Abstracts from the Literature

William J. Dawson, MD

Iñesta C, Terrados H, Garcia D, Pérez JA: Heart rate in professional musicians. *J Occup Med Toxicol* 2008; 3:16. [www.occup-med.com/content/3/1/16; accessed Aug 27, 2008.]

Very few studies have analyzed heart rate with regard to music playing, and the existing scarce evidence is controversial. This study's purpose was to analyze the heart rates of professional musicians during their usual work activity. Sixty-two instrumentalists (42 men, 20 women), whose ages ranged from 15 to 71 yrs, were fitted with pulsometers, which recorded their heart rates during rehearsals and concerts. The authors calculated the subjects' maximum theoretical heart rate (MTHR) based on age for intergroup comparison. Throughout the recordings, musicians presented a heightened heart rate while playing. In rehearsals, they showed a mean heart rate of 74 beats/min and a maximum rate of 124, equivalent to 49% and 64% of MTHR, respectively. Cardiac demand was expected to be significantly higher in concerts than in rehearsals while performing the same material. During concerts, the musicians' rates increased to 123 and 152 (63% and 79% of MTHR), respectively. When performing as soloists, their mean rates rose to 140 and their maximum to 164, representative of 72% and 85% MTHR, respectively. The heart rate curves of the same musician playing in repeated concerts were similar. Overall, the heart rate values are higher than previously described and could be placed in the "moderate" to "heavy" levels of work intensity, reflecting a cardiac demand that is much greater than what could be expected from a supposedly sedentary activity.

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Brown S, Parsons LM: The neuroscience of dance. *Sci Am* 2008; July:78–83.

[*Editor's note: Although hundreds of articles, book chapters, and books published over the past 15 years have discussed the neurobiology of music, this is the first to report on dance neuroscience of which I am aware. Hopefully, it will not be the last.*]

Dance is a fundamental form of human expression that likely evolved together with music as a way of generating rhythm. Dance can be viewed as a marriage of the representational capacity of language and the rhythmicity of music. This paper reports the results of the first neuroimaging study of dance movement, using positron emission tomography on 10 amateur tango dancers (5 men, 5 women). Dance movements of the legs during scanning produced activation in the precuneus, a parietal lobe area very close to where the kinesthetic representation of the legs resides; this area contributes to spatial perception and orientation in both humans and other mammals. Dance scans with music produced greater activity in the anterior vermis portion of the cerebellum than did scans of self-paced dancing without music. A second analysis shed light on the natural human tendency to tap one's feet unconsciously to a musical beat. A subcortical structure, the medial geniculate nucleus, lit up during the music-synchronized scans, but not during simple listening to music. This finding led the authors to postulate a hypothesis that unconscious entrainment occurs when a neural auditory message projects directly to the auditory and timing circuits in the cerebellum, bypassing high-level areas in the cerebral cortex. Thirdly, learning complex dance moves had a major influence on the premotor cortex; activity there increased only when subjects viewed dances that they themselves could execute, and this finding was gender specific (males viewing male-only moves, and vice versa). This type of learning activates, in addition to a direct motor system for the control of muscle contractions, a motor-planning system that contains information about the body's ability to accomplish a specific movement.

Bové MJ, Kansal S, Rosen CA: Influenza and the vocal performer: update on prevention and treatment. *J Voice* 2008;22(3):326–332.

Upper respiratory tract infections (URIs) are a major cause of morbidity among vocal arts professionals, both from their acute impairment of the vocal mechanism and their predisposing influence for the development of serious vocal sequelae. The authors present a brief review of the epidemiology and some of the salient features of currently available treatments effective against influenza, the virus family responsible for the most serious form of URI. Treatment options include an inactivated vaccine and four antiviral drugs, each approved in the U.S. and many other countries for the treatment and prevention of influenza. The drugs fall into two classes: ion-channel inhibitors (amantadine and rimantadine, effective against type A influenza only) and neuraminidase inhibitors (zanamivir and oseltamivir, active against both type A and B). A live attenuated influenza A vaccine is also

available now, and other vaccines and antiviral drugs are under development. This review provides a summary of influenza treatment options available to professionals entrusted with the care of the professional voice, including drug and dosage regimens for preventing and acutely treating both influenza- and non-influenza-related URIs.

Stewart L, Overath T, Warren JD, et al: fMRI evidence for a cortical hierarchy of pitch patterns processing. *PLoS ONE* 2008;3(1):e1470. [doi: 10.1371/journal.pone.0001470; accessed Sep 20, 2008.]

Pitch patterns, such as melodies, consist of two structural levels: the contour or pattern of ups and downs ("global" level) and the precise levels that make up this contour ("local" level). These two levels seem to be hierarchically linked, with processing of the global structure occurring within the right hemisphere in advance of local processing within the left. However, the predictions of this model and its anatomical basis have not been tested in neurologically normal individuals. This study required participants to listen to consecutive pitch sequences while performing a same/different one-back task. Sequences, when different, either preserved (local) or violated (global) the contour of the sequence preceding them. When the activations for the local and global conditions were contrasted directly, additional activation for local processing was seen in the right planum temporale and posterior superior temporal sulcus (pSTS). These findings support the hierarchical view that the global structure of a pitch sequence acts as a "framework" on which the local detail is subsequently hung. However, the lateralization of activity in this study, with global processing occurring in left pSTS and local processing occurring bilaterally, differed from that predicted by the neuroanatomical model. While the present study supports the hierarchical view of local and global processing, further research is needed both in patients with lesions and in neurologically normal individuals, before an understanding of the functional lateralization of local and global processing can be considered established.

Fujioka T, Trainor LJ, Ross B: Simultaneous pitches are encoded separately in auditory cortex: an MMNm study. *NeuroReport* 2008;19(3):361–366.

Auditory scene analysis involves two automatic complementary processes of segregating sounds into concurrent objects (or streams) and integrating sounds into a single object (stream) based on sound properties such as frequency, pitch, timbre, and temporal synchrony. This study examined whether two simultaneous pitches produce separate memory representations or an integrated representation in pre-attentive auditory memory. Mismatched negativity (MMN) fields were examined when a pitch change occurred in either the higher-pitched or the lower-pitched tone at 25% probability each, thus making the total deviation rate of the two-tone dyad 50%. The magnetoencephalographic equivalent of MMN (MMNm) is elicited mainly in auditory cortices in response to occasional changes in the auditory environment and reflects memory traces that encode invariant aspects of the recent acoustic past. Clear MMNm was obtained for deviants in both tones, confirming separate memory traces for both tones. At the same time, deviants to the lower-pitched, but not higher-pitched, tone within the two-tone dyad elicited a reduced MMNm compared to when each tone was presented alone. The latter finding indicates that the representations of the two pitches are not completely independent and that the emergence of a unified entity in the form of an interval is likely occurring by this stage of processing.

Shah S: Caring for the dancer: special considerations for the performer and troupe. *Curr Sports Med Reports* 2008; 7(3):128–132.

Dancers are a unique group of athletes in that they execute physically challenging movements while making them look beautiful and artistic. This performance ability requires a high level of fine motor control, flexibility, and core stability. A dancer's technique, environment, and mentality are unique among athletes. The medical needs of a dancer-patient can be daunting to the uninitiated physician. Unlike with team sports such as football or basketball, physicians are often unfamiliar with dancers' injuries and requirements to facilitate a safe, timely return to dance. The author's goal is to help foster better communication between dancers and the medical community by describing dance epidemiology, dance basics including technique, footwear, and flooring, and elements of rehabilitation. Specific injuries discussed include flexor hallucis longus tendinitis, anterior and posterior ankle impingement syndromes, snapping hip syndrome, and Lisfranc joint injuries. Understanding dance basics and terminology, and the mental and physical demands of the activity, will enable physicians and other health care providers to effectively communicate with and care for the dancer without excessively prohibiting the performer from participating in dance. In general, most medical care for the dancer is not as well organized as it is for other elite athletes in the U.S., a situation likely due to financial considerations. Nonetheless, dance medicine specialists and organizations are actively working to create awareness among the dance and medical communities, and this article is recommended especially for the occasional practitioner of dance medicine.

Master S, De Biase N, Chiari BM, Laukkanen AM: Acoustic and perceptual analysis of Brazilian male actors' and nonactors' voices: long-term average spectrum and the "actor's formant." *J Voice* 2008;22(2):146–154.

This study used acoustic and perceptual analyses to investigate the possible differences between actors' and nonactors' vocal projection strategies. A total of 11 male actors and 10 male nonactors read an extended text sample at habitual, moderate, and loud levels. Samples were analyzed for sound pressure

level (SPL), alpha ratio (difference between the average SPL in the 1 to 5 kHz region and that of the 50 Hz to 1 kHz region), fundamental frequency (F0), and long-term average spectrum (LTAS). Authors measured the mean frequency of the first formant (F1) range, the mean frequency of the "actor's formant," the level differences between the F1 frequency region and the F0 region (L1–L0), and the level differences between the strongest peak at 0-1 kHz and that at 3-4 kHz. Eight voice specialists evaluated perceptually the degree of projection, loudness, and tension in the samples. The actors' text reading in three loudness levels was perceived as louder and better projected than nonactors'. Actors also demonstrated a greater alpha ratio and stronger level of the "actor's formant" range, which seemed to be related to the degree of perceived loudness. Other parameters showed no significant differences. It appears that the main acoustic difference between the actors' and nonactors' readings was a less tilted spectral scope among the actors. Physiologically, a more favorable glottal setting, providing a higher glottal closing speed, may be characteristic of these actors' projected voices.

Walzak P, McCabe P, Madill C, Sheard C: Acoustic changes in student actors' voices after 12 months of training. *J Voice* 2008;22(3):300–313.

This longitudinal study aimed to evaluate acoustic changes in student actors' voices after a year of actor training. Eighteen students enrolled in an Australian tertiary 3-year acting program (9 male, 9 female) were assessed at the beginning of their acting course and again 12 months later using a 6-page questionnaire (appended at the end of the article), interview, maximum phonation time (MPT), reading, spontaneous speaking, sustained phonation tasks, and a pitch range task. Samples were analyzed for MPT, fundamental frequency across tasks, pitch range for speaking and reading, singing pitch range, noise-to-harmonic ratio, shimmer, and jitter. After training, measures of shimmer significantly increased for all subjects. Female participants' pitch range also increased significantly after training, with a significantly lower mean frequency for their lowest pitch. Many acoustic measures did not change after training or were lowered. This indicates that further investigation is needed into the long-term effects of actor voice training and which parameters of voicing are most targeted and valued in training. Particular investigation into the relationship between training targets and outcomes could more reliably inform acting programs about changes in teaching methodologies. Further research into the relationship between specific training technologies, physiological changes, and vocal changes may also provide information on implementing more evidence-based training methods to assist actors in achieving optimal use of their voice.

Heman-Ackah YD, Sataloff RT, Hawkshaw MJ, Divi V: How do I maintain longevity of my voice? *J Singing* 2008;64(4):467–472.

Vocal hygiene is a set of preventive measures that are undertaken actively and consciously by the voice user to maintain the health, consistency, and reliability of the voice. Proper training, strengthening, and conditioning are important to the professional voice user. Voice training includes exercises designed to build strength and coordination throughout the vocal tract. These include not only vocal exercises, but also medically supervised body exercises that improve aerobic condition and strength in the support systems. Avoiding sources of voice abuse is paramount among preventive techniques. Care of the voice during conversation is an often-overlooked aspect of vocal health. The authors stress daily warm-up and cool-down of the speaking voice, including warm-up exercises; these should be taught by a voice teacher or voice pathologist/ therapist. Adequate vocal fold lubrication depends on proper hydration, both in quantity and type. Other preventive topics covered include minimizing esophagolaryngeal acid reflux by timing one's food and liquid intake, proper breath support and the role posture plays in respiration, and the correct positioning and alignment of the vocal tract to facilitate resonance. Every vocal performer should have a baseline laryngeal evaluation early in his or her career; this can prove useful in preventing future problems and helpful in identifying the cause of new problems as they arise.