The BASES Expert Statement on the Use of Music in Exercise

Produced on behalf of the British Association of Sport and Exercise Sciences by Dr Costas I. Karageorghis FBASES, Prof Peter C. Terry FBASES, Prof Andrew M. Lane FBASES, Dr Daniel T. Bishop and Dr David-Lee Priest

Introduction

Music use by exercisers and athletes has become commonplace but selection of music is often intuitive rather than scientific. For this reason, sport and exercise scientists have considered the role of evidence-based music prescription for physical activity. In this expert statement we will outline the current status of music research, summarise research themes and findings, and conclude with recommendations for practitioners and researchers. As the title of the statement suggests, the evidence presented refers primarily to exercise participants rather than elite athletes.

Background and evidence

Research conducted in the exercise domain prior to the mid-1990s was of variable quality and produced equivocal findings. This equivocality has been attributed to methodological limitations and the lack of a guiding theoretical framework (see Karageorghis). Researchers often misused musical terminology, operated poor music selection protocols, chose inappropriate measures and failed to standardise important aspects of experimental protocol, such as playing music at a consistent volume. Developments in conceptual understanding and standardisation of music selection (e.g., Karageorghis *et al*., 2006) have helped to rectify these limitations.

A corpus of research work has focused on identifying factors contributing to the motivational qualities of music; that is, qualities which stimulate or inspire physical activity. Following more careful attention to music selection by researchers, a range of benefits have been shown in the exercise domain that include diversion of attentional focus, triggering or regulation of specific emotions, alteration or regulation of mood states, evocation of memories and other cognitive processes, control of arousal, induction of flow state, reduction of inhibitions and encouragement of rhythmic movement (see Terry & Karageorghis, 2011).

These responses to music may, in turn, promote an ergogenic (work-enhancing) effect. This occurs when music improves exercise performance by either reducing perceptions of fatigue or increasing work capacity. Typically, this results in higher-than-expected levels of endurance, power, productivity or strength. Long-term benefits of music use have yet to be investigated thoroughly but are thought to include increased adherence to exercise programmes. This is especially pertinent to music use in medical rehabilitation settings in which exercise plays a role (e.g., physiotherapy, stroke, chronic pain, cardiac episodes; see Siedlecki & Good, 2006). Exploratory work has demonstrated the utility of music in these secondary care contexts where, owing to their condition, patients are in particular need of encouragement, affective enhancement, distraction and stimulation.

Primary factors that influence responsiveness to music in exercise and sport settings are the musical qualities of rhythm, melody and harmony. Secondary factors include the extra-musical qualities of cultural impact (i.e., pervasiveness of the music within specific cultural groups or society generally) and associations that a piece of music may carry (e.g., Heather Small's Proud is closely associated with the British team at the 2000 Sydney Olympics). The latest iteration of our conceptual model incorporates the influence of gender and personality. Research findings suggest that these variables play a role in determining musical preferences and responses within exercise settings. For example, males generally express a greater preference for bass frequencies compared to females (McCown *et al*., 1997), and extraverts respond more favourably than introverts to lively musical selections (e.g., Crust & Clough, 2006). Further, Hargreaves and North (2008) have identified situational context as a key influence on effects of music, whereby exercisers have pre-conditioned expectations about music that should be played in different contexts (e.g., upbeat, arousing music in gymnasia).

Left: The effects of recuperative music are only now beginning to receive research attention in the exercise domain

Courtesy Sally Trussler, Brunel University

Effects of music prior to exercise and sport have been studied extensively. Pre-task music has been shown to act as an effective stimulant that can optimise arousal level and psychological states (see Terry & Karageorghis, 2011). Effects of music during physical activity have also been investigated thoroughly. Use of asynchronous music (i.e., background music to which movements are not consciously synchronized) provides both psychological (distraction and enhancement of positive feelings) and ergogenic (performance-enhancing) benefits. Although the role of such music is typically motivational, it may also serve to promote relaxation and efficiency in long-duration, repetitive activities such as distance running (see Terry & Karageorghis, 2011). Some of our experimental work has addressed the association between heart rate (a proxy for exercise intensity) and preference for musical tempo (speed). Findings indicate that, among young adults, preferred music tempo generally falls within a narrow band (125-140 beats per minute) regardless of exercise intensity (Karageorghis *et al*., 2011). Contrary to theoretical predictions, the relationship between exercise heart rate and preferred music tempo is nonlinear, characterised by a series of inflections. The relationship has yet to be examined among older exercisers, and may possibly be different for them, given that maximal heart rate reduces considerably with age.

Synchronous music use (i.e., when an exerciser consciously moves in time with a musical beat) has been shown to provide ergogenic and psychological benefits in repetitive endurance activities. For example, motivational synchronous music used during treadmill walking improved time to voluntary exhaustion by 15% compared to motivationally-neutral and control conditions (Karageorghis *et al*., 2009). Other findings suggest that synchronous music may increase rhythmicity of movement, resulting in an efficiency gain that is associated with lower relative oxygen uptake (see Terry & Karageorghis, 2011).

In steady-state aerobic exercise, motivational music has also been shown to improve affective states by up to 15%. Similarly, music listening can be an effective dissociation strategy, reducing perceptions of effort and fatigue by up to 12%. However, this distraction effect is attenuated at higher exercise intensities (> ~70% $VO_{2\ max}$) as internal feedback dominates due to the limited channel capacity of the respective afferent nervous system. Notably, the affective and attentional effects of music appear to interact, in that positive feelings can alter perception of intense effort. The effects of post-exercise music, to aid recovery from training, competition or injury – known as recuperative music – are now beginning to receive research attention (see Terry & Karageorghis, 2011).

Conclusions and recommendations

Research evidence demonstrates that music has consistent and measurable effects on the behaviour and psychological states of male and female exercise participants. Music can also positively influence performance by improving endurance and/or exercise intensity. When music is selected according to its motivational qualities, the positive impact on performance (e.g., increased endurance) and psychological states (e.g., enhanced affect) are even greater, which has important implications for exercise adherence. Salient recommendations are that music should be:

- Congruent with the socio-cultural background and age group of listeners (i.e., reflect familiarity and preferences).
- Functional for the activity (e.g., rhythm should usually approximate motor patterns involved).
- Selected with the desired effects in mind (e.g., loud, fast, percussive music with accentuated bass frequencies as an arousal-increasing intervention).
- Selected in consultation with participants using some form of objective rating method (e.g., Brunel Music Rating Inventory-2; Karageorghis *et al*., 2006).
- Characterised by prominent rhythmic qualities and percussion in addition to pleasing melodic and harmonic structures for repetitive aerobic and anaerobic exercise tasks. Harmony refers to sounding multiple notes together, giving music its emotional "colour" (e.g., happy, sad, ruminative).
- Within the tempo band of 125-140 beats per minute for most healthy exercisers engaged in repetitive, aerobic-type activity (slower music is appropriate for warm-up and cool-down).
- Imbued with motivating associations, conditioned either through the media or the personal experiences of the listener.
- Accompanied by lyrics with affirmations of movement (e.g., "run to the beat") or generic motivating statements (e.g., "the only way is up").
- Used in ways where safety is not compromised (e.g., exercisers should not use music when running or cycling on the roads). ■

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