Effects of music interventions on emotional states and running performance

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Abstract
The present study compared the effects of two different music interventions on changes in emotional states before and during running, and also explored effects of music interventions upon performance outcome. Volunteer participants (n = 65) who regularly listened to music when running registered online to participate in a three-stage study. Participants attempted to attain a personally important running goal to establish baseline performance. Thereafter, participants were randomly assigned to either a self-selected music group or an *Audiofuel* music group. *Audiofuel* produce pieces of music designed to assist synchronous running. The self-selected music group followed guidelines for selecting motivating playlists. In both experimental groups, participants used the Brunel Music Rating Inventory-2 (BMRI-2) to facilitate selection of motivational music. Participants again completed the BMRI-2 post-intervention to assess the motivational qualities of *Audiofuel* music or the music they selected for use during the study. Results revealed no significant differences between self-selected music and *Audiofuel* music on all variables analyzed. Participants in both music groups reported increased pleasant emotions and decreased unpleasant emotions following intervention. Significant performance improvements were demonstrated post-intervention with participants reporting a belief that emotional states related to performance. Further analysis indicated that enhanced performance was significantly greater among participants reporting music to be motivational as indicated by high scores on the BMRI-2. Findings suggest that both individual athletes and practitioners should consider using the BMRI-2 when selecting music for running.

Key words: Psychological skills, affect, mood, endurance, performance, meta-emotional beliefs.

Introduction

The notion that affective states such as emotion and mood influence sport performance has received a great deal of attention in the sport psychology literature (Beedie et al., 2000; Botterill and Brown, 2002; Davis et al., 2010; Hanin, 2000, 2003; Lane and Terry, 2000; Totterdell and Leach, 2001). The ability to control affective states is proposed to be a key psychological skill (Terry, 1995; Jones, 2003). Emotion regulation is defined as a set of automatic and controlled processes involved in the initiation, maintenance, and modification of the occurrence, intensity, and duration of affective states (Eisenberg et al., 2000; Gross, 2007; Gross and Thompson, 2007). It is generally accepted that most people tend to actively monitor and develop self-regulating strategies to regulate their affective states (Parkinson and Totterdell, 1999; Thayer et al., 1994). The use of terms such as affect, mood and emotion means that some clarification of terminology is

required. Regulatory strategies can be focused on intense emotional reactions to specific events such as competitive-anxiety, or anger deriving from being passed by another runner in the final stages of a race. Regulatory strategies can also relate to feelings that are not attributed to a specific antecedent, (e.g., feeling downhearted but not attributed to a specific cause), typically referred to as moods.

Differences between mood and emotion are subject to considerable discussion within the literature (Beedie et al., 2005). Whilst it is possible to distinguish between the two concepts at a theoretical level, it has proven more difficult in terms of measurement. Research that uses single-adjective checklists such as the Profile of Mood States (McNair et al., 1971) cannot distinguish mood from emotion (Beedie et al., 2005). In the present study, we asked participants to report how they were feeling shortly before performance and then during performance. Whilst it is possible that high scores could be a product of intense mood states to which the athlete cannot attribute the cause, we propose that by assessing feeling states shortly before competition, reported feelings are more likely to be emotions resulting from anticipated and actual performance. Consequently, we use the term *emotion* to describe feelings experienced before and during running.

Research examining strategies used to regulate emotions in sport is relatively scarce. In a study of strategies used to regulate their emotions, Stevens and Lane (2001) found that athletes up-regulate vigour and down-regulate unpleasant emotions (e.g., anger, confusion, depression, fatigue and tension) by listening to music, talking to or being with someone, and attempting to control thoughts. However, Stevens and Lane did not examine the type of music participants listened to, nor the sports or situations within sports when music might be functional for mood. Terry et al. (2006) extended the study of Stevens and Lane by examining in greater depth the types of music that athletes listened to. They found that 24% of athletes preferred to listen to "fast up-beat" music with 21% reporting a preference for "soft, slow" music. In a case study of an endurance runner, Lane (2008) described how the runner selected music that he associated with emotional states experienced during successful performance. Lane reported that the runner listened to slow sedative music an hour before competition when the main goal, in terms of emotion regulation, was to feel calm. Alternatively, when the runner wished to feel energized shortly before competition, he increased the tempo and selected tracks with inspirational lyrics. Lane suggested that the runner also selected tracks in accordance with his pacing strategy. This involved listening to

songs with a moderate tempo at the start of the race as a reminder not to start too quickly. Thus, music was used to help establish emotional states and pacing strategies required at different points of the race.

When considered collectively, the extant evidence indicates that music listening can function not only as an effective emotion regulation strategy, but also a strategy to improve performance. Research has argued that people learn from their emotional experiences, developing meta-emotional beliefs regarding which performance states are optimal and which states are dysfunctional for performance (Baumeister et al., 2007; Hanin, 2003). In sports such as running where the activity is repetitive, athletes encounter similar situations more often. Based upon these experiences, the athlete may obtain knowledge of his or her emotional reactions and meta-emotional beliefs about the impact of these emotions (Nieuwenhuys et al., 2008; 2010). These meta-emotional beliefs contribute to the selection of actions intended to regulate emotions in accordance with anticipated emotions and corresponding outcomes. Hanin (2000) proposed a Triple-A framework to describe this process in sport. This is comprised of 1) Awareness of thoughts or feelings about the current situation or state; 2) Acceptance that the experience is having some influence on performance; and 3) Action to self-regulate or cope with the emotions and/or consequences. Within this framework the individual develops knowledge, beliefs and preferences in relation to emotional responses within their performance environment, and also knowledge, beliefs and preferences for strategies perceived to be effective for emotion regulation in particular situations. In the example offered by Lane (2008), the runner selected music to feel calm before the race and modified his music selection when he wished to feel energized once the race began.

In conducting the act of selecting music, an individual displays meta-emotional beliefs about emotion in that they perceive particular emotions to be helpful or harmful for performance and seek to elicit, attenuate or eliminate emotions accordingly via the use of music. Accordingly, to access the anticipated benefits of music athletes need to invest time examining the potentially motivating effects of tracks to listen to before and during performance. To facilitate the identification of motivational songs, Karageorghis et al. (1999) developed and validated a psychometric instrument for use in sport and exercise settings; the Brunel Music Rating Inventory (BMRI). This inventory was developed initially with the intention to provide exercise leaders, sports coaches, and researchers with a standardised method through which to prescribe music intended to have motivational effects including improved emotion, reduced perceptions of exertion and arousal control.

The BMRI has four factors which Karageorghis et al. (1999) proposed as contributing to the motivating qualities of a piece of music. These include: *rhythm response; musicality; cultural impact*; and *association*. Individuals engaged in sport and exercise select music in accordance with anticipated emotional outcomes (Lane, 2008) derived both directly and indirectly from music listening (Karageorghis et al., 1999). Rhythm response relates to how people react to the rhythm, a factor that

includes the tempo of the music (the speed of music as measured in beats per minute). Musicality relates to pitch-related elements such as harmony and melody. Both the rhythm response and musicality are internal factors related to the quality of the music as determined by the listener. Cultural impact relates to the persuasiveness of music within society whilst association relates to extra-musical associations (e.g., *Eye Of The Tiger* and boxing), hence both cultural impact and association are factors external to the music itself. Karageorghis et al. (1999) proposed a hierarchical relationship with internal factors being more important in predicting how a person will respond to a piece of music rather than external factors. Subsequent research has found support for the utility of the conceptual framework proposed by Karageorghis et al. (1999; see Karageorghis, 2008 for a review). However, as the scale is used to rate individual songs, and playlists can be lengthy, in order to increase end user appeal, Karageorghis et al. (2006) produced a shorter version (the BMRI-2). Karageorghis et al. (2006) demonstrated factorial validity of this measure using confirmatory factor analysis.

In the present study, we argue that self-regulatory mechanisms underlie the effectiveness of music as an emotion and performance enhancing strategy. Consistent with the notion that music is a behavioural strategy used to regulate emotions (Totterdell and Parkinson, 1999), we propose that the effectiveness of music as an emotion regulation strategy involves not only the act of choosing to listen to music, but also the act of selecting the appropriate music. In contrast to proposals by authors such as Sloboda (2008) who argue that inherent qualities in the music evoke an emotional response, we propose that the act of selecting each track has an influential role in determining the likely effects of listening to music before and during running. The extent to which listening to music elicits changes in emotions and performance is determined by the extent to which the selected music aligns with motivational and emotional requirements, in other words an individual's meta-emotional beliefs. The process of selecting music to listen to before and during running is a deliberate one that is typically not distinguished from the act of listening to music in the related research literature (Augustine and Hemenover, 2008; Stevens and Lane, 2001; Thayer et al., 1994).

Given the shortage of research examining emotion regulation in sport, and the identification of music as an effective emotion regulation strategy (see Augustine and Hemenover, 2008; Stevens and Lane, 2001; Thayer et al., 1994), the aim of the present study was to investigate the act of selecting and listening to music intended to facilitate goal attainment. We took *a priori* position that runners would aim to improve performance and regulate emotions to states associated with goal attainment (Hanin, 2003). We hypothesized that there would be significant improvements in performance coupled with increased pleasant emotions and reduced unpleasant emotions following intervention. The study examined the effects of two music conditions (self-selected music vs. *Audiofuel*) on emotion states experienced before and during running, and effects on running performance. Further, the relative motivational quotient of the music that participants lis-

tened to during the experimental trials was also assessed. Consistent with the theoretical proposals of Karageorghis (2008), we argue that high scores on BMRI-2 would associate with improved performance and increased pleasant emotions.

The self-selected music condition involved participants following guidelines suggested by Karageorghis et al. (2006) to select music. We instructed participants to compile a new playlist while considering the motivational qualities of tracks from their existing playlists. The second approach involved participants selecting tracks from *Audiofuel* playlists (see http://www.audiofuel.co.uk/free-running-music.html*). Audiofuel* is a company that develops music specifically designed for running. Participants were instructed to select tracks with beats per minute (bpm) that related to their intended running speed. Running was chosen as the focus sport because there is evidence to suggest that runners experience intense emotion states during competition (Buman et al., 2008; Lane, 2001, 2008; Raglin, 2007) and runners can use portable musical equipment during some competitions. We delimited our sample to participants already using music as an aid to running. Practical reasons such as participants owning a personal music player and potential safety concerns were deciding factors in establishing these inclusion criteria. Lane et al. (2010) noted that in the USA, and to some extent in the UK, many running race organizers have banned the use of personal music during races for safety reasons.

Methods

Participants
Volunteer runners (n = 65, Age; M = 41.48 years, SD = 9.39, Male, n = 19, Female, n = 41, with five not providing information on age and gender) were heterogeneous in terms of previous experience. In terms of level of competition, 56 participants were recreational or club athletes with nine reporting being national standard. Participants covered an average of 25.51 miles (SD = 14.78) per week and reported to participate in races ranging in distance from five km to a marathon.

Measures
Emotions
A 9-item measure was used to assess emotion with items being selected from previously validated scales (Jones et al., 2005; Matthews et al., 1990; Terry et al., 2003). Items assessed pleasant emotion ('Calm', 'Happy', and 'Energetic'), unpleasant emotion ('Gloomy', 'Guilty', 'Sluggish', and 'Downhearted'), and unpleasant emotion associated with high activation ('Anxious' and 'Angry'). Items are rated on a 7-point scale (1 = *not at all*, 7 = *a great extent*).

Music-mood regulation
The Music-Mood Regulation Scale (MMRS) assesses perceived effectiveness of music as a strategy to change feelings (Hewston et al., 2009). Previous research has provided evidence of factorial validity and predictive validity (Hewston et al., 2009). Examples of items include: "If you need to feel alert, then how effective is

listening to music as a strategy to achieve this feeling?" and, "If you are feeling worn out, then how effective is listening to music as a strategy to change this feeling?". Participants responded on a 5-point scale (1 = *not at all*, 5 = *extremely*). Alpha in the present study was 0.80.

Motivational quotient of music
The motivational quotient of music was assessed using the Brunel Music Rating Inventory-2 (BMRI-2; Karageorghis et al., 2006). Each BMRI-2 item refers to an action, a time, a context, and a target (e.g., "the style of this music [i.e., rock, dance, jazz, hip-hop, etc.] would motivate me during exercise"). It is a single-factor 6-item instrument that has demonstrated psychometric properties superior to those of its predecessor (BMRI: Karageorghis et al., 1999). Participants respond on a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*). Alpha coefficients from data collected in the present study were .90 pre-intervention and .95 post-intervention.

Goal difficulty and importance
Participants reported relative goal difficulty and goal importance (Lane and Karageorghis, 1997) by responding to the items "How important is it for you to achieve your goal?" and "How difficult will it be for you to achieve your goal?" Participants rated items on a 7-point scale (1 = *not at all*, 7 = *very much so*).

Performance
A self-referenced measure of performance was used in order to assess the relatively subtle influence of emotion on performance (Terry, 1995). Participants responded to the items: "How well did you perform today?", "To what extent do you believe your emotional state helped you during the run?", and "To what extent do you believe your emotional state hampered you during the run?" Participants rated items on a 7-point scale (1 = *not at all*, 7 = *very much so*).

Procedure
Volunteer runners registered online to participate in this three-stage study and all data were collected online. Participants were offered personalised feedback to try to incentivise involvement in the study. During stage one participants recalled a recent running event, the extent to which listening to music was used to regulate emotions (Hewston et al., 2009), and provided ratings on the motivational quotient of their current playlist using the BMRI-2 (Karageorghis et al., 2006). Thereafter, participants were instructed to set a running goal they wished to pursue for the purpose of this study during stage two and stage three. Participants attempted to attain this goal during pre-intervention stage two thereby providing baseline data. During stages two and three, participants' perceptions of emotions and emotion regulation strategies used before and during running were reported with reference to each run.

Following stage two, participants were randomly assigned to either a self-selected music group or an *Audiofuel* music group. In the self-selected music group, participants were encouraged to consider how they wished to feel before and during running and then select

music tracks that they associated with those feelings. Participants were encouraged to listen to each track and then rate its motivational qualities using the BMRI-2. They were provided with a BMRI-2 within a Microsoft Excel file that could be used to calculate the motivational quotient of each song. This file also provided information on how to interpret their scores as suggested by Karageorghis (2008). We emphasized that participants should select music to cover the time it would take to attain their running goal and to have a contingency plan if the run did not transpire as planned. For example, participants could under- or over-estimate the time taken to complete a run due to the influence of factors such as course conditions or weather conditions. Failure to accommodate factors such as this could influence the efficacy of the music intervention and subsequent analyses. On completion of the stage three run, participants reported the motivational quotient of each music track they listened to using the BMRI-2 (Karageorghis et al., 2006).

Participants in the *Audiofuel* group were encouraged to select music that related to their intended running speed. Runners could select from speeds such as a) jogging; b) running; and c) high intensity, faster running. Participants were able to listen to a sample of the music, provided free-of-charge, before downloading. On completion of the stage three run, participants reported the motivational quotient of each music track they listened to using the BMRI-2 (Karageorghis et al., 2006) adopting the same procedure as described for self-selected music participants.

Data analysis
Prior to testing the main hypothesis, differences between the two groups (self-selected vs. *Audiofuel*) in terms of music-mood expectancy beliefs, perceived goal difficulty and goal importance were investigated using a one-way MANOVA. To clarify, the main hypothesis was that there would be significant improvements in performance coupled with increased pleasant emotions and reduced unpleasant emotions following a music intervention.

A repeated-measures MANOVA with a within-group factor (changes in emotion before, during the early stages and during the latter stages of running) and a between-group-factor (self-selected vs. *Audiofuel*) over time (pre- and post-intervention) was used to assess the extent to which one music condition led to significantly different changes in emotions than the other condition. A repeated-

measures MANCOVA with a within-group factor (performance, beliefs on whether emotions helped or harmed performance) and a between group factor (self-selected vs. *Audiofuel)* was used to assess the extent to which each music condition associated with improved performance and improved emotional experiences during running. We used BMRI-2 (Karageorghis et al., 2006) completed by participants at the end of the study as the covariate. If participants selected motivational music in both music conditions, then the covariate effect would interact with both performance and beliefs on the influence of emotions.

Results

MANOVA results showed no significant difference (Wilks's lambda $_{2,62}$ = 0.70, p = 0.50, Partial Eta^2 = 0.02) between *Audiofuel* and self-selected music groups in terms of expectancies of how effective listening to music is as a mood-regulation strategy, perceived goal difficulty and goal importance (see Table 1). Consequently, we can surmise that groups were similar in their beliefs on the effectiveness of music as a mood regulation strategy and there were no significant differences in the difficulty and the importance of the self-set goals.

Table 1. Baseline variables for self-selected and *Audiofuel* music groups. Data are means (±SD).

	Self-set music (n = 29)	*Audiofuel* (n = 36)
Music mood expectancy beliefs	5.15 (1.69)	5.32 (1.11)
Perceived goal difficulty	5.52 (.83)	5.14 (1.44)
Perceived goal importance	5.93 (1.13)	5.58 (1.32)

Perceived goal difficulty and importance; 1 = not at all, 7 = very much so Music mood expectancy beliefs; 1 = strongly disagree, 7 = strongly agree

Effects of music interventions on emotion
Descriptive statistics showing changes in emotion before and after the intervention by music groups are contained in Table 2. Repeated-measures MANOVA to examine changes in emotions during each run (pre, early, later part), by time (pre- and post-intervention), and by intervention group (self-selected vs. *Audiofuel*) revealed no significant interaction (Wilks's Lambda$_{6,58}$ = 0.85, p = 0.13, Partial Eta^2 = 0.02). Further, there were no significant interaction effects for differences by time (pre and post), by intervention group (Wilks's Lambda$_{3,61}$ = 0.94, p

Table 2. Emotional states before and after the intervention by music groups. Data are means (±SD).

	Pre intervention		Post intervention	
	Self-selected Music	*Audiofuel*	Self-selected Music	*Audiofuel*
Pre-race pleasant emotion	3.63 (.74)	3.80 (.56)	3.99 (.61)	3.89 (.63)
Early stage of run pleasant emotion	3.68 (.71)	3.79 (.70)	3.86 (.85)	3.85 (.61)
Late stage of run pleasant emotion	3.57 (.62)	3.85 (.75)	3.87 (.63)	3.96 (.64)
Pre-run unpleasant emotion	2.59 (.68)	2.71 (.71)	2.40 (.64)	2.56 (.69)
Early stage of run unpleasant emotion	2.41 (.79)	2.71 (.86)	2.47 (.86)	2.24 (.68)
Late stage of run unpleasant emotion	2.72 (.81)	2.73 (.86)	2.35 (.58)	2.26 (.61)
Pre-race unpleasant emotional arousal	1.67 (.97)	1.83 (.86)	1.79 (.95)	1.67 (.85)
Early stage of run unpleasant emotional arousal	1.66 (.99)	1.69 (.78)	1.57 (.81)	1.50 (.56)
Late stage of run unpleasant emotional arousal	1.90 (.99)	1.79 (.91)	1.79 (.99)	1.60 (.88)

Emotion states; 1 = not at all, 7 = a great extent

Table 3. Self-rated performance by self-selected music and *Audiofuel* music groups pre and post intervention. Data are means (±SD).

	Pre intervention		Post intervention	
	Self-selected Music	*Audiofuel*	**Self-selected Music**	*Audiofuel*
"How well did you perform today?"	4.24 (1.64)	4.44 (1.61)	4.93 (1.36)	5.42 (1.16)
"To what extent do you believe your emotional state helped you during the run?"	4.24 (1.86)	3.89 (1.80)	4.59 (1.72)	4.94 (1.51)
"To what extent do you believe your emotional state hampered you during the run?"	3.66 (1.70)	3.19 (1.91)	2.66 (1.20)	2.94 (1.71)

Self-rated performance and impact of emotions; 1 = not at all, 7 = very much so

$= 0.30$, Partial Eta$^2 = 0.06$), for changes in emotion within each run by intervention group (Wilks's Lambda $_{6,58} = 0.94$, $p = 0.68$, Partial Eta$^2 = 0.06$), or for changes in emotion within each run over time (Wilks' Lambda $_{6,58} = 0.89$, $p = 0.32$, Partial Eta$^2 = 0.11$). There were no significant main effects for changes in emotion within each run (Wilks's Lambda $_{6,58} = 0.86$, $p = 0.17$, Partial Eta$^2 = 0.14$) or for differences in emotion by intervention group (Wilks's lambda $_{11,61} = 0.82$, $p = 0.84$, Partial Eta$^2 = 0.01$). Hence, it can be concluded that differences in emotional states between the music groups were not statistically significant with relatively small effect sizes evident in each analysis conducted. Repeated-measures MANOVA results did reveal that emotions differed significantly between pre-post intervention (Wilks's Lambda$_{11,61} = 0.76$, $p < 0.001$, Partial Eta$^2 = 0.24$). Follow-up univariate results indicated an increase in pleasant emotions ($F_{1,58} = 5.90$, $p = 0.02$, Partial Eta$^2 = 0.09$) and a reduction in unpleasant emotions ($F_{1,58} = 11.80$, $p < 0.001$, Partial Eta$^2 = 0.15$).

Effects of intervention on performance

Descriptive statistics for changes in performance are contained in Table 3. Repeated-measures MANCOVA with BMRI-2 scores used as the covariate indicated a significant interaction effect for the BMRI-2 scores over time with a large effect size (Wilks's Lambda$_{3,60} = 0.74$, $p < 0.001$, Partial Eta$^2 = 0.26$). Further, results indicate that there was no significant interaction effect for intervention group (self-selected group vs *Audiofuel*) over time (Wilks's Lambda $_{3,60} = 0.91$, $p = 0.12$, Partial Eta$^2 = 0.09$), and no main effect for the intervention group (self-selected group vs *Audiofuel*; Wilks's Lambda $_{5,60} = 0.96$, $p = 0.52$, Partial Eta$^2 = 0.04$). Results also show that there were no significant differences in BMRI-2 scores between each intervention group ($t_{1,63} = 0.74$, $p = 0.49$).

Univariate interaction effects indicated that participants who rated music as motivating reported significantly greater improvements in perceived performance following intervention ($F_{1,62} = 20.89$, $p < 0.001$, Eta$^2 = 0.25$) and that participants believed that emotions experienced before and during running helped performance ($F_{1,62} = 10.92$, $p = 0.004$, Eta$^2 = 0.15$). Further analysis revealed MMRS scores (Hewston et al., 2009) correlated with BMRI-2 scores ($r = 0.36$, p = 0.001).

Discussion

The present study investigated emotional states of runners before and during the pursuit of an important running goal. Research has found that individuals are motivated to try to regulate their emotions to aid performance (Davis et al., 2010; Tamir et al., 2007) and develop meta-emotional beliefs regarding which performance states are optimal and which states are dysfunctional for performance (Baumeister et al., 2007; Hanin, 2003). Music has been found to be an effective strategy for the purposes of regulating emotional states in accordance with anticipated and desired performance outcomes (Bishop et al., 2007; Karageorghis, 2008; Terry et al., 2006; Stevens and Lane, 2001; Thayer et al., 1994). To this end, we examined the efficacy of listening to music as a strategy to regulate emotions associated with running. We tested the process through which runners select music to enhance emotions and performance. This was achieved by providing runners with instructions that outlined how to self-select motivating music as guided by Karageorghis et al. (2006). In both music conditions, participants were active in their decision-making to select music in relation to their intended running goal and emotional states perceived as helping to achieve goal attainment.

The act of selecting motivating music is proposed to be a behavioural strategy to regulate emotions (Niven et al., 2009, 2011; Totterdell and Parkinson, 1999). That is, selecting music to run to forms part of a deliberate emotion regulation process that involves identifying how one wants to feel and the purposeful implementation of that strategy to bring about such a change. Using Hanin's (2000) Triple-A framework to outline this process, the runner is made aware of current emotion states, accepts that these states have some influence on performance and takes action to self-regulate these emotions in view of perceived consequences. Findings from the present study showing that higher scores on the BMRI-2 (Karageorghis et al., 1997) associated with improved performance, and also beliefs that emotions influenced performance support the concept of meta-emotional beliefs and are consistent with the Triple-A framework.

Participants in the present study identified an important goal (see Table 1) that was perceived as personally meaningful and difficult to attain; therefore, attempts to attain this goal should be associated with an emotional response (Lazarus, 2000). Participants regularly listened to music whilst running and therefore had some awareness of tracks considered as motivating when running. For music to assist with emotion regulation and performance enhancement, participants must have an awareness of likely emotions encountered during a race, and the impact of these emotions. He or she must also have reasonable knowledge of the likely impact of listening to music on emotions; otherwise, runners might select music that inspires increased effort at times during a race when re-

maining calm is required for goal attainment. Lane (2008) presented a case study identifying a process whereby a runner selected music in relation to an intended pacing strategy and desired emotions at different stages of a race evidencing idiosyncrasies in music choice, desired emotions and pacing strategies.

The experimental protocol used in the present study represented a training method that requires the selection of motivational music. The research design involved participants identifying a running goal that they wanted to achieve with two attempts to attain this goal pre and post music intervention. The goal was self-determined as were the course and conditions under which it was completed. Participants attempted to achieve this running goal on two different occasions separated by a two-week period using the same course and ideally under the same conditions. The act of attempting to complete a goal in the first stage of the study provided participants with knowledge of some of the course demands. For example, they learned where the hills were, difficult turns, variations in running surface and so on. Therefore, when participants sought music to accompany this run, they did so with knowledge of how they felt at different parts of the course and could strategise accordingly. With this in mind, the present study illustrates possible conditions for selecting music to use when running with a view to achieve a personal goal. We suggest that the method used in the present study is a strategy that runners should use for important races. That is, runners firstly develop a detailed knowledge of the course, then estimate how they might feel during different sections, and finally select appropriate music to help bring about how they want to feel to help accomplish personal goals. This strategy enables a runner to establish and test meta-emotional beliefs and consider strategies intended to regulate emotions during different course sections.

Previous research has examined the use of music as an emotion regulation strategy to improve mood in general (Thayer et al., 1994) and in sport (Terry et al., 2006; Stevens and Lane, 2001). The present study builds upon this research by suggesting that when selecting music individuals must carefully consider task characteristics, emotion states experienced during task completion, and desired goals. Participants benefited from making conscious decisions regarding the use of music to improve emotion states, and considering how emotions might help performance. Findings illustrate that selecting music to listen to during running involves a great deal of planning; a process that has not been addressed in research literature examining the use of music in sport.

There are several acknowledged limitations to the present study. Karageorghis et al. (2006) identified limitations in rating the multitudinous facets of the musical response when exclusively using a psychometric-type approach. Some aspects of aesthetic experience transcend scientific evaluation; therefore, to elicit optimum selection of music in sport and exercise settings, it may be necessary to use the BMRI-2 in tandem with qualitative methods.

A second limitation is that runners followed a self-managed intervention and therefore controls over administration and adherence are difficult. However, it is argued that incentivising participants with personal feedback encouraged honest responses. A third limitation is the absence of a suitable control condition. Whilst the use of participants who do not regularly listen to music is useful, practical reasons (i.e., participant safety) delimited this possibility. The within-subject nature of the study arguably permits participants to act as their own control with the control condition being performance on the first attempt to attain a goal. Extending this limitation, the research design of the present study would have benefited from the measurement of multiple baseline conditions; that is, we should have asked runners to have two attempts at attaining a self-determined goal prior to the intervention and assess the reliability of their performance. Taking double baseline measure would have helped ensure that any changes that occurred following the intervention condition could be attributed to the intervention rather than random performance changes. It should be noted that few studies in sport and exercise have taken multiple baseline measures.

Conclusion

In summary, the findings of the present study lend support to the notion that listening to music is an effective emotion regulation strategy for use in running. Results also indicate that the motivational quotient of music is associated with improved performance and beliefs that emotions helped performance. Although the nature of the relationships between music, emotions, and running performance appears to be complex, runners appear to be cognizant of a number of emotional and performance benefits resulting from the use of motivational music. Findings offer support for the concept of meta-emotional beliefs in terms of their influence in selecting and implementing music interventions intended to regulate emotions.

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Key points

- Listening to music with a high motivational quotient as indicated by scores on the BMRI-2 was associated with enhanced running performance and meta-emotional beliefs that emotions experienced during running helped performance.
- Beliefs on the effectiveness of music intended to alter emotions were associated with high scores on the BMRI-2.
- Runners seeking to use music as an emotion regulating strategy should consider using the BMRI-2 as an effective means by which to identify potentially motivating tracks.

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