

Running with Music

By Jasmin C. Hutchinson, PhD

Take a look around you the next time you lace up at the gym, hit a local running path, or toe the line at a road race. More often than not you'll see runners tuning into a personal beat. While some running purists recoil at the idea of listening to music while running, a growing subculture of runners wouldn't dream of taking a single step without their pulsating playlists. Case in point, there was uproar in 2007 when the USATF banned the use of portable music devices in its sanctioned events* and many chose to flaunt the rules; "I dare them to find the iPod on me," said Richie Sais, 46, a police officer in Suffolk County, New York, before running the Marine Corps Marathon as he clipped his iPod Shuffle under his shirt (1).

Of course, moving to the beat isn't anything new, but recent technological advances have facilitated this marriage between music and movement. As portable listening devices have become smaller, increasingly dependable, and more affordable we have seen a veritable explosion in the use of music by runners and other exercisers. Similarly, over the last 20 years, there has been a dramatic increase in empirical research on the psychological and psychophysical effects of music in sport and exercise settings. Insights gleaned from this body of work will be outlined below, together with a brief overview of the mechanisms by which music might exert an effect during sport and exercise, and a series of evidence based applied recommendations. Future papers in this series will explore in greater detail the varied underlying mechanisms by which music influences running performance.

Overview of Research Findings

The benefits of music listening in a sport or exercise setting are numerous, and have each received strong empirical support. Prior to a run, music can enhance emotional state and motivation, allowing runners to find their optimal arousal "zone" and priming the various bodily systems for action (2). During a run, music can function as a distractor, drawing attention away from feelings of pain and fatigue (3). Music is also known to increase the release of feel-good chemicals in the brain, such as dopamine and opioids, that may enhance feeling state, dull pain, and delay fatigue (4). Moreover, synchronizing



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to a beat during running, a process known as auditory-motor synchronization, helps regulate and maintain pace, and can improve running economy (5). Finally, appropriately selected post-run music can enhance recovery, facilitating the return of runners' internal systems, such as heart rate and blood pressure, to the pre-workout state (6).

Optimizing Arousal and Affective Valence

Music can be used as either a sedative or a stimulant to engender the optimal arousal state prior to and during a run. Research has broadly supported the assumption that stimulative music increases psychomotor arousal, while soft or sedative music decreases arousal and facilitates relaxation. Music may also influence arousal if it evokes an extra-musical association that either inspires physical activity or promotes relaxation (7). A classic example of a piece of music with highly arousing extra-musical associations would be Survivor's *Eye of the Tiger*, from the Rocky movie series. Many athletes harness the arousal regulatory qualities of music to help get them "in the zone" before competition. A well-known example is Olympic swimmer Michael Phelps, who listens to music until the last possible moment before competition. "It helps me to relax and get into my own little world" says Phelps (8).

Mood responses and feeling states during exercise tend to be more positive under music compared to no-music conditions (3). This effect has been found consistently and across

a variety of exercise modalities (9), intensities (10), age groups (11), and fitness levels (12). Feeling states and motivation are closely related constructs; put in simple terms, how we feel about something directs our motivation toward it. Running intensities that are associated with significant cardiorespiratory gains can induce feelings of fatigue and negative affect, which can act as a deterrent to continued participation and impact negatively on motivation levels (3). Therefore, interventions that improve the running experience, such as music, are likely to have a positive impact on motivation and adherence, particularly among novice runners.

Researchers have attempted to tease out which particular aspects of music influence emotional states in listeners. Two key elements are tempo and mode (major or minor key). "Happy music" is characterized by fast tempo and major mode, whereas sad music is typically played in slow tempo and minor mode (13). Faster tempo music also leads to enhanced psycho-motor arousal. Several studies have shown increased activation of the sympathetic nervous system—the system responsible for priming the body for action—with higher tempo music. Conversely, listening to sedative music can lead to decreased heart rate, respiration rate, and blood pressure, indicating an increase in parasympathetic activity (14).

The role of music in the affective response to exercise is complex. Perhaps more than any other stimulus, music has the ability to invoke powerful images and feelings. Music is

* USATF later amended the ban and it now applies only to those vying for prizes in championships



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often associated with enjoyable activities like socializing and relaxing, and can sometimes bring back memories of a particular person or place. Think, for example, of a particular song we associate with our youth or an important life event such as a wedding. Hearing this song can often bring back a tidal wave of memories. Scientists refer to this phenomenon as “music-evoked autobiographical memories” (15). Music has also been linked to drug-like effects in the brain. When pleasurable music is heard, dopamine is released in the striatum, a critical component of the reward system which is known to respond to naturally rewarding stimuli like food and sex (16).

An alternate mechanism by which music improves the affective experience of exercise is by functioning as a distractor, which can modulate pain levels and distract runners from the tedium and monotony of long runs. This principle is known as *dissociation*, and will be explicated in the next section.

Attentional Focus and Perceived Exertion

Based upon the idea that attention is a limited capacity resource (17), it is assumed that the presence of a distracting stimulus (such as

music) will occupy attentional capacity thereby preventing or delaying sensations of pain and fatigue from entering conscious awareness (3). This reduced awareness of afferent feedback appears, in turn, to lower perceptions of exertion in the order of approximately 10% (18). It is important to note that this particular effect appears to hold for low to moderate exercise intensities only. At high exercise intensities, attentional processes are dominated by afferent feedback which demands attention, thus perceptions of fatigue override the distractional capabilities of music (19). In other words, all of the *Eye of the Tiger* in the world isn't going to help you block out fatigue during a grueling set of hill sprints!

Although the vast majority of research findings support this distraction hypothesis, qualitative data indicates that there is considerable variability in the ways in which people use music during exercise. Using in-depth interviews, it was found that during low intensity runs, music was largely used to facilitate dissociation, with runners detailing strategies such as singing along and “daydreaming” in response to the music. Contrastingly, during high intensity runs, runners described ways in which they used the music in a more associative mode (e.g., “I

think about my stride,” “I am able to focus”) (3). Thus, it seems that when exercise intensity is high, the music is coupled with the task demands to a greater degree.

Synchronization (entrainment) and Efficiency

Entrainment is the process by which two oscillating systems assume the same period (or period ratio) when they interact. In experimental paradigms, entrainment usually refers to the synchronization of endogenous rhythms in the subject with an exogenous rhythm in the environment (20). One example of this is our natural tendency to tap our fingers, hands, or feet along to a beat when listening to music (21). Likewise, runners have a natural tendency to synchronize their stride to the beat. A prime example of an elite runner harnessing the power of auditory-motor synchronization is Haile Gebrselassie's astonishing 5,000m performance in Zurich in 1995. Described by Gebrselassie as his “most memorable achievement” (22) he smashed Kiptanui's world record by nearly 11 seconds with a time of 12:44.39 seconds. He says that as he ran the beat of the hit song “Scatman” kept ringing around his head. “It's nice music, it's fast written, that's why I could break a world record, by that music,” he recalls (22).

Synchronizing movements with music also enables athletes to perform more efficiently. In one study, participants who cycled in time to music required 7% less oxygen to do the same work as compared to cycling with background (asynchronous) music (23). The implication is that music provides temporal cues that have the potential to make athletes' energy use more efficient. Significant research attention has been devoted to the optimal tempo for musical accompaniment to exercise. Tempo is considered the most significant factor in determining an individual's response to a piece of music, and, from an applied standpoint, is among the easiest aspects of music to manipulate. Karageorghis and colleagues (24,25) undertook an extensive examination of the relationship between exercise heart rate and preferred music tempo. They reported that the preferred tempo band across the range of exercise intensities was relatively narrow, 125-140 bpm. This tempo range has become known anecdotally as “the sweet spot.”

Evidence Based Recommendations

Prior to selecting music for use in an exercise setting, personal and contextual factors should be taken into consideration. A runner should begin with a selection of familiar tracks that reflect their musical taste and preferences. Ideally, these tracks should have strong rhythmical elements and some personal meaning which may be drawn from past experiences and accomplishments or from

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extra-musical associations to sport and exercise. Motivational and affirming lyrics can also provide meaning, as well as a powerful source of inspiration. A good starting point for selecting songs is to consider what you want the music to do. For example, are you using the music to relax and put the stresses of a hard day behind you or to energize you during a warm up? Are you hoping the music will distract you from feelings of fatigue during a workout or do you want the music to inspire you to perform at a higher level?

Runners should also consider factors such as desired intensity and duration of the exercise bout. Typically, warm-up tracks will be slower (80-100 bpm), and the music program will gradually build in tempo with increasing workload to the ideal range of 125-140 bpm. When it comes to a prolonged exercise bout, such as distance running, it is advisable to choose songs that have a steady beat and similar tempos to help maintain a comfortable steady pace. It is also beneficial for the rhythm of the music to approximate the motor patterns entailed where possible (27) which may promote neuromuscular relaxation and cardiovascular efficiency. Faster tempo tracks lend themselves to more intense workouts, although a ceiling effect exists at around 140bpm. Tracks that greatly exceed this tempo tend not to be preferred, and may result in negative affective experiences such as boredom or irritation.

On occasion, particular tracks or segments of a musical piece can be tailored to various components of an exercise bout, for example, to distinguish work time and recovery time during interval training. Priest and Karageorghis (26) reported that exercise participants experience a strong sense of expectancy regarding segments of a musical piece that they find especially motivational, such as the introduction or the chorus. Exercisers can tap into this phenomenon, known as *segmentation*, to coordinate bursts of effort or to plan a sprint finish.

Although the benefits of music during running are numerous, it's not for everyone. Many runners use their time on the road to "get away" or become lost in thought. Others enjoy the social element of running with a friend or a group. It also goes without saying that safety is paramount. Music use while running on roads, trails, or anywhere where safety could

be compromised is not advised. But for your next track session, spin or treadmill (groan) workout, maybe you'll find some extra oomph from jamming to your favorite tunes.

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