

USE OF MUSIC INTERVENTIONS WITH ELITE ATHLETES



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Introduction

Music has been shown to be an effective intervention to achieve a range of desirable psychological and performance effects among athletes. Effects that have been demonstrated empirically include enhanced mood (Bishop, Loizou, & Karageorghis, in press; Hayakawa, Miki, Takada, & Tanaka, 2000; Hewston, Lane, Karageorghis, & Nevill, 2005; Terry, Dinsdale, Karageorghis, & Lane, 2006), arousal control (Szmedra & Bacharach, 1998), promotion of flow states (Pates, Karageorghis, Fryer, & Maynard, 2003), reduced perceived exertion (Szmedra & Bacharach, 1998), extended work output (Atkinson, Wilson, & Eubank, 2004; Szabo, Small, & Leigh, 1999), improved skill acquisition (Pates et al., 2003), and enhanced performance (Karageorghis, Drew, & Terry, 1996; Simpson & Karageorghis, 2006). The process by which such effects accrue has been summarized into an evolving conceptual model by the present authors, the most recent version of which (see Figure 1) can be found in Terry and Karageorghis (2006). Given the very fine margins between winning and losing in elite sport, all of these potential benefits of music should be of interest to applied sport psychologists.

The present paper explains the underlying principles and provides examples of applied music interventions, and associated contextual information, across a range of sports for a variety of purposes. General examples include the synchronization of activities to music in order to capitalise on the well-established ergogenic effect, and using music asynchronously to, for example, intensify responses to relaxation or imagery techniques. Specific examples of music interventions with elite performers include (a) providing inspiration to bobsleigh and shooting medallists at the 1998 and 2000 Olympic Games, respectively; (b) implementing pre-event arousal control strategies with boxing and rowing medallists at the 2000 Olympic Games; (c) team cohesion strategies during different phases of a national hockey championships; (d) maintaining motivation and a desirable mindset during successful rehabilitation from chronic fatigue syndrome of a world champion marathon canoeist; (e) to intensify visualisation strategies among a lawn bowls team at the 1999 South East Asian Games; (f) as an adjunct to audio-visual entrainment, also known as brainwave training, during the trap shooting event at the 2006 Asian Games, and (g) conditioning responses to specific music in order to promote ideal brain activity among international clay target shooters.

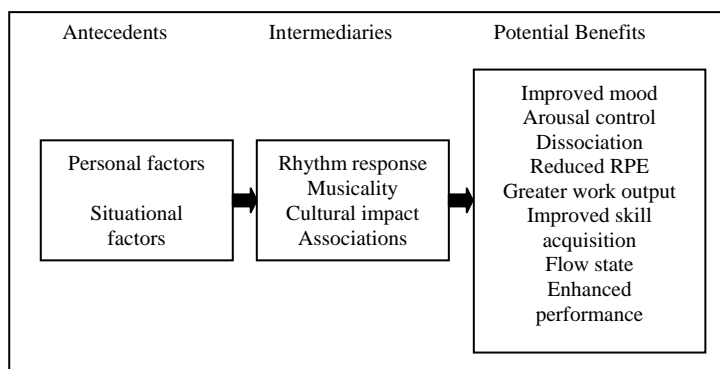


Figure 1. Conceptual framework for benefits of music in sport and exercise contexts.

Synchronous Music

Synchronous use of music involves performing repetitive movements in time with its rhythmical elements such as the beat or tempo (Karageorghis & Terry, 1997). A very clear example of the benefit of synchronous music in sport occurred when legendary Ethiopian athlete, Haile Gebreselassie, broke the indoor 2000-metre record in 1998 while synchronizing his stride rate to the rhythmical pop song *Scatman*. Recent scientific evidence has further confirmed the performance-enhancing effects of synchronous music in 400 metre running (Simpson & Karageorghis, 2006). Research has consistently demonstrated the efficacy of synchronous music as an ergogenic aid in aerobic activities such as cycle ergometry (e.g., Anshel & Marisi, 1978; Karageorghis & Jones, 2000). Further, it has been shown that switching from slow to fast tempo music during a cycle ergometry test produced an ergogenic effect (Szabo et al., 1999), demonstrating the potential for synchronous music to be used to increase work output in the latter stages of an exercise bout or when intensity level plateaus. The second author regularly applies synchronous music to training in repetitive activities, such

as distance running, cycling, and rowing, in order to capitalise on its ergogenic benefits. Use of synchronous music requires consideration of both the motor patterns of training activities and the preferred motor rhythms of the athletes in question before choosing the music. Music tempo can be digitally altered to remain constant from track to track, and can be selected to coincide either with expected work rate, which tends to prolong work output and make the training activity more pleasurable, or to be marginally ahead of an athlete's preferred motor rhythm, to motivate athletes towards higher work output.

Asynchronous Music

Asynchronous use of music occurs when there is no conscious synchronisation between movement and music tempo. With asynchronous applications, at least four factors – rhythm response, musicality, cultural impact, and association – are proposed to mediate its potential benefits (Terry & Karageorghis, 2006). Rhythm response relates to natural responses to musical rhythm, especially tempo (speed of music as measured in beats per minute [bpm]). Musicality refers to pitch-related elements such as harmony (how the notes are combined) and melody (the tune). Cultural impact is the pervasiveness of the music within society or a sub-cultural group. Association pertains to the extra-musical associations that music may evoke, such as the composition *Chariots of Fire* by Vangelis, with Olympic glory. Of all the salient factors, tempo is postulated to be the most important determinant of response to music. It has been shown that preference for different tempi may be affected by the physiological arousal of the listener and the context in which the music is heard (North & Hargreaves, 1997). A general preference for medium and fast tempo music during physical activity has been found (Karageorghis, Jones, & Low, 2006), although some research has indicated that slower tempi may increase physiological efficiency and thus prolong exercise performance (Copeland & Franks, 1991). Overall, effects of asynchronous music are less reliable than for synchronous use of music, although considerable potential benefits can be accrued. Many of the benefits of asynchronous music lie beyond ergogenics. In particular, asynchronous music may serve to enhance athletic performance by triggering emotions and cognitions associated with flow states (Pates et al., 2003), enhanced perceptions of state self-confidence (Lanzillo, Burke, Joyner, & Hardy, 2001), and pre-performance mindsets associated with peak performance (Hewston et al., 2005; Terry et al., 2006).

Music to Inspire

The first example, which illustrates the capacity of music to inspire athletes, comes from the 1998 Olympic Winter Games in Nagano, Japan. Having worked with the Great Britain bobsleigh squad for the previous 10 years, the first author impressed upon the four-man team that this was a rare opportunity – their moment in time – to clinch an Olympic medal. As the team drove to the bob track each day for training and competition, they would listen to Whitney Houston's *One Moment in Time* while visualising themselves calmly and decisively seizing the moment; which is precisely what happened on race day with a storming last run that clinched GB's first Olympic medal in the sport since 1964. Exactly the same strategy, indeed with the same song, was implemented successfully with gold medallist, double trap shooter Richard Faulds, at the Sydney 2000 Olympic Games.

Music and Pre-event Routines

It is very common for athletes to use music as part of their pre-event routine, principally as a way of manipulating pre-competition mindset. Olympic super-heavyweight boxing champion, Audley Harrison, who studied sport psychology under both authors prior to the 2000 Olympics, exploited the arousal control qualities of music by listening, perhaps counter-intuitively, to Japanese classical music prior to each bout. This served to temper his pre-fight anxiety, reduce tension, and create an inner state of calm and tranquillity. Similarly, double Olympic rowing champion, James Cracknell, utilised music by the Red Hot Chilli Peppers as an important component of his pre-race routine. In his own words, "The music is vaguely aggressive and powerful, but it's also familiar, so it serves a joint purpose. It makes you relax a bit, but also winds you up at the same time. It keeps you going, which is very important."

Music and Team Cohesion

This example demonstrates the potential of music to contribute to team cohesion. Working with an elite hockey team during the Australian national championships, different musical selections were used to symbolise different phases of the tournament. For example, prior to the first game of the tournament, Pink's *Let's Get This Party Started* became the team song during training, team talks, and travel to the venue, whereas prior to the final, Eminem's *Lose Yourself* became the music of choice, partly because it was a very popular song at the time but also because of its appropriate lyrics: "You only get one shot, do not miss your chance to blow, the opportunity comes once in a lifetime." The timing of the music on the way to the final game was meticulously rehearsed so that the song ended just as the bus came to a halt inside the stadium. The players stepped off the bus and entered the changing rooms singing the song in unison.

Music and Rehabilitation

Another example describes support for a three-time world champion marathon canoeist during a period when she was incapacitated by chronic fatigue syndrome and unable to compete. Having worked with her for more than a decade, the first author was very familiar with the qualities she needed during training as she paddled the long and lonely road to recovery from this debilitating condition. To replace the relentless intensity during every training session that had contributed to the condition in the first place, with a lighter, more enjoyment-focused approach to rehabilitation, a number of songs were chosen that carried associations of fluency, ease of action and fun. One selection, *I'm Like a Bird* by Nelly Furtado, proved particularly helpful during bouts of steady state training and eventually came to symbolize her path to recovery, which became complete with further world championship wins in 2005 and 2006.

Music and Visualisation

Music can also be used to support visualisation. During 1999, the first author spent eight months working in the Sultanate of Brunei as part of a team from the Australian Institute of Sport, helping to prepare Bruneian athletes for participation in the South East Asian Games (SEAGames), hosted in the tiny nation's capital, Bandar Seri Begawan. The women's lawn bowls team, perhaps surprisingly considering their Islamic background, chose Queen's *It's a Kinda Magic* as the ideal music to intensify their visualisation efforts. In particular, they found the lyric "One dream, one soul, one prize, one goal" to aptly capture the joint vision they had for the SEAGames, and the lyric "One shaft of light that shows the way" to provide the best cue for visualising the intended path of their bowl. They would regularly play this song over the loudspeaker system at their training venue during practice sessions to act as a trigger for pre-shot visualisation. During the bronze medal round at the SEAGames with the Brunei team down 18-19 to Singapore, who were holding two shots and thus in a match-winning position in the first-to-21 format, the game was interrupted mid-end for a 12 min break by a call to prayers from an adjacent mosque, much to the bemusement and frustration of the Singaporeans. Once prayers had been offered but before the game resumed, the sound of Queen echoed around the stadium inspiring the next Bruneian player, as she later reported, to play two immaculate bowls and secure the three shots necessary to win the game.

Music and Brain Activity

A recent innovation that has been promoted as a performance-enhancing strategy among the sport shooting community is audio-visual entrainment, also known as brainwave training, which uses the flicker response delivered via custom-made sunglasses to promote alpha wave activity. During an assignment with the Malaysian trap shooting team at the 2006 Asian Games in Qatar, the first author augmented this strategy with simultaneous use of inspirational music, in the form of *Together We Are One* by Delta Goodrem, to manipulate pre-event mood. Results showed dramatic changes between pre- and post-intervention mood responses following a brief period of brainwave training accompanied by music. Most recently, the first author has been applying music in conjunction with analysis of brain activity using electroencephalography (EEG) among international clay target shooters. The strategy utilized is to (a) assess the link between brain activity and best shots for each individual shooter using on-range, wireless EEG analysis, (b) implement a program of individualized neurofeedback training to promote ideal brain activity (Terry, Mahoney, & Mills, 2006), (c) introduce music with associations of winning during neurofeedback training to promote a conditioned response, and (d) use the music as a pre-task stimulus to promote ideal brain activity during performance. Initial results of this process have shown promising performance gains. The evidence-based examples described in this paper provide a guide for applied sport psychology practitioners to implement music interventions with elite athletes.

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