The Beat Goes On: The Effects of Music on Exercise

by Nicole M. Harmon (http://www.ideafit.com/fitness-expert/nicole-m-harmon) and Len Kravitz, PhD (http://www.ideafit.com/fitness-expert/len-kravitz) on Sep 01, 2007

A review of the research on the ergogenic and psychophysical impact of music—tempo, type and timing—in an exercise program.

How does music affect exercise—and the exerciser? A previous review of the literature on the subject took a physiological approach, investigating the evidence-based findings on how different types of music affect physical results, such as strength, gait, endurance, performance and motor skill acquisition (Kravitz 1994). In this article, we will take a slightly different tack, reviewing the ergogenic and psychophysical effects of music in an attempt to understand the relationship between the physical stimulus of the music and the sensory responses that may enable the exerciser to achieve better results.

The prevailing belief is that music facilitates exercise performance by reducing the sensation of fatigue, increasing psychological arousal, promoting relaxation and improving motor coordination (Szabo, Small & Leigh 1999). An examination of the research will put these theories to the test.

Music as a Motivator in Exercise Performance

For years researchers have investigated the effects of music on exercise performance, and results have revealed conflicting data, most likely because of the very different research designs employed (Karageorghis & Terry 1997).

Some researchers have studied the role music might play in enabling exercisers to increase their workloads or their times to exhaustion. The theory is that music can prevent exercisers from focusing on the specific physical sensations of fatigue, although some research suggests that this mechanism may be more effective at lower exercise intensities than at higher intensities, where the body's internal cues of fatigue have a greater influence (Karageorghis & Terry 1997).

Szabo and colleagues (1999) studied the effects of slow-rhythm and fast-rhythm classical music on progressive cycling to voluntary physical exhaustion. (Symphony music was used, and the fast music was two times faster than the slow music.) The 12 male and 12 female subjects in the study listened to music that was slow, fast, slow-to-fast, and fast-to-slow—and a control group had no music. For the slow-to-fast and fast-to-slow trials, the tempo was adjusted once a subject's heart rate reached 70% of maximal reserve. The investigators found that the participants in the slow-to-fast intervention completed a slightly higher exercise workload than the participants in all other study conditions, and the difference was statistically significant. According to the authors, the study suggests that music may temporarily distract exercisers from some of the body's internal cues typically associated with tiredness.

The Importance of Workout Intensity

Does the intensity of the workout influence music's effect? In a recent study, eight males performed two 30-minute submaximal cycle ergometer exercise bouts—one at 40% of maximal oxygen consumption (VO_2max) and one at 60% VO_2max (Yamashita et al. 2006). The researchers found that subjects in the 40% VO_2max trial who listened to self-selected music had a lower rating of perceived exertion (RPE) than controls (no music); however, the music did not show this effect during the 60% VO_2max trial.

The Role Played by Music Type

One study investigated the effects of different types and intensities of music on a graded maximal treadmill test (Copeland & Franks 1991). Thirteen females and 11 males of college age walked/ran to maximal capacity while listening to type A (loud, fast, exciting) music; type B (soft, slow, easy-listening) music; or no music. The actual times to exhaustion varied by less

than 30 seconds, and the maximal heart rates varied by only 2 beats per minute in the three conditions, which may very well indicate that in measures of maximal work capacity, music is not able to provide an ergogenic effect above that of the body's physiological limitations.

Unlike many researchers who focus on time to exhaustion during exercise trials, Atkinson and colleagues investigated average speed, power, heart rate and RPE for 16 physically active 25-year-old males during timed trials on a cycle ergometer (Atkinson, Wilson & Eubank 2004). "Dance" music (142 beats per minute [bpm]) was used in a 10-kilometer (10K) trial, and the results were compared with those from a 10K control trial that used no music. Average speed, power and heart rate were significantly higher in the group who had music accompaniment than in the control group. Though subjects were cycling at higher speeds during the music trial, their perceived exertion was also higher. This suggests that they were fully aware of how hard they were working, despite the attempt to alter perceived exertion with the use of music. In their qualitative assessment of the trials, subjects noted an ergogenic effect of the music that seemingly stimulated their cycling performance. Substantiating this qualitative finding with a very large group (532 subjects) of male and female participants, Priest and colleagues demonstrated that participants were inspired to exercise by preferential choices of music, with the one commonality being a strong rhythmic component (Priest, Karageorghis & Sharp 2004).

Practical Application. Research findings suggest that, regardless of whether music lowers exercisers' RPE, it can act as a motivator, enabling individuals to exercise with greater efficiency. However, the motivational stimulus may be less effective at higher intensities.

Improving Strength and Endurance Through Psychological Arousal

One investigation examined the effects of different types of music on the grip strength of 25 males and 25 females of college age (Karageorghis, Drew & Terry 1996). Participants were subjected to three testing conditions prior to a grip strength test: listening to stimulative, energetic music (more than 130 bpm); listening to sedative, relaxing music (less than 100 bpm); and listening to white-noise sounds from a blank cassette. Care was taken to choose music familiar to the subjects in order to enhance any arousal effect. Analysis of the results revealed that subjects had significantly higher strength scores when they listened to stimulative music rather than sedative music or white noise. Furthermore, sedative music produced significantly lower grip scores than white noise. No significant difference in gender responses was found.

The Timing of the Music Intervention

To determine whether the timing of the music intervention makes a difference, Crust (2004) examined the effects of listening to music *during* a muscular endurance test (holding a dumbbell at a 90-degree angle in front of the body to exhaustion) rather than just prior to the test. Twenty-seven college-age males listened to either white noise or self-selected motivational music (120 bpm) in the following three conditions: (1) music or white noise was played immediately before the task (prior exposure); (2) music or white noise was played simultaneously with the task but terminated halfway through (half exposure); and (3) music or white noise was played simultaneously with the task and continued throughout (full exposure). Crust found that *all* conditions of music exposure produced significantly longer endurance times than the white noise exposure. A comparison of the results showed that subjects who experienced full exposure produced significantly longer times to exhaustion than those with prior exposure. Crust noted that using self-selected motivational music (as opposed to researcher selected music) was indicative of a real-life situation.

Practical Application. Music can increase exercisers' psychological arousal. Musical choices should reflect the level of arousal needed to perform certain tasks (North & Hargreaves 2000). Specifically, when clients are doing physically demanding work or exercise, energetic music that they enjoy is most beneficial.

Promoting Relaxation

The idea behind the theory that music increases relaxation during exercise is that music can "dampen" some of the byproducts of high-level exercise, such as acidosis and elevated hormone levels, thereby enhancing performance.

To test this theory, Szmedra and Bacharach (1998) had 10 healthy, well-trained males complete two 15-minute treadmill trials at 70% VO_2max. In one trial the subjects listened to classical music (Hooked on Classics, Volume 3) while exercising, and in a second trial there

was no music. Because plasma lactate and norepinephrine have been identified as indices of exercise stress, the researchers measured these components—along with heart rate, blood pressure and perceived exertion—during the treadmill running. The results showed statistically significant decreases in heart rate, systolic blood pressure, RPE and lactate levels when individuals listened to music during the treadmill test. Though the levels of norepinephrine were also slightly lower in the group who listened to music, the difference was not statistically significant. The authors suggested that music has the ability to interfere with unpleasant stimuli and sensations associated with exercise. In this study, music not only led exercisers to have a lower RPE but also influenced the metabolic (acidosis) and hemodynamic (heart rate and blood pressure) components of the exercise session.

Practical Application. Although the exact mechanism of this phenomenon is unclear, music does appear to limit some of the uncomfortable physical sensations associated with exercise. Encouraging clients to listen to self-selected music during challenging exercise is an application that fitness professionals have employed for years.

Improving Motor Coordination

Researchers have been interested in how music or rhythmic stimuli might be used to improve, augment or enhance both large and small motor tasks.

Music and Gait Training

Many stroke patients have abnormal gait function, caused mainly by abnormalities in motor control. Recovery can be enhanced with the use of extensive motor training. Schauer and Mauritz (2003) demonstrated that subjects in a gait training group that combined auditory feedback of the patients' own steps with a musical accompaniment showed greater improvements than subjects in a conventional gait therapy control group. Significant differences seen in the intervention group included increases in walking speed and stride length, decreases in symmetry deviation and improved rollover path length. The researchers hypothesized that motor, cognitive and perceptive processes were in some way influenced by the musical stimulus, producing an overall improvement in walking. An earlier review of the literature suggested that the beat in music might improve gait regularity by allowing individuals to find a desired rate of movement (Kravitz 1994). The rhythm and percussion of auditory cues may have a positive effect on coordinated walking and proprioceptive control.

The Effect of Rhythmic Stimuli on Other Movement Disorders

Thaut and colleagues (1999) pointed out that rhythm "constitutes one of the most essential structural and organizational elements of music." Although more research is needed to identify the exact mechanisms at work, these researchers found that rhythmic music can provide an external auditory stimulus that may augment some motor behavior processes. According to the authors, "one of the most exciting findings in this area of research . . . may be the evidence that the interaction between auditory rhythm and physical response can be effectively harnessed for specific therapeutic purposes in the rehabilitation of persons with movement disorders."

As Molinari and colleagues (2003) explained, this motor control enrichment from auditory rhythmic stimuli probably affects motor effectors in the cortex of the brain, or at the spinal levels. An enhanced understanding of the way rhythmic stimuli work may lead to new approaches for rehabilitating patients with cerebral motor defects. As an example, when patients with Parkinson's disease were exposed to a musical selection and then asked to perform certain motor tests, results showed significant improvement in aiming and line tracking, providing evidence of fine motor improvement through hand-arm coordination (Bernatzky et al. 2004).

Practical Application. Applying a rhythmic component to exercise sessions may help clients with the coordination of motor skills, large and small. As the research above suggests, this is especially applicable in fields that involve working with people with motor disturbances from conditions such as stroke, brain injury and Parkinson's disease. More research is needed to determine the exact physiological and neurological effects that rhythm and music have on motor control.

Drawing Some Conclusions

A review of the research confirms—and adds to—many of the experiences fitness professionals have had when using music in exercise and movement therapy programs. The four central hypotheses explaining music's facilitation of exercise performance include (1) a reduction in the feeling of fatigue, (2) an increase in levels of psychological arousal, (3) a physiological relaxation response and (4) an improvement in motor coordination. Although the research is somewhat conflicting when it comes to measuring the extent to which music can enhance maximal and near-maximal exercise performance, it does seem clear that stimulative, self-chosen music can provide an acute incentive to male and female exercisers of all ages and abilities. In addition, as more understanding evolves, the future looks very hopeful for individuals with some motor behavior and/or neuromuscular disturbances to improve their motor skill ability through the use of auditory rhythmic stimuli.

SIDEBAR: SIDEBAR: How Has Music Shaped The Fitness Industry?

We asked a number of innovative and esteemed fitness pioneers to share their views on how music has shaped the industry. The distinguished group included the following:
• **Ken Alan**, lecturer, department of kinesiology, California State University, Fullerton
• **Lawrence Biscontini**, MA, wellness and spa specialist
• **Jay Blahnik**, 1996 IDEA Fitness Instructor of the Year and 2006 Can-Fit-Pro Fitness Instructor of the Year
• **Shannon Griffiths Fable**, fitness educator and owner of Sunshine Fitness Resources
• **Gay Gasper**, fitness educator and group exercise director at Planet Image in Union, New Jersey
• **Maureen Hagan**, vice president of operations for GoodLife Fitness Clubs and director of education for Can-Fit-Pro
• **Petra Kolber**, 2001 IDEA Fitness Instructor of the Year
• **Sara Kooperman**, chief executive officer of SCW Fitness Education and founder of the MANIA fitness instructor training conventions
• **Angie Proctor**, executive director of the Aquatic Exercise Association
• **Julie See**, president of the Aquatic Exercise Association

Q: How has music evolved in the fitness industry over the last 20- plus years?

Alan: Pre-1985, workout music was available only on vinyl records. Organizing music required thoughtful preparation. To maintain group energy, you literally threw one record off and another one on the record player. This necessitated six to 12 breaks during class to change songs. The music didn't last long enough to build progressive combinations.

Biscontini: Music used to be primarily for background in all types of fitness classes. Today, although that still occurs, there is also another branch of fitness which weaves music . . . into the workouts. Instructors have found ways to use music to deepen a sense of awareness of self and promote an inward focus by choosing certain types of instruments, volume and orchestrations.

Blahnik: Years ago, classes were primarily dance exercise, so the music had to be mixed at specific speeds, depending on what you were teaching. With the expansion of group exercise into cycling, yoga, Pilates, sports-inspired workouts, treadmill classes and even rowing classes, the music variety has expanded beyond anything I could have ever imagined. Some classes still require the music to be mixed for best results, but other classes might only need music purchased directly from iTunes. We are not always "exercising to the beat" now, and that changes everything. Now I teach with an iPod and have hundreds of classes stored in a device that fits into the palm of my hand!

Proctor: Music has become one of the strongest motivators in exercise adherence and is largely responsible for the success of physical fitness activities, not only in group exercise settings, but also in personal cardio training and strength training.

Q: In what ways has the professional fitness music industry contributed to exercise?

Alan: There's no question fitness music companies have been an asset to instructors. They have made [the arduous task of] finding and selecting music less painful, less costly, less time-consuming and perhaps less stressful. They do [a lot of] the groundwork for you; they select songs, determine bpm, blend songs into a continuous mix, and remove extra music counts for consistent phrasing. Their catalogs also introduce new music to instructors.

Kolber: The quality, content and feel of the music have improved by leaps and bounds. The

area [in which] I have seen the biggest improvement is vocals; these days it can be pretty hard to distinguish between the original version and the "soundalike," which is so important when teaching.

Kooperman: There is a great deal of musical variety available now—different styles and techniques. This makes it easier to create, and succeed at developing, new programs.

See: Having 32-count phrasing makes program design and instructing so much easier and the outcome more professional. By recognizing the dynamic nature of fitness and constantly evolving bpm, arrangements (e.g., circuit vs. continuous training vs. cycling) and music styles, the music industry has been an integral part of the continued success of group exercise. Having a wide selection of music choices prevents me, as well as my students, from getting bored with training—even after 25 years!

Q: Is music a vital part of classes and programs?

Blahnik: Music can help you execute movements at the proper speed, and it can even help you get through the toughest parts of a workout! Music can also have a calming effect for classes like yoga, and an "I want to kick, punch and jump" effect for classes like kickboxing and sports workouts. It can make you smile and lift your spirits!

Fable: Music showcases an instructor's personality and individualizes the exercise experience. The way an instructor works with the music can make magic, as it can [eliminate the need] to count repetitions or time exercises, thus providing quality motivation and cuing time. Music can calm and soothe and seal a workout; there is nothing better than finishing off a fabulous class with a well-thought-out, specifically chosen cool-down track that leaves students feeling amazing when they walk out the door!

Gasper: Music is one of the most important ingredients in group exercise classes. Music inspires us to move and keeps us together as a group. Music is the greatest motivation to move and work out.

Hagan: The number-one reason music has become such a vital component is that it motivates and inspires participants to move, express themselves, feel/explore rhythm and energy, and release stress/inhibitions. Exercisers of all ages are able to "lose themselves in the music" and reap more health benefits (including mindfulness) by being fully engaged in the workout, whether it be yoga, dance or weight training.

Kolber: Your music selection can make or break a class. It can add energy and excitement. [Choosing] your music well . . . makes your job easier. Music is the heartbeat of the class—constantly in the background but a vital part of the exercise experience.

Nicole M.Harmon recently earned her bachelor's degree in exercise science from the University of New Mexico at Albuquerque (UNMA). She plans to continue her education in the health sciences and pursue a degree in physical therapy.

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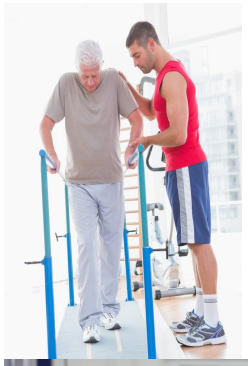

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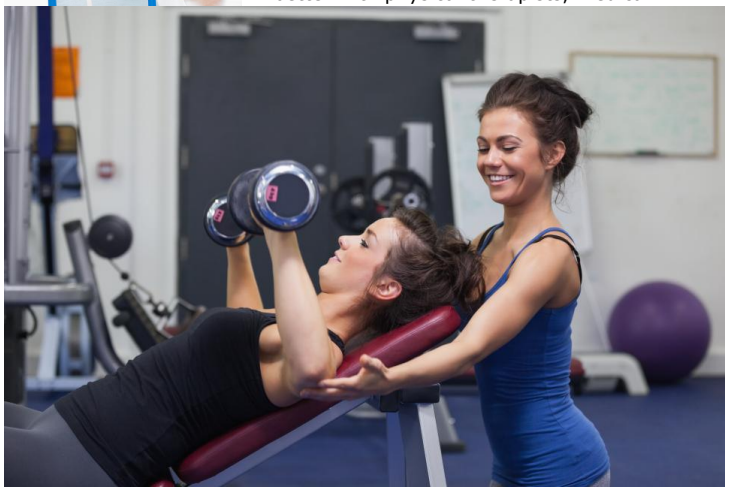

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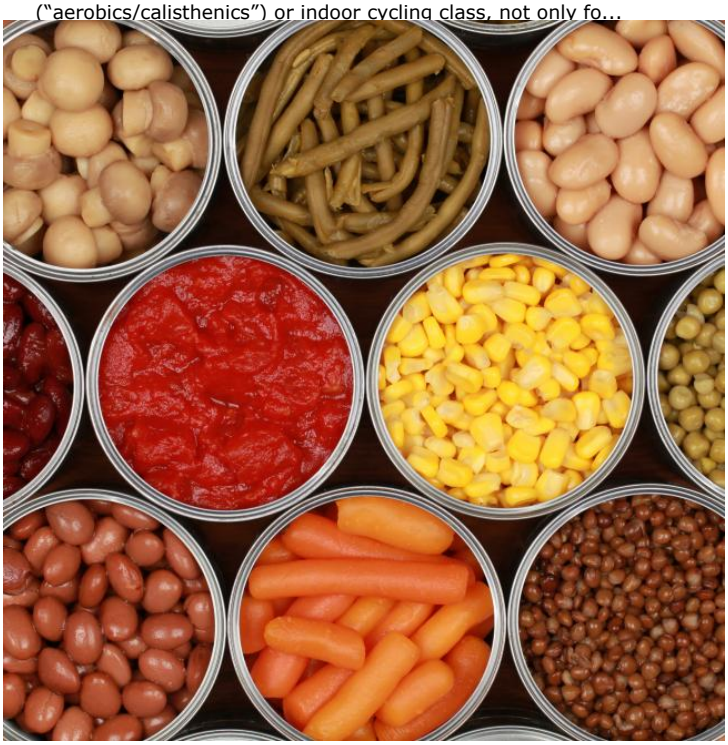

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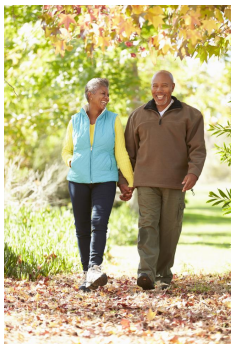

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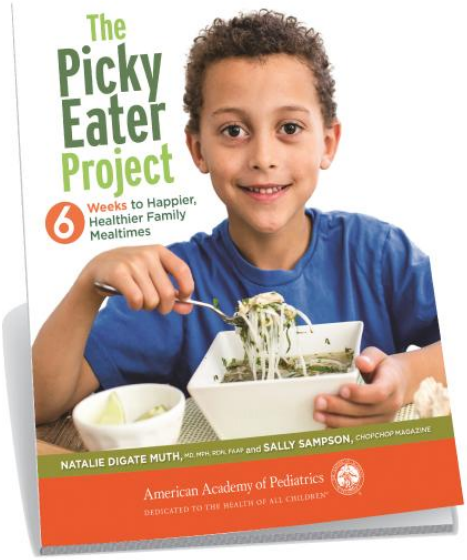

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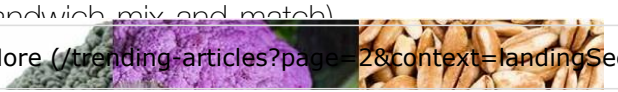

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