSIC group showed improvement on NEPSY core domain scores and improvement individually on the Stroop Color and Word tests, but showed mixed results on the combined Stroop Color/Word test. A paired samples T-test showed no significant differences between pre- and post-Toni-3 scores or Stroop Color/Word scores. Significant improvement was found for the Stroop Color and Stroop Word scores individually and for the NEPSY Executive Function/Attention subscale index scores. Between-group analysis showed the NF-MUS group significantly superior to the other NF groups and control subjects on three measures: the NEPSY audio subtest ($p = .01$); the Conners Parent Rating Scale ADHD index ($p = .015$); and, the Conners Parent Survey Cognitive subscale ($p = .043$). NF-MUSIC subjects decreased their Theta/Beta ratio ($p = .004$) and increased their SMR ($p=.012$) as hypothesized. Theta reduction alone, however, was not significant ($p=.189$).
Several studies have shown a positive relationship between musical training and reading ability. Furthermore, a positive relationship has been demonstrated between the degree of musical training in children and precursors of literacy development, specifically phonological processing, and early reading skills. This study investigated the relationship between performance on a novel music task and a variety of cognitive-linguistic assessments in forty-three Portuguese-speaking students at a Brazilian elementary school in São Paulo. While previous studies investigating this relationship have presented musical stimuli as individual tones or chords recorded or produced with software, the music task implemented here preserves an authentic musical experience through live presentation using the guitar. The music task involves discrimination between two sounds, one from the high, the other from the low registers of the guitar. Children were asked to code sequences of four sounds on the guitar, using an answer key to identify the “thicker” or “thinner” sound. We hypothesized a significant relationship between the music task and tasks that measure precursors to reading and reading ability. Results show a strong relationship between performance on the music task and a number of linguistic variables, specifically tasks involving phonological processing. Furthermore, a number of children (n=22) recorded responses for more than four items within the music task, which was classified as Reverberation. Upon dividing the sample into two groups, those with instances of Reverberation and those without, all significant relationships between the music task and linguistic measures could be explained by Reverberation. These findings provide implications for the use of music based screenings as a diagnostic tool for identifying early literacy struggles.