



The BASES Expert Statement on Use of Music in Exercise

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The BASES Expert Statement on Use of Music in Exercise

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Abstract

The use of music during exercise has become ubiquitous over the past two decades and is now supported by a burgeoning body of research detailing its effects and the contingencies surrounding its use. The purpose of this statement is to present a synopsis of the body of knowledge, with selected references, and to provide practical recommendations for exercise practitioners regarding music selection. Following the identification of methodological shortcomings in early studies (see Karageorghis & Terry, 1997), researchers have been guided by new conceptual frameworks, and have produced more consistent findings as a consequence. The use of music has been found to yield ergogenic effects in the exercise domain while also promoting psychological (e.g. enhanced affect) and psychophysical (reduced RPE) benefits. There is a paucity of research examining the longitudinal effects of music on key outcome variables such as exercise adherence.

Introduction

The use of music by exercisers and athletes has become commonplace but selection of music is often intuitive rather than systematic in nature. For this reason, sport and exercise scientists have considered the role of evidence-based music prescription for physical activity (see Terry & Karageorghis, 2011). In this statement we provide an overview of salient research, as well as presenting a series of recommendations for practitioners and researchers. As our title suggests, the evidence we present refers primarily to exercise participants rather than elite athletes. For the interested reader, a review of music research relevant to the sports domain was produced recently by Bishop (2010).

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 & Terry, 1997). 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, Priest, Terry, Chatzisarantis, & Lane, 2006; Terry & Karageorghis, 2006) have helped to rectify these limitations.

A significant body of research work has focussed on identifying factors contributing to the motivational qualities of music; that is, qualities that inspire the listener to exercise harder and/or for longer. 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 (e.g. Nethery, 2002), triggering or

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4 regulation of specific emotions and moods (e.g. Priest & Karageorghis, 2008; Terry,
5 Karageorghis, Mecozzi Saha, & D'Auria, 2012), evocation of memories and other
6 cognitive processes (e.g. Priest & Karageorghis), control of arousal (e.g. Hall &
7 Erickson, 1995), induction of flow state (e.g. Karageorghis, Vlachopoulos, & Terry,
8 2000), and encouragement of rhythmic movement (e.g. Karageorghis et al., 2009).

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15 These responses to music may, in turn, promote an ergogenic (work-
16 enhancing) effect. This effect occurs when music improves exercise performance by
17 either reducing perceptions of fatigue or increasing work capacity. Typically, this
18 effect results in increased work rates (e.g. Rendi, Szabo, & Szabó, 2008), endurance
19 (e.g. Crust & Clough, 2006), or strength (e.g. Karageorghis, Drew, & Terry, 1996).
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26 Long-term benefits of music use have yet to be investigated thoroughly but are
27 thought to include increased adherence to exercise programmes (Annesi, 2001). This
28 is especially pertinent to music use in medical rehabilitation settings in which
29 remedial exercise plays a role (e.g. physiotherapy, stroke, chronic pain, cardiac
30 episodes; see Siedlecki & Good, 2006). Exploratory work has demonstrated the
31 utility of music in these secondary care contexts where, owing to their condition,
32 patients are in particular need of encouragement, affective enhancement, distraction
33 and stimulation (Karageorghis, Lim, Priest, Clow, & Forte, 2008).
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Primary factors that influence responsiveness to music in exercise and sport
settings include 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 personal and situational factors (Terry &

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4 Karageorghis, 2006). The importance of such variables has only recently begun to
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6 receive close attention from researchers. Findings provide tentative evidence that
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8 variables such as personality and gender play a role in determining musical
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10 preferences and responses within exercise settings (Crust & Clough, 2006;
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12 Karageorghis et al., 2010). Males generally express a greater preference for bass
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14 frequencies compared to females (McCown, Keiser, Mulhearn, & Williamson,
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16 1997), and extraverts tend to respond more favourably than introverts to lively
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18 musical selections (e.g. Crust & Clough). Furthermore, North and Hargreaves (2008)
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20 have identified the listening situation as a key determinant of the effects of music,
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22 whereby exercisers may have pre-conditioned expectations about the type of music
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24 that should be played in particular contexts (e.g. upbeat, arousing music in
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26 gymnasias).

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31 The effects of music *prior to* exercise and sport have been examined by a
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33 relatively small number of researchers (e.g. Hall & Erickson, 1995; Karageorghis,
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35 Drew, & Terry, 1996; Yamamoto et al., 2003). Pre-task music has been shown to act
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37 as an effective stimulant that can optimise arousal level and psychological states (see
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39 Terry & Karageorghis, 2011). The effects of music *during* physical activity have also
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41 been investigated thoroughly with at least 55 studies conducted to date. Use of
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43 asynchronous music (i.e. background music to which movements are not consciously
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45 synchronised) provides both psychological (e.g. distraction and enhancement of
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47 positive feelings) and ergogenic (performance-enhancing) benefits, which are
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49 especially apparent at low-to-moderate exercise intensities. Although the role of such
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51 music is typically motivational, it may serve to promote neuromuscular efficiency in
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53 long-duration, repetitive activities such as long distance running (Copeland &
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55 Franks, 1991). Recent experimental work has investigated the relationship between
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4 heart rate (a proxy for exercise intensity) and preference for musical tempo
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6 (Karageorghis et al., 2011). Contrary to predictions (Iwanaga, 1995), the relationship
7
8 was not linear, but instead characterised by a series of inflection points. Across a
9
10 broad range of exercise intensities (40-90% max HRR), preferred musical tempo fell
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12 within a narrow band (125-140 bpm). This relationship has yet to be examined
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14 among older exercisers, and may possibly be different for that age group, given that
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16 maximal heart rate reduces considerably with age.
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20 Synchronous music use (i.e. when an exerciser consciously moves in time
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22 with a musical beat) has been shown to provide ergogenic and psychological benefits
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24 in repetitive endurance activities. For example, motivational synchronous music used
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26 during treadmill walking improved time to voluntary exhaustion by 15% compared
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28 to motivationally neutral and control conditions (Karageorghis et al., 2009). Other
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30 findings suggest that synchronous music may increase rhythmicity of movement,
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32 resulting in an efficiency gain that is associated with lower relative oxygen uptake
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34 (Bacon, Myers, & Karageorghis, in press; Terry et al., 2012).
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38 In steady-state aerobic exercise, motivational music has also been shown to
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40 improve affective states by up to 15% (e.g. Karageorghis et al., 2009). Similarly,
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42 music listening can be an effective dissociation strategy, reducing perceptions of
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44 effort and fatigue by up to 12% (Bharani et al., 2004; Nethery, 2002). However, this
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46 distraction effect is proposed to be attenuated at higher exercise intensities (> ~70%
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48 $\dot{V}O_{2\text{max}}$) as internal feedback dominates due to the limited channel capacity of the
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50 respective afferent nervous system (Tenenbaum, 2001). Notably, the affective and
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52 attentional effects of music appear to interact, in that positive feelings can alter
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54 perceptions of effort (cf. Hardy & Rejeski, 1989). Recent research findings have
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56 challenged the notions espoused in extant theory (Rejeski, 1995; Tenenbaum) in so
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4 far as well-selected music appears to promote positive affect even at very high
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6 exercise intensities (e.g., Hutchinson et al., 2011; Karageorghis et al., 2009; Terry et
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8 al., 2011). The effects of post-exercise music, to aid recovery from training,
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10 competition or injury – known as *recuperative music* – are now beginning to receive
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12 attention from researchers (Jing & Xudong, 2008; Savitha, Mallikarjuna, & Chythra,
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14 2010). Although initial findings are encouraging, further research is required before
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16 practitioners have a sound empirical basis for prescriptions they might make.
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19 20 **Conclusions and Recommendations**

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22 Research evidence demonstrates that music has measurable and relatively
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24 consistent effects on the behaviour and psychological states of exercise participants.
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26 When carefully selected music accompanies exercise, the individual's performance
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28 (e.g. work rate) and psychological state (e.g. affect) are generally enhanced, which
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30 has important implications for exercise adherence. Currently, there is a sufficient
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32 volume of research to enable us to make evidence-based recommendations for music
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34 used *during* exercise. Our recommendations are that music should be:
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- 37 • At least moderately familiar to the listener and reflective of their personal
38 preferences;
- 39 • Functional for the activity (i.e. rhythm should approximate the motor patterns
40 involved);
- 41 • Selected with the desired effects in mind (e.g. loud, fast, percussive music
42 with accentuated bass frequencies as an arousal-increasing intervention);
- 43 • Selected for its motivational qualities using some form of objective rating
44 method (e.g. Brunel Music Rating Inventory-2; Karageorghis et al., 2006);
- 45 • Characterised by prominent rhythmic qualities and percussion in addition to
46 pleasing melodic and harmonic structures for repetitive aerobic and anaerobic
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exercise tasks – melody is the highest sounding part or “tune” of the music while 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 more appropriate for warm-up and cool-down) - this recommendation applies to the asynchronous application of music only – in its synchronous application, tempo should be matched to movement rate;
- 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 near traffic).

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