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The effects of self-selected asynchronous pre-task music on performance in a soccer task

by

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The author of this thesis, in order to make the study feasible, has received assistance from Nicole Cara on the set up of the experimental phase.

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Abstract

Research has suggested that listening to music can enhance physical performance by acting as a stimulant or sedative and thus altering athletes' arousal levels (Bishop, 2010). The purpose of this study was to investigate the effects of self-selected asynchronous pre-task music on performance in a soccer skill test and in the achievement of participants' individual zone of optimal functioning (IZOF; Hanin, 2000). An idiographic A-B-A-B single subject design was used. Hrycaiko and Martin (1996) suggested the single subject designs as the most appropriate methodology for applied research. Nine male collegiate soccer athletes from a university in London participated in this study. Participants were asked to describe their most and least successful performances, and the emotions related to these experiences. Based on the information provided, participants' IZOF was established (Hanin, 2000; 2004). Participants then selected three or four music tracks from their own play list that they considered would help them in achieving their IZOF. The motivational qualities of the selected tracks were assessed using the BRMI-3. Participants in each trial were asked to complete two circuits of a soccer skill test (Abouzekri& Karageorghis, 2010) developed to emulate the skills used in a soccer match. Performance was assessed through time to complete the soccer skill test and kick accuracy. The studywas composed of four experimental trials; two with pre-task music, and two without. Before the no-music trials, athletes completed the concentration grid as a filler. After each trial participants completed their IZOF and at the end of the study participants completed the intervention evaluation questionnaire. According to the study results the hypothesis suggesting that pre-task music would improve performance has not been supported. The graphically displayed data did not show a consistent improvement in time or kick accuracy. Moreover results on the IZOF did not present stable improvements in the pre-task music trials. Nevertheless, participants reported in the intervention evaluation questionnaire an improvement in concentration and motivation and an increase in activation levels as effects of listening to pre-task music. Therefore it is necessary for further investigation, with an idiographic approach, of the relationship between pre-task music and subsequent performance and emotions.

Keywords: sport psychology, pre-performance routines, single case design, IZOF.

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Introduction

Athletes are often seen listening to their favourite tracks before performing as part of their pre-performance routine. The rationale behind the use of this routine is the common association between listening to music and changes in mood. Research has shown that listening to music can enhance physical performance by acting as a stimulant or sedative and thus altering athletes' arousal levels (Bishop, 2010). That would suggest music as an appropriate component of pre-performance routines as one of its aims is to help athletes achieve an optimal level of arousal (Lidor, 2007).

Research has shown that music is in fact a common strategy of emotional regulation for athletes (Bishop, Karageorghis, & Loizou, 2007). Bishop et al. developed a grounded theory of precompetitive music use in young tennis players. Results from this study indicated that listening to music improved mood, increased arousal, visual and auditory imagery. Moreover, the choice of music and the impact of music listening are influenced by a number of factors, including extra-musical associations, inspirational lyrics, music properties, and desired emotional state (Bishop et al., 2007).

Pates, Karageorghis, Fryer, and Maynard (2003) suggested that music can trigger emotions that are important antecedents of the flow experience. The participants in Pates et al. study reported that as a consequence of listening to music movements became more automatic and there was an increase in relaxation, concentration and confidence. Moreover, Karageorghis et al. (1999) proposed that asynchronous motivational music (when there is no conscious attempt to synchronise movement with beat; Karageorghis & Terry, 2009) can be used to control arousal and improve mood. Participants in the Karageorghis et al. study also showed an increase in netball shooting performance as a result of the music intervention.

Karageorghis, Terry and Lane (1999) constructed a conceptual framework to predict the motivational effects of asynchronous music on exercise and sport performance. More recently Terry and Karageorghis (2006) focussed the framework on a sporting context and indicated possible benefits associated with music listening, such as increased positive mood and reduced negative mood and enhanced performance.

Understanding the performance emotion relationship is particularly important in applied sport psychology (Hanin, 2004). More specifically it is essential to investigate the influence of pleasant and unpleasant emotional states over sport performance. In order to evaluate this relationship Hanin suggests that instead of a generalized approach a focus on performance experiences of each individual athlete would be more appropriate. For this purpose, Hanin developed the Individual Zones of Optimal Functioning (IZOF). This model has an idiographic approach that focuses on idiosyncratic emotional experiences of individual athletes. Moreover the zone aspect of the model suggests a specific relationship between the perceived intensity of the emotional state and the quality of performance. According to Hanin (2004) optimal emotions are defined as most relevant and appropriate for a particular athlete performing a specific task. The optimal performance state results in a total task involvement and the best recruitment and use of available resources.

Literature Review

Music in Sport and Exercise

Music is a part of peoples' daily routines for different reasons. These may be mood regulation, motivation, leisure, and as a form of cultural manifestation. What we call music is the organization of five primary elements: melody, harmony, tempo, rhythm, and dynamics (Karageorghis & Terry, 2011). Melody is the tune of a piece of music, what people may whistle along with. The music harmony is the combination of notes that will shape the mood of the music (i.e. happy, sad, soulful). Tempo is the speed at which the music is played and is commonly measured in beats per minute (bpm). Rhythm is the distribution of the notes over time and how they are emphasized; it is combined with tempo to make people unconsciously move in time with it. The result of the energy transmitted by the musicians through how they touch or breath to influence the volume of their instruments is called dynamics (Karageorghis & Terry, 2011; Terry & Karageorghis, 2011). Interest in the study of the influence of music over sport and exercise performance has increased during the last two decades. However early research efforts were not able to come to reliable conclusions due to a lack of a theoretical model. For this reason Karageorghis and Terry (1997) in their review of the effects of music in sport and exercise proposed methodological guidelines for future research on the topic. In particular, it was suggested that music selection for experimental purposes should consider factors such as musical preferences, age and the social and cultural backgrounds of participants.

Conceptual approaches

Karageorghis, Terry and Lane (1999) developed the first conceptual framework to predict the effects of music in sport and exercise. This inaugural framework breadth was limited to the asynchronous use of music, that is, when there is no conscious effort from an individual to synchronize their movements to the music rhythm. According to this framework four factors determine the motivational qualities of a music piece: rhythm response, musicality, cultural impact and association (Karageorghis et al., 1999). Rhythm response refers to inherent responses to the music rhythm, particularly tempo. Musicality refers to the pitch-related components of music such as harmony and melody (the tune). Cultural impact is the pervasiveness of a piece of music within a given culture or subculture. Lastly, association refers to the extra-musical associations that music can evoke, for example the music *We are the champions* by Freddy Mercury is associated with moments of achievement (Karageorghis & Terry, 2011; Karageorghis et al., 1999; Terry & Karageorghis, 2011). According to the conceptual model the two most important factors are rhythm response and musicality. These factors were termed internal factors because they refer to the constituents of music. Thus, cultural impact and association were referred to as external factors. Similarly Sloboda and Juslin (2001) proposed that there are intrinsic and extrinsic sources of emotional responses to music. The intrinsic sources would be the acoustic properties of the music that influence the intensity of emotions.

According to Sloboda and Juslin the extrinsic sources of emotion are psychological and can be iconic or associative. The content (i.e. whether the emotions are pleasant or unpleasant) of the music induced emotions is strongly determined by the extrinsic sources of emotion (Sloboda & Juslin, 2001). According to the 1999 conceptual framework the expected benefits or motivational qualities of listening to music would be: arousal control, reduced perception of exertion and improved mood (Terry & Karageorghis, 2011).

Terry and Karageorghis revised and modified the 1999 conceptual framework in 2006 (Terry & Karageorghis, 2011). The new model included a more complete list of the benefits of listening to music based on the latest research findings. The benefits included in the 2006 conceptual framework were: dissociation, greater work output, improved skill acquisition, flow state, and enhanced performance. Also included in this conceptual framework were supplementary antecedents that may influence the effects of music. These antecedents were divided into two categories: personal factors related to the exerciser (age, socio-cultural background, musical preferences) and situational factors which involved the environment and details of exercise regimes (presence of others, type of activity engaged in, and listening context).

Asynchronous music

There is a vast literature on the effects of psychological and psychophysical effects of asynchronous music. From this literature several studies have focused on the effects of music of different tempo. One example would be the Szabo, Small and Leigh (1999) study where participants would listen to Beethoven's Symphony No. 7 while performing a static cycling task to voluntary exhaustion. The study results showed that when music tempo was switched from slow to fast it yielded an ergogenic effect. This finding is in agreement with the Priest and Karageorghis (2008) qualitative study of the characteristics and effects of music accompanying exercise. According to the participants in this study a fast or upbeat tempo was considered to be motivational during exercise. Moreover participants in this research also mentioned that listening to music during exercise can increase their endurance and influence exercise attendance (Priest & Karageorghis).

Self-selected asynchronous music can trigger emotions and cognitions associated with flow according to a study among netball players (Pates, Karageorghis, Fryer, & Maynard, 2003). Participants recruited for the purpose of this study were three female athletes who were members of a collegiate netball squad. The authors used a single case design and participants listened to their self-selected music while attempting shots from three different shooting positions. According to the study results, the perception of flow was increased for two participants. Participants indicated that they felt more relaxed, calm, composed, in control and confident. Due to the music intervention participants mentioned that during the shooting task they felt that their shooting had more rhythm and that the music changed their emotions and levels of concentration. Additionally netball shooting performance was improved for all participants. A limitation of this study is that the experiment conditions may not be equivalent to a game situation. When attempting the shoots performed in the experiment in a game there is the pressure imposed by an opponent or team. Additionally the use of music during competition is limited by the rules of governing bodies of sport, and in many competitions it is not feasible to incorporate music. Pates et al. (2003) suggested that even with this limitation there are other opportunities to use music to maximize performance, as for example during training, during time-outs or half-time intervals, and during the pre-match routine.

Mesagno, Marchant, and Morris (2009) also investigated the effects of asynchronous music over performance and as a prevention of choking under pressure. For the purpose of this research three “choking susceptible” experienced female basketball players were recruited. The study used a single case A_1-B_1-A_2-B_2 design, the music intervention occurred in the B_2 phase. Choking was defined in this study as a critical deterioration in the execution of habitual processes as a result of an elevation in anxiety levels under perceived pressure (Mesagno et al., 2009). Moreover, choking under pressure could be a result of an increase in anxiety and self-awareness about performing correctly on important competitive events. Thus, in order to avoid self-focusing Mesagno et al. based on previous research, suggested the use of a dual task. The piece of music selected for this study should work as a second task while the athletes were attempting the free throws. Participants were instructed to attend to the music lyrics while performing, thus diverting attention from self-focusing under pressure. The song chosen for the purpose of this experiment was *Always look on the bright side of life* from *Monty Python’s Life of Brian*. This particular piece of music was chosen because the lyrics convey sport psychology performance strategies such as relaxation, humour and cognitive restructuring. The study results indicated an improvement in performance during the B_2 phase due to the music intervention. Participants reported a decrease of self- awareness and explicit monitoring, and less distractibility. Participants stated that they were able to ignore the presence of an audience and only focus on the music lyrics. The music, according to the participants, helped them to feel relaxed, and to have fun. The lyrics were not only a distraction but also a positive method of cognitive restructuring (Mesagno et al., 2009).

Pre-performance Routines

There is strong evidence in the sport psychology literature linking the use of routines with successful performance in sport (Lidor, 2007; Schack, Whitmarsh, Pike, & Redden, 2005; Wilson, Peper, & Schmid, 2006). Performance routines can aid in the improvement of concentration by helping to avoid task irrelevant thoughts and getting the athlete ready to perform (Cohn, 1990; Lidor, 2007). The most frequently described routine in the literature is the pre-performance routine. This type of routine has been described as a “sequence of task-relevant thoughts and actions which an athlete engages in systematically prior to his or her performance of a specific sport skill” (Moran, 1996, p. 177).

According to Schack, Whitmarsh, Pike, and Redden (2005), a routine can help athletes to be fully prepared before a training session or a competition therefore allowing the athletes to achieve their best performances. Wilson, Peper, and Schmid (2006) reinforced the advantage of using routines saying that they can help athletes to concentrate if they associate concentration status with a certain performance ritual, thereby helping athletes prepare for performance. In the next paragraphs evidence supporting this argument will be presented.

Gould, Jackson, and Eklund (1992) conducted an investigation with American Olympic wrestlers to study the effects of the use of pre-competitive routines before their "all time best-match, worst Olympic match, and most crucial Olympic match" (Gould et al., 1992, p. 358). The results indicated that the athletes in their all time best matches engaged in mental preparation plans, and were exceptionally confident, entirely focused, and optimally aroused. In the reports about the worst matches the researchers found evidence indicating lack of focus, concentration, awareness, and absorption. Additionally in their worst matches athletes reported that they had many task irrelevant thoughts and deviated from their regular preparation plans. These authors found that mental readiness was an important factor to influence success in an athletic performance. Conversely it was found that many athletes didn't perform at their optimal levels due to inadequate preparation to cope with the distractions at the Olympic Games. According to Gould et al., experimental evidence shows that pre-organizing cognitive content can have a positive influence on subsequent performance outcomes.

A pre-performance routine can reduce choking under pressure, in choking-susceptible athletes. Mesagno, Marchant, and Morris (2008) conducted an investigation with three "choking susceptible" bowlers where they implemented a pre-performance routine to observe if they would perform better under pressure. As a result of the intervention all participants showed an improvement in performance under pressure, although the authors suggested further research on the topic to discard others factors that might have influenced this result (e.g., Hawthorne effect, pressure desensitization).

Marlow, Bull, Heath, and Shambrook (1998) conducted a single case study design with three water polo players with the goal of verifying the effect of a pre-performance routine on the penalty shot. First the players were assisted in creating a personalised and sport specific pre-performance routine. Then the players incorporated this routine in their practice, and finally a mental training program was established to ensure players adhered to the routines. The performance in penalty shots was measured in a simulated trial. As a result of this intervention the players showed an enhancement in performance in penalty shots.

Another important benefit of the use of routines is that they can help athletes focus before and during the sport task, helping them to concentrate on relevant cues and to ignore any task irrelevant thoughts (Lidor, 2007). Lidor also argued that with a pre-performance routine an athlete in self-paced tasks can carry out a plan of action before the execution of the task. In addition, according to Cohn (1990), using a routine can help athletes to feel they are in optimal control of the task.

Hanton, Wadey, and Mellalieu (2008) investigated four advanced psychological strategies and their effects on competitive anxiety responses. For this research eight highly successful athletes, from team and individual sports (i.e., athletics, badminton, basketball, rhythmic gymnastics, soccer, rowing, rugby union, and trampoline) were interviewed. The strategies investigated by Hanton et al. were simulation training, cognitive restructuring, pre-performance routines, and overlearning of skills. The athletes in this study reported that they developed their routines with their coaches, teammates, or by themselves. These routines would begin the moment they arrived at the competition venue. According to Hanton et al. the athletes reported that the routines enabled them to control their anxiety related symptoms, and helped them to avoid being distracted by irrelevant cues. Moreover the athletes described feeling more settled and in control before competing and with higher levels of confidence and an optimistic outlook for the imminent performance (Hanton et al.).

There is consistent research on the use of pre-performance routines in self-paced tasks that provides sufficient support for their benefits. Research has been conducted in basketball free throws (Czech, Ploszay, & Burke, 2004; Foster, Weigand, & Baines, 2006; Lonsdale & Tam, 2008), golf (Cohn, Rotella, & Lloyd, 1990; Mccann, Lavallee,

& Lavallee, 2001), penalty shots in water polo (Marlow et al., 1998), serving in tennis and volleyball (Lidor & Mayan, 2005), bowling (Mesagno et al., 2008), and goal kicking in rugby (Robin C. Jackson, 2003; Robin C Jackson & Baker, 2001). Therefore, the theoretical support for pre-performance routines is well established for self-paced tasks, although there is still a great demand for the investigation of the use of routines in open skilled sports.

Pre-task music

Athletes are often seen listening to their favourite tracks before performing as part of their pre-performance routine. The study of Karageorghis, Drew, and Terry (1996) was one of the first experiments that investigated the effects of pre-task music on performance. The purpose of this study was to investigate the effect of fast, energizing music and slow, relaxing music played before a hand-grip dynamometer task. The results showed that after listening to stimulating music participants produced significant higher grip strength than sedative music or a white-noise control. In contrast, participants presented lower strength scores after listening to sedative music compared to white-noise. The results indicated a strong connection between music and subsequent performance in an experimental setting. However the study lacked in external validity as the music was selected by the researchers and the experimental conditions did not necessarily reflect real-competition settings (Karageorghis et al., 1996).

Bishop, Karageorghis, and Loizou (2007) developed a grounded theory of the use of music as a pre-performance routine to manipulate emotional states of young athletes. Participants recruited for this study were 14 youth tennis players who indicated music listening as part of their pre-performance routine. The authors developed an interview schedule based on musically induced emotions and music listening in sport and exercise. The objective was a better understanding of the participants' emotional response to music and the factors that motivate these responses. Additional to the interview 10 of the 14 participants completed a diary data collection. Bishop et al. (2007) study results showed that the participants' music selections were highly idiosyncratic; there were significant differences in musical properties of tracks selected to achieve identical emotional states. For some participants to achieve an ideal emotional state they used a medley of tracks. According to the authors this idiosyncrasy of the participants' music selection may reflect the unavoidably distinctive combination of peer and family influence on their cultural exposure to music. For young people music offers an opportunity to create a strong and temporary unique self-identity that comes from the artist's performance of the chosen tracks (Bishop et al., 2007). Participant music selection and the impact of listening to music were mediated by extra musical associations, inspirational lyrics, music properties, and desired emotional state. During the interviews and daily reports participants frequently pointed to improved mood as a consequence of music listening. Regarding athletes' music selection, tracks rated as highly liked were also rated as highly arousing, including tracks selected for relaxation. Bishop et al. argued that *relaxed* for these athletes may refer to a playing style and not to psychophysical relaxation. A consequence of listening to music reported by the participants was the presence of auditory imagery (e.g., singing to oneself; Bishop et al.). According to Bishop et al. auditory imagery follows the same neural principals of visual imagery, thus even in the absence of the physical stimulus it is possible to have the song on the brain especially for familiar music tracks. Therefore, only singing to oneself the lyrics of a well known music track may be already a way of achieving a performance-facilitating emotional state (Bishop et al.). Moreover, music not only positively influenced athletes' pre-performance emotions but it also shifted participants' attentional focus. According to the participants' reports listening to music as part of a pre-performance routine promoted an increase of automacity. Therefore according to Bishop et al. Findings, pre-task music could prevent choking under-pressure by preventing task irrelevant thoughts and explicit monitoring as also suggested in Mesagno et al. study (2009). One limitation of the Bishop et al. study was that participants had insufficient knowledge about music structure for them to be able to articulate the properties of the music they had selected. A possible solution to avoid this problem in future studies would be the use of instruments like the Brunel Music Rating Inventory -2 (BMRI-2; Bishop et al., 2007; Karageorghis, Priest, Terry, Chatzisarantis, & M.Lane, 2006)

Bishop, Karageorghis, and Kinrade (2009) investigated the effect of musically-induced emotions on athletes' subsequent choice reaction time (CRT). A sample of 54 randomly recruited tennis players listened to a researcher selected music track that was modified to create six versions (3 tempi x 2 intensities) before completing a CRT task. Participants' affective responses, heart rate (HR), and RTs for each condition were compared with white noise and silence conditions. Findings showed that fast, loud music produced more pleasant emotional states, higher arousal, and faster choice reaction time than the same music played at moderate volume. The present finding indicates that tempo is a strong determinant of affective responses to music. Music tracks played both at fast and normal tempo were rated as more pleasant and arousing compared to music at a slow tempo. Thus Bishop et al. (2009) suggested that listening to music may be an appropriate pre-performance strategy for athletes wishing to achieve a positive and aroused emotional state. Nevertheless the authors indicated the need for further studies using participant-selected music to clarify the influence of musically-induced emotions on subsequent performance.

Cox, Karageorghis, and Pates (In preparation) study had the purpose of extending the findings of Pates et al. (2003) who investigated the effects of self-selected asynchronous music on flow states and netball shooting performance. This research as mentioned previously lacked in ecological validity, thus the Cox et al. study aim was to investigate the influence of a music intervention on pre-competitive anxiety and performance in netball players in an ecologically valid setting. Five female South England Premier League netball players were recruited to participate in this study, and a single-case, with multiple-baseline, across-subjects design (ABAB) was used. To increase the study's ecological validity participants were administered a pressure manipulation to induce anxiety. Participants were informed before the beginning of the experiment that their results on the study trials would be posted on the club notice board for the coaches and the remainder of the team to view. Moreover, participants were also filmed while performing the shooting trials. Cox et al. results didn't allow a direct relationship between pre-task music and netball performance improvement. Also the hypothesis that pre-task music would lead to more facilitative interpretations of cognitive and somatic anxiety wasn't supported. Nevertheless, according to the study results, the use of pre-task music decreased cognitive and somatic anxiety intensity. Thus it can be suggested that music can lessen the intensity aspect of cognitive anxiety but does not appear to influence how athletes interpret the nature of their anxiety symptoms (Cox et al.). Participants in the present study may have had differences in the benefits from listening to music on performance as a result of how each music track was interpreted and participants' mood on the day of testing. Bishop et al. (2007), as presented previously, reported that music selections of young tennis players were highly idiosyncratic. According to Bishop et al. athletes' music selection and the effects of music listening are influenced by a number of factors such as extra musical associations, inspirational lyrics, music properties, and desired emotional state.

Moreover, fast-tempo, highly arousing music could be detrimental to performance when a high level of concentration and coordination is required. Thus Cox et al. argued that the music selections of some participants in their study may not have been ideal in light of these factors. The optimal arousal level of a netball player will vary during a match according to whether they are involved in court play or preparing to take a shot. Therefore, a netball player may need a high level of arousal before a match, and low levels of anxiety to successfully execute a shot (Cox et al.)

Bishop (2010) reviewed the literature about the use of music to enhance performance in sports. Based on this review Bishop suggested that music should be selected aiming to achieve athletes' idiosyncratic emotional profile (Hanin, 2000, 2004). Hence, to achieve this purpose Bishop proposed guidelines for music selection based on music and performance literature. For example, when selecting pre-task music it is important to consider the athlete's current emotional state and desired emotional state. Moreover, it is important to consider if an athlete's emotional state needs to become more or less positive, and if arousal levels should be increased or decreased (Bishop, 2010). When selecting pre-task music it is also essential to consider the extra-musical associations that may promote the desired emotional state (Bishop, 2010; Sloboda & Juslin, 2001; Terry & Karageorghis, 2011). Additionally, music track's acoustical qualities such as tempo should be taken into consideration (Karageorghis & Terry, 1997) as well as motivational and catchy lyrics that can allow athletes to prolong emotional response by singing to themselves (Mesagno et al., 2009).

Individual Zones of Optimal Functioning (IZOF)

The IZOF model investigates defining characteristics of the emotional experience that are related to performance (Hanin, 2000, 2004, 2007). Thus this multilevel system of emotion description will analyse athletes' emotion through at least five interrelated dimensions: form, content, intensity, time, and context. According to Hanin (2000) the main focus of the IZOF model is to describe, predict, explain and regulate performance related psycho biosocial states that affect individual or team activity. The IZOF model allows the prediction of individually successful and less-than-successful performances based on current emotional states and previously established individualized criteria. The IZOF focuses on the individual patterns, structure, and functions of idiosyncratic emotional experiences (Hanin, 2004).

The IZOF model explains the relationship between emotion and performance with a foundation of five basic dimensions: form (substrate), intensity (energy), content (information), time, and context (space; Hanin, 2007).According to the model, emotional content is idiosyncratic and successful performance happens frequently when an athlete has used his or her best performance patterns based on cognitive, emotional, motivational, bodily-somatic, and psychomotor resources (Hanin, 2000).

The term *individual* on the IZOF acronym emphasises the model idiographic approach. Thus, the main focus of the model is on the "within-individual dynamics of subjective emotional experiences and meta-experiences related to performance" (Hanin, 2004, p. 740) For Hanin (2000, 2004, 2007) the term *optimal* emotions refers to those most relevant and appropriate for a particular athlete under specific conditions. An athlete is in optimal performance state when they have the best internal conditions, a total involvement in the task and the best possible recruitment of resources (Hanin, 2000). The principle of *zone* present on the IZOF model is fundamental for the understanding of the relationship between emotional state and performance. Hanin (2004) suggested that the notion of zone (range) indicates that there is a specific relationship between the perceived intensity of emotional state and the quality of performance. Thus being in the optimal zone implies a high probability of individually successful performance. The term *optimal* in the IZOF model is a multidimensional concept, hence relating to content, intensity, form, time and context dimensions. The term *functioning* refers to the optimal or dysfunctional effect of emotion on performance quality (Hanin, 2000, 2004). Optimal functioning is a result of an athlete's efficient recruitment and use of available resources. Conversely, emotional dysfunction reflects a failure to recruit resources, erroneous use of resources and inability to recover.

To predict the emotion performance relationships it is necessary to consider the interactive as well as the separate effects of emotions on sport activity. According to the IZOF model, the relationship between emotion and performance is based on the concept that emotion is functionally significant for behaviour and performance. Thus Hanin (2004) suggested that emotion is an unfolding process reflecting person-environment interactions. The way the individual appraises the interaction with the environment will influence the content and intensity of performance-related emotional experiences (Hanin, 2004). Frequently, optimal emotions before and during activity are usually anticipatory and are triggered by appraisals of challenge and threat (Hanin, 2007). Conversely, situational dysfunctional outcomes can be triggered by appraisals of gain and loss before task completion. Experiencing an emotion outcome too early can result in impaired energy mobilization and/or utilization (Hanin, 2007).

According to Hanin (2000) the emotion intensity is the base of the in-out zone concept. This idea was previously acknowledged by the literature on sport psychology especially regarding anxiety. However, only two dimensions were investigated (cognitive and somatic; Hanin, 2000). Previous models of anxiety predicted that similar levels of anxiety would be detrimental to performance for all athletes. The IZOF model nevertheless proposes an individual analysis of intensity of emotion and effect on performance. Through a series of observations of an athlete's performance in different sport events the sport psychologist consultant will identify the emotions and their intensities as they occur during the athlete's best and worst performances. The IZOF model will examine the influence of positive and negative affect on performance (Hanin, 2004). The result of this investigation is the establishment of an individualized zone of optimal and dysfunctional performance. These zones will predict the athlete's performance according to the intensity of the emotions they are experiencing and if they have a positive or negative affect (Hanin, 2000, 2004, 2007). The IZOF will have a similar iceberg shape as that obtained on the POMS (Profile of Mood States), with however, a deeper interaction between negative and positive affect as predictors of performance.

Single Case Design

Sports psychologists focus their efforts on helping athletes to achieve their optimal performances; therefore sport psychology is essentially an applied field (Bryan, 1987). Thus sport psychologists need a methodology to assess the results of their interventions on athletes' performances, or changes in specific behaviours. Hence according to the literature, an appropriate strategy to evaluate the effects of an intervention in sport psychology is the single case design (Bryan, 1987; Hrycaiko& Martin, 1996; Martin, 2007).

A traditional approach to research in psychology has been the control group design. This design involves at least two groups, one group receives the treatment (the treatment group), and another does not (the control group, Martin, 2007). In the single case design, however, there is no comparison between groups with different treatment conditions, hence avoiding ethical issues of leaving a group without the intervention. This approach has more acceptance with coaches and athletes, who are sometimes resistant to participating in a no treatment group (Bryan, 1987; Hrycaiko & Martin, 1996).

Additionally in the group design performance is normally assessed only prior to and post treatment. Athletes and coaches, however, are concerned about performance variation over time (Martin, 2007). In the single case design, the athletes' performances are analysed before, during, and post intervention. Therefore in the single case design there is an on-going assessment of the dependent variable (Hrycaiko & Martin, 1996). This method provides a more comprehensive assessment of the athletes' performances and intervention effects.

In the single case design, before the intervention, performances are observed for a period of time to establish a baseline, which increases the reliability of data collected after the intervention (Byran, 1987; Hrycaiko & Martin 1996; Martin). According to Martin and Hrycaiko, to increase the reliability of data the baseline, before the intervention, should be stable or with a tendency in an opposite direction than desired at the end of the intervention. Even though single case design does not have treatment and control groups, in this type of research design each participant acts as his or her own control (Hrycaiko & Martin; Martin). The athletes' performances during and after the intervention are compared to the baseline established previously.

Another characteristic of the group design is that the treatment results will be assessed for statistical significance (Bryan, 1987). Nonetheless, according to Bryan, averaging results of the intervention to compare groups can sometimes be misrepresentative and neglect the effects of the intervention on the individual. Bryan pointed out that small but still important differences between groups can appear with low within-group variability. In applied studies where control is harder to achieve and within-group variability is high, performance improvements that are small can appear as not statistically significant. Nevertheless for athletes, especially elite athletes, small changes in performance are indeed important. A small improvement in performance can result in success at a competition.

An important feature of the single case design, as in any research design, is the reliability of the measurement of the dependent variable (Bryan, 1987; Martin, 2007). This reliability should be demonstrated to guarantee that the changes in performance are due to the intervention and not by variations in the measurement. Therefore the single case design requires interobserver reliability (IOR) assessment, to ensure that the recordings of the athletes' performances are precise (Hrycaiko& Martin, 1996; Martin). The procedure of the IOR requires that during a number of observations session two experienced observers rate the dependent variable (Hrycaiko& Martin). The rating should be done in a manner where the two observers don't influence each other. According to Hrycaiko and Martin, after both observers have assessed the dependent variable, their assessments are compared. There are various ways of computing the IOR. One frequent method is to divide the smaller total of the dependent variable recorded by one observer by the larger total recorded by the second observer (Hrycaiko& Martin) then multiply the dividend by 100%. Hrycaiko and Martin pointed out that satisfactory IOR scores by convention are 80% or higher.

Studies using the single case design are normally assessed in two ways to analyse the intervention effects (Hrycaiko& Martin, 1996). One assessment type is the examination of the influence of the independent variable on the dependent variable, and is named the scientific assessment. The second approach to the analysis of data is the clinical or practical assessment. This assessment is based on the effects of the treatment from the perception of the individual client, coach, or society (Bryan, 1987; Hrycaiko& Martin)

Studies using the single case design traditionally use the visual inspection of data for the scientific assessment of the effects of the treatment on the dependent variable (Bryan, 1987; Hrycaiko& Martin, 1996; Martin 2007). Nevertheless, as pointed out by Hrycaiko and Martin, this analysis is not subjective, and should follow specific criteria before judging the effects of the intervention. Firstly it is necessary to ensure that, as mentioned before, the baseline prior to the intervention was stable or in a direction opposite to that predicted for the effects of the treatment. Also there will be more confidence in the results if these are repeated several times both within and across participants and the fewer times there is an overlap of data points between the baseline and the intervention phases (Hrycaiko& Martin). Additionally there will be more confidence in the effects of the intervention if they are perceived straight after the intervention started. Lastly, there will be a stronger link between the intervention and its effects if the results are consistent with previous literature and theory on the topic.

Nevertheless, according to Bryan (1987), even though behavioural researchers have relied on the statistical relevance of an intervention to assess its effects, they are also concerned with the clinical importance of the treatment. Bryan pointed out that coaches’ and athletes’ own assessments of their changes in performance are important, even more than if the changes are statically relevant. According to Hrycaiko and Martin (1996), the clinical or practical assessment of a treatment effect is referred to as an assessment of the social validity.

Method

Participants

Nine male collegiate soccer athletes from a university in London participated in this study. The participants were aged between 18 and 20 (M = 19, 1). Participation in the study was voluntary, institution ethical procedures (Appendix A) were followed and participants provided written informed consent (Appendix B) prior to engaging in the study. Participants answered a demographic questionnaire (Appendix C) and in terms of nationality, six participants were British, and the remainder were Brazilian, Italian and Iranian (one of each).

Apparatus and Instruments

Individual Zones of Optimal Functioning (IZOF). The IZOF model is an idiographic approach that focuses on athletes' idiosyncratic emotional experiences related to their successful and less than successful performances. The method used to develop participants' IZOF was a structured interview following Hanin's guidelines (2000, 2004). During the first part of the interview, athletes detailed their experiences in terms of best and worst performances (Appendix D). Thereafter they selected emotions according to how they felt before their best and worst performances from the IZOF-based emotion stimulus list. The IZOF stimulus list consists of 46 pleasant emotions and 50 unpleasant emotions, arranged in 14 synonymous rows. Participants could also add another adjective to the list if they considered it necessary. Finally the athletes identified the intensity of their emotions (optimal and dysfunctional) before their best performance. Emotion intensity was established using Borg's CR-10 scale.

Brunel Music Rating Inventory-3 (BMRI-3). To assess the motivational qualities of athletes' self-selected music the BMRI-3 (Appendix E; Karageorghis& Terry, 2011) was used. The BMRI-3 instructions were slightly modified from its predecessor the BMRI-2 (Karageorghis, Priest, Terry, Chatzisarantis, & Lane, 2006)to become sport specific. The BRMI-3 is a single factor 7-point Likert scale, ranging from 1 ("strongly disagree") to 7 ("strongly agree"). The BMRI-3 have six items, each of them refers to an action, time, context, and target (e.g. "The beat of this music would motivate me during my mental preparation before playing"). For the purpose of this research the action time used was "before" performance, and the instrument instructions used examples related to soccer. On table 1 participants' music tracks with the highest score on the BMRI-3 and used on the experimental trials are listed.

Table 1

Participant's Experimental Trial Music Track

Participant	Music Track	Artist
1	Let's get married	Jagged Edge
2	Live forever	Oasis
3	Buddaflie	Chris Webby
4	Black coffee	Bucie Superman
5	Beautiful people	Chris Brown, ft Benny Benassi
6	Here I am	Rick Ross
7	Power	Kanye West
8	The contender theme	Hans Zimmer
9	Go for the goal	Pro Evolution Soccer 2008

Concentration grid. The concentration grid is an exercise that involves the athlete scanning a grid divided into 100 equal sized squares that are randomly numbered from 00 to 99 (Appendix F; Greenless, Thelwell& Holder, 2006; Harris & Harris, 1984). The execution of the concentration grid requires considerable attentional control without working as an anxiety-reduction technique (Harris & Harris). Therefore this exercise can be used to prevent carryover effects (Ashford, Karageorghis, & Jackson, 2005). Participants were instructed to locate a number from 00 to 99 selected by the researcher and then to mark as many consecutive number as they could locate in a 1 minute timeslot.

Skill test trial. The soccer skill test (Figure 1) designed by Abouzekri and

Karageorghis (2010) was used on this study. This skill test comprises of a ball dribbling task, an accuracy task consisting of 10 levels of accuracy, and a running task without the ball. The soccer skill test aims to imitate the movements of a real game situation. The skill test was conducted on an indoor sports hall with springboard flooring. On each trial, participants ran through the skill test circuit twice. Performance time was recorded as the time each participant expended to complete two skill tests. The participants had to perform a long pass kick over a distance of 20m in the direction of a line of cones. Kicking the ball through the central cones earned 10 points for participants; each cone further away from the centre earned one less point, with the outer cones earning just one point. Performance accuracy was calculated using the sum of the accuracy points the participants obtained from the two passes.

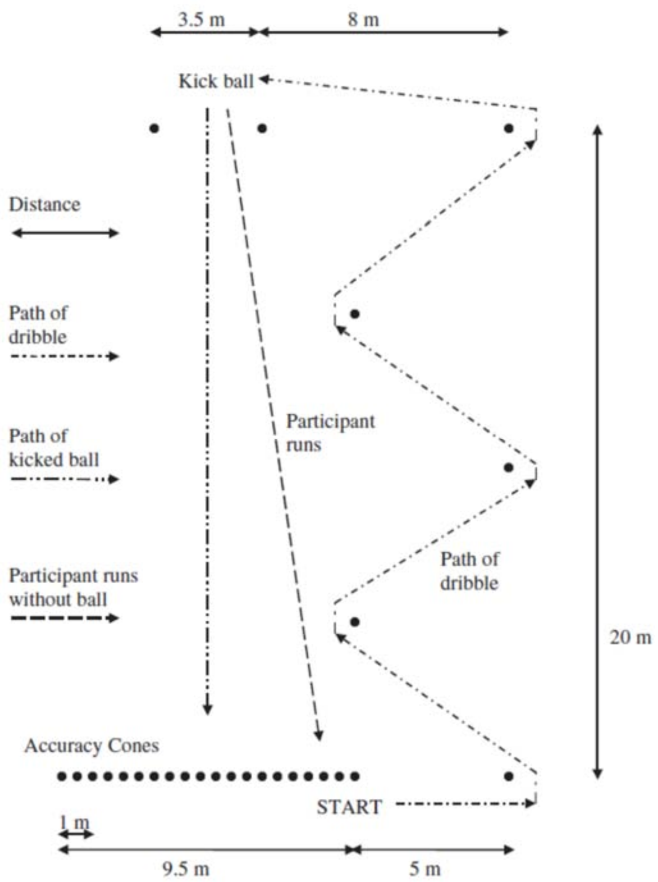

Figure 1. Skill test circuit.

Intervention evaluation questionnaire. The evaluation questionnaire (Appendix G) was developed by the researcher, based on the model developed by Hanrahan (2004). Participants were asked to score the intervention from 1 (unhelpful) to 5 (helpful), and to answer the three open-ended questions about the intervention.

Apparatus. For the setting up of the soccer skill test 27 cones were used. A tape measure was used to guarantee the accuracy of the cones' position, and the cones were fixed on the floor with tape. Two standard soccer balls were used on the skill test. Skill test execution was recorded with a Panasonic video cam, standing on a tripod. Two stop watches were also used to record performance time.

Procedure

Assessment. During participants' first meeting with the researcher they were asked to describe their most and least successful performances, and the emotions related to these experiences (Appendix D). Based on the information provided, participants' IZOF was established (Hanin, 2000; 2004). Participants then selected three or four music tracks from their own play list that they considered would help them in achieving their IZOF. Thereafter they assessed the motivational qualities of the selected tracks using the BRMI-3 (Appendix E). The track that was used for the experimental trials has the highest BMRI-3 score. At the end of this first meeting, participants completed two full test trials as a habituation.

Experiment trials. The second individual meeting with the participants was composed of four experimental trials; two with pre-task music, and two without. Before the no-music trials, athletes completed the concentration grid as a filler (Appendix F). After each trial participants completed their IZOF according to the intensity of their emotions before the execution of that trial. At the end of the study, participants completed the intervention evaluation questionnaire.

Pressure manipulation. A pressure manipulation was performed to increase anxiety and therefore maintain some similarity with real competition settings. During the experimental trials a second researcher was present videotaping participants' trial execution. Additionally participants were informed that their results would be published in the club lounge at the end of data collection.

Data Analysis

Inter-observer reliability. Performance data were assured to be reliable by meeting the standard requirements of inter-observer reliability (IOR; Barlow, Nock, & Hersen, 2009; Hrycaiko & Martin 1996; Martin, 2007). During all data collection a second observer independently registered the dependent variable. Then the IOR was calculated dividing the smaller total of the dependent variable coded by one observer, by the larger total coded by the second observer. The dividend was multiplied by 100% (Barlow, Nock, & Hersen; Hrycaiko & Martin; Martin)

Visual inspection. The data were graphically displayed and analysed according to the criteria on single case design (Hrycaiko & Martin, 1996). Thus, according to the literature the criteria to establish a treatment effect are: (a) baseline performance is stable or in the direction opposite to that predicted for the treatment; (b) the number of times an effect occurs both within and across participants; (c) the number of overlapping data points between baseline and treatment phases; (d) the speed at which the effect occurs following the treatment; and (e) the larger the size of the effect in comparison to baseline (Hrycaiko & Martin; Johnson, Hrycaiko, Johnson, & Halas, 2004; Patrick, & Hrycaiko, 1998).

Clinical (Practical) assessment. The clinical assessment of the intervention, based on the social validity evaluation (Barlow, et al., 2009; Hrycaiko, & Martin, 1996) for all the participants in the study was performed with the intervention evaluation questionnaire. To assess the participant's perceptions of the music tracks' effects on their performances and emotions before the trials, the answers collected on each of the three open questions on the evaluation questionnaire were clustered by themes.

Results

Inter-Observer Reliability Assessment (IOR)

The inter-observer reliability for the participants overall performances illustrated that the observers were in 90% agreement on the trials sample analysed by both.

Time and Accuracy

Participants' accuracy and time performance data are presented in Figures 2-10. The music intervention led to performance improvement (time and accuracy) in both music trials conditions for one participant (Figure 3). One participant showed improvement in time on all music conditions (Figure 4). Collectively the scores demonstrate inconsistent results for time and kick accuracy.

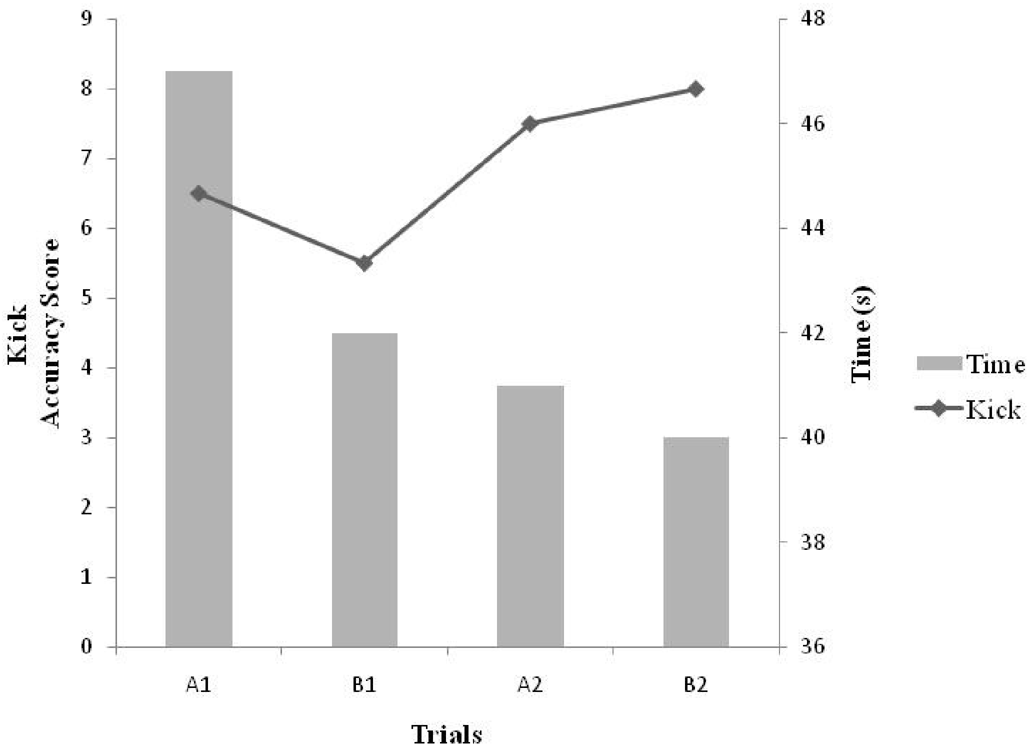

Figure 2. Time and kick accuracy for participant 1.

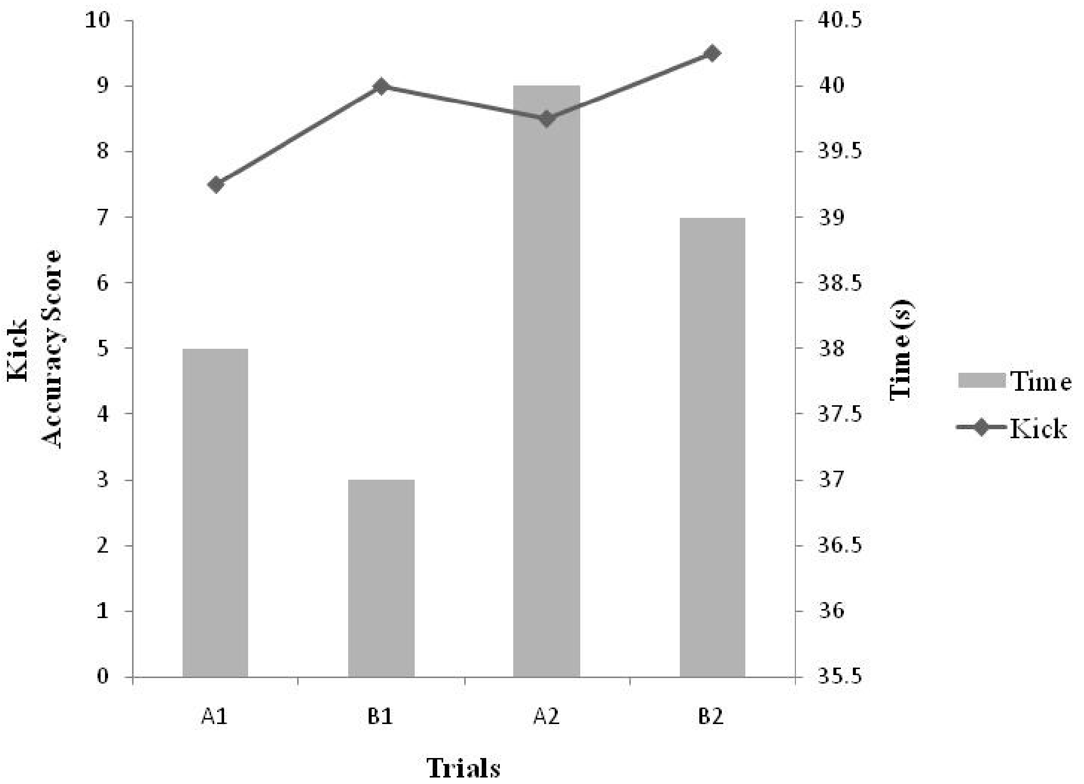

Figure 3. Time and kick accuracy for participant 2.

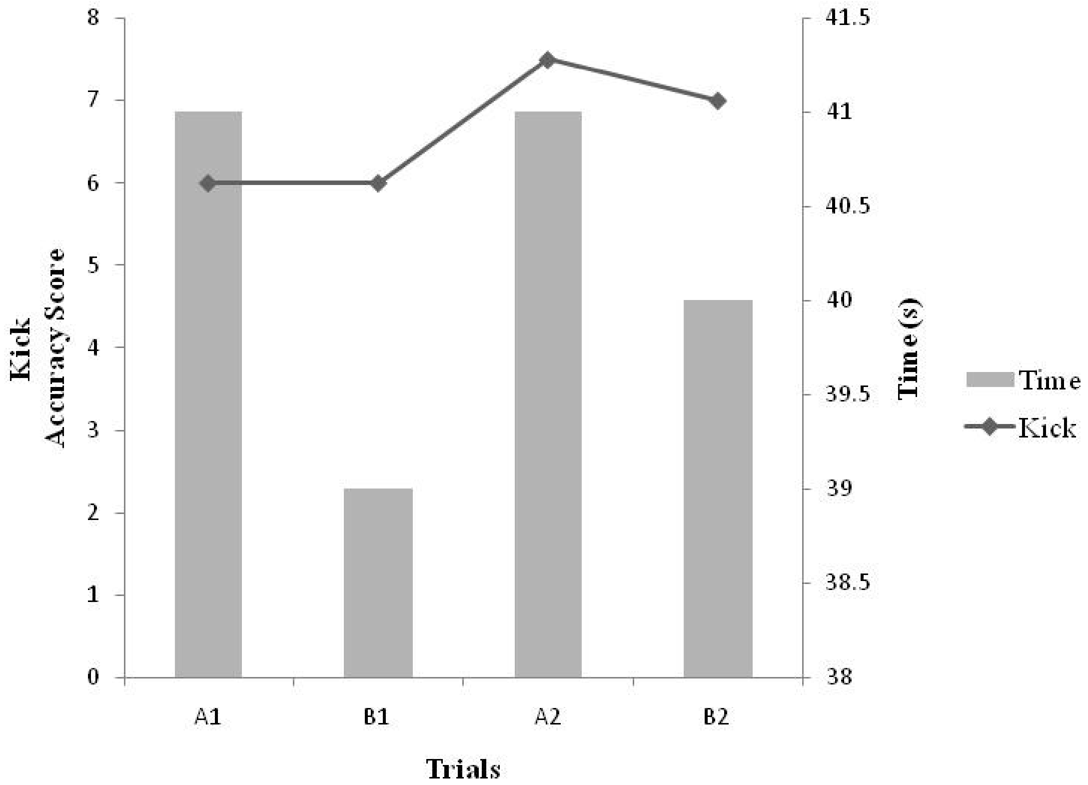

Figure 4. Time and kick accuracy for participant 3.

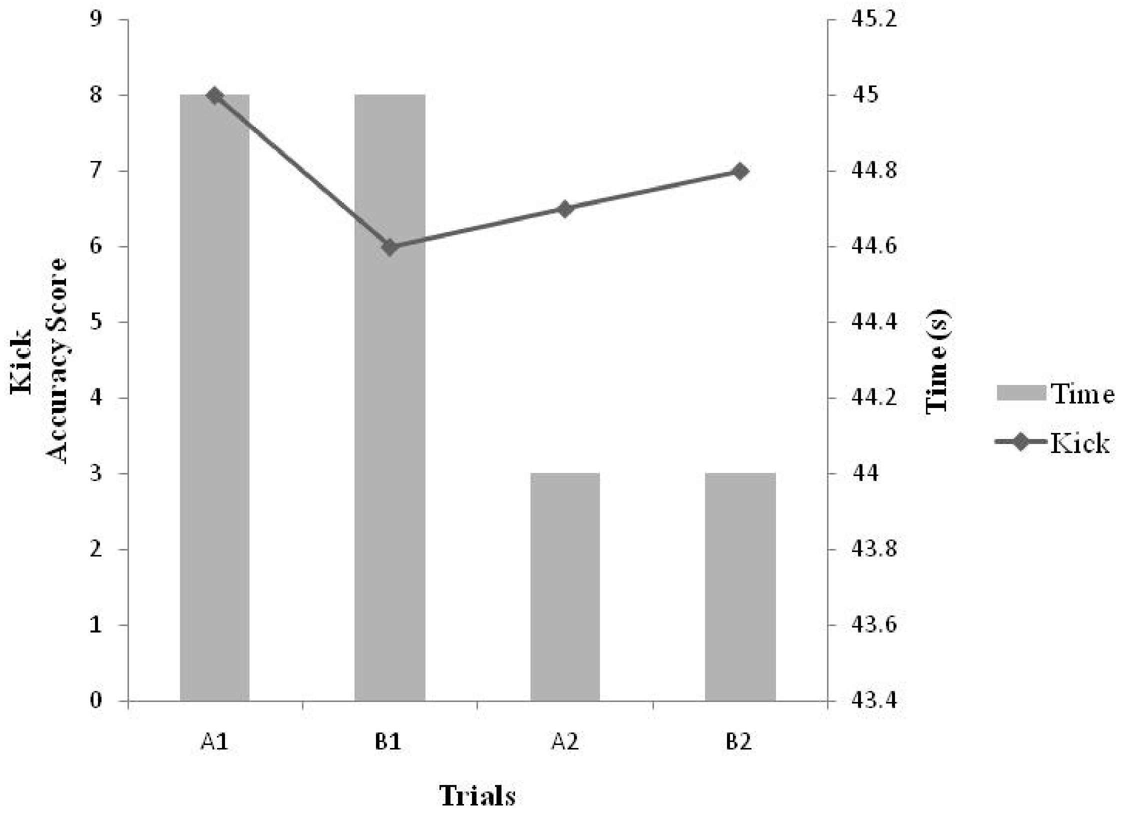

Figure 5. Time and kick accuracy for participant 4.

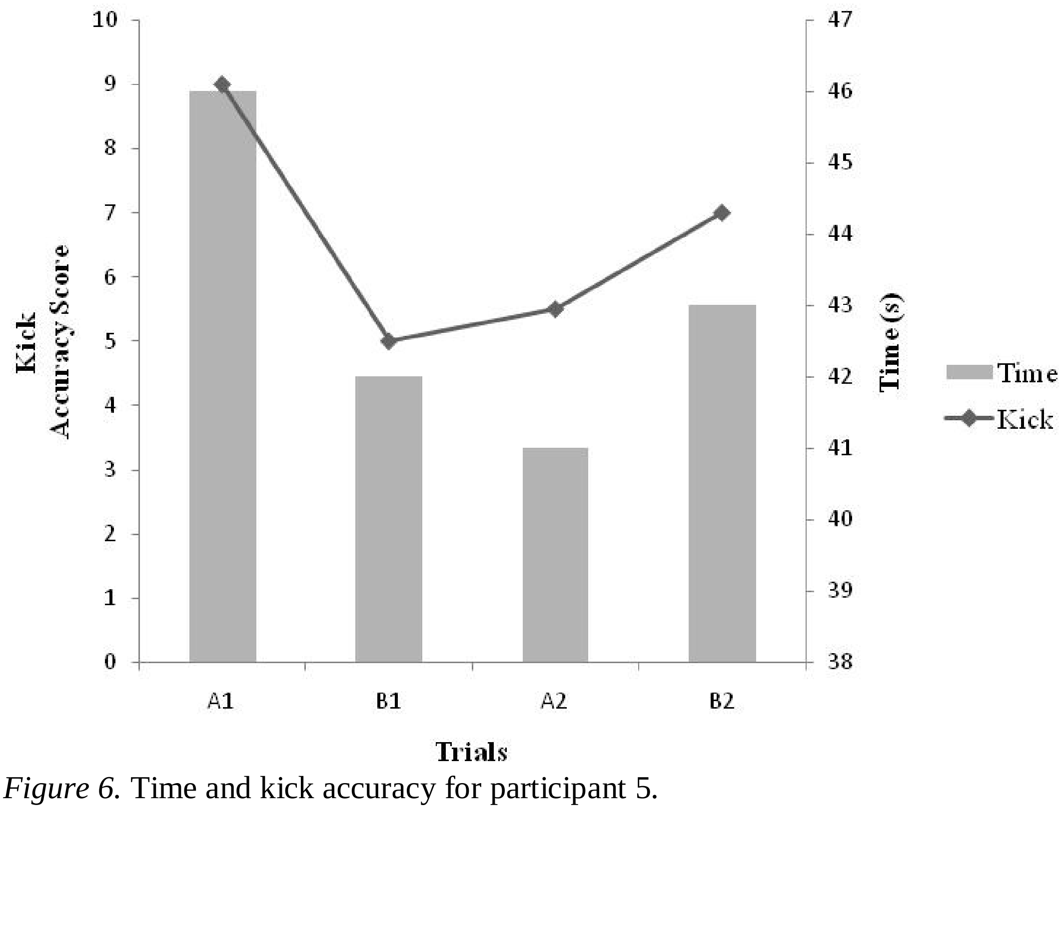

Figure 6. Time and kick accuracy for participant 5.

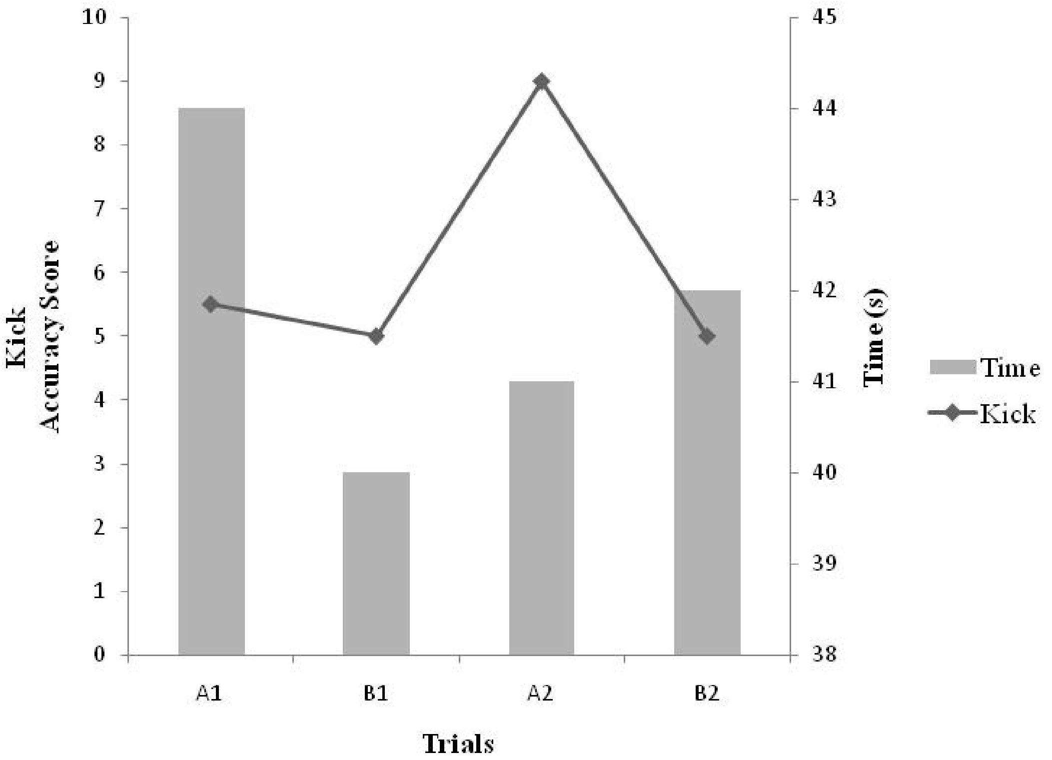

Figure 7. Time and kick accuracy for participant 6.

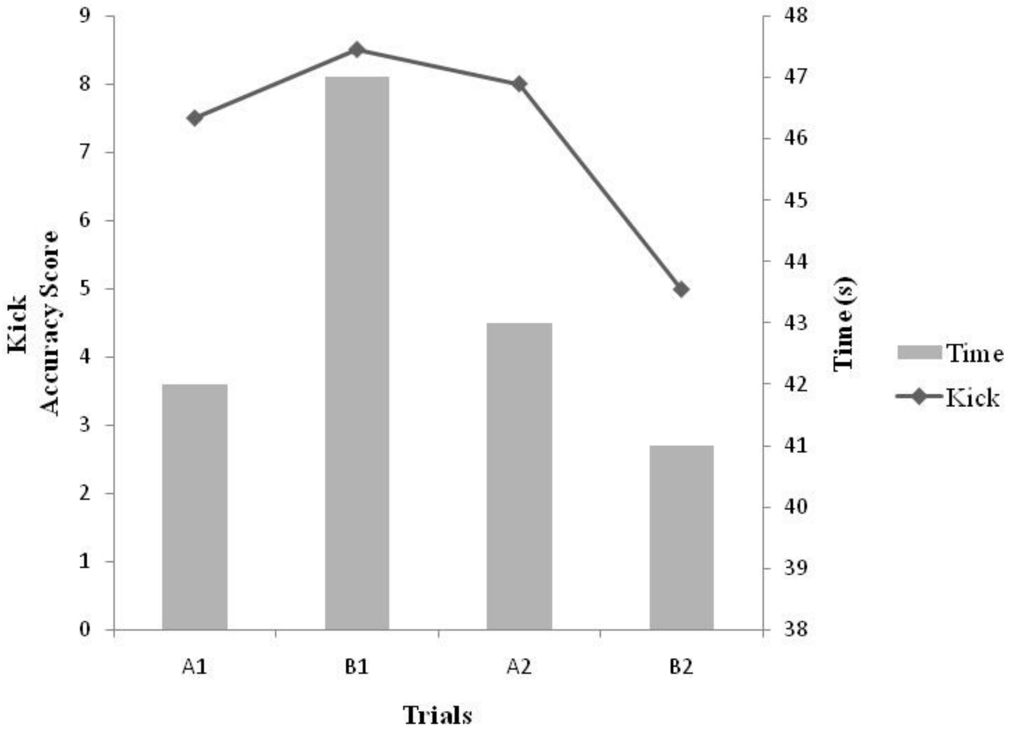

Figure 8. Time and kick accuracy for participant 7.

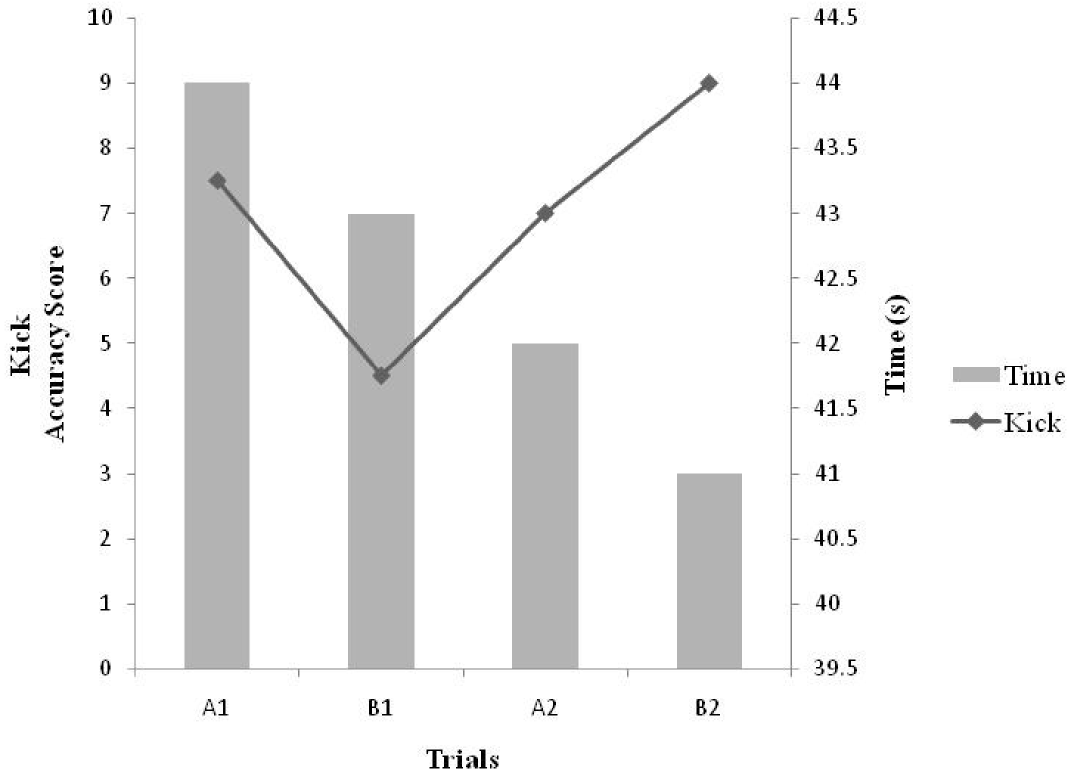

Figure 9. Time and kick accuracy for participant 8.

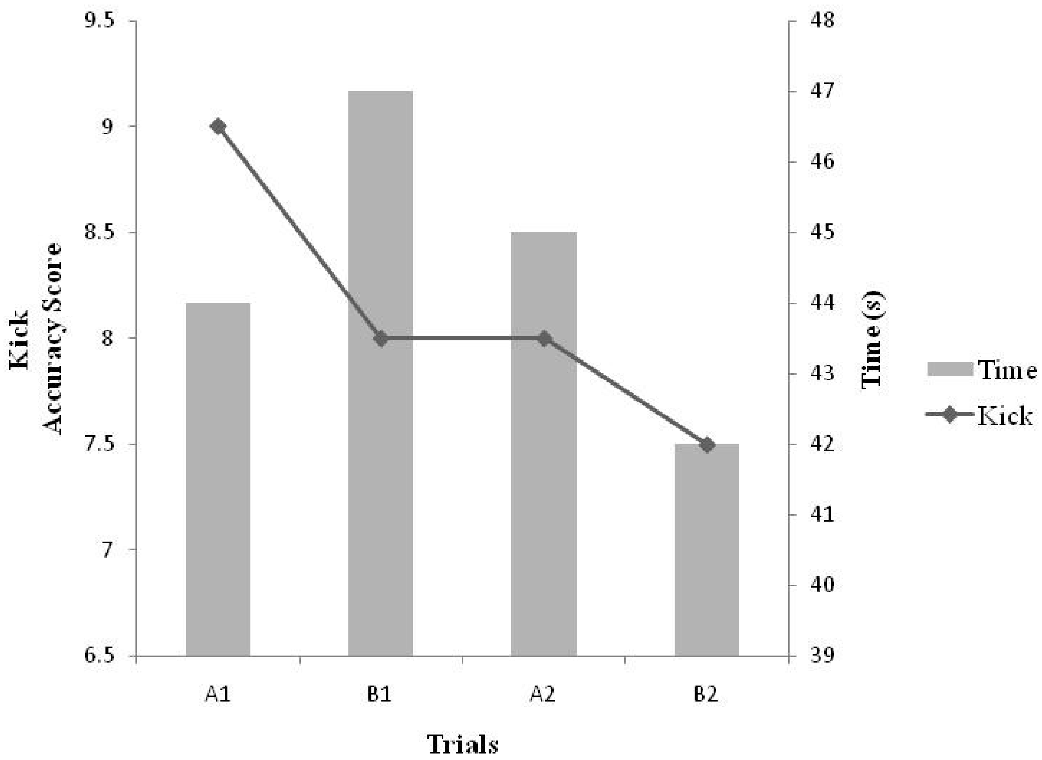

Figure 10. Time and kick accuracy for participant 9.

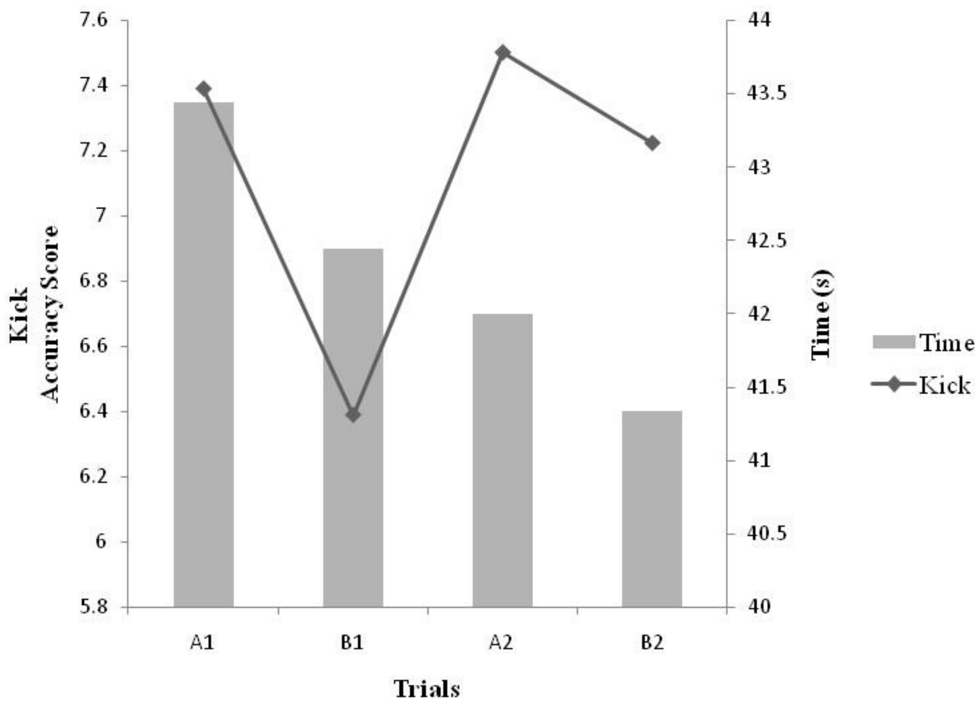

Figure 11. Time and kick accuracy for all participants.

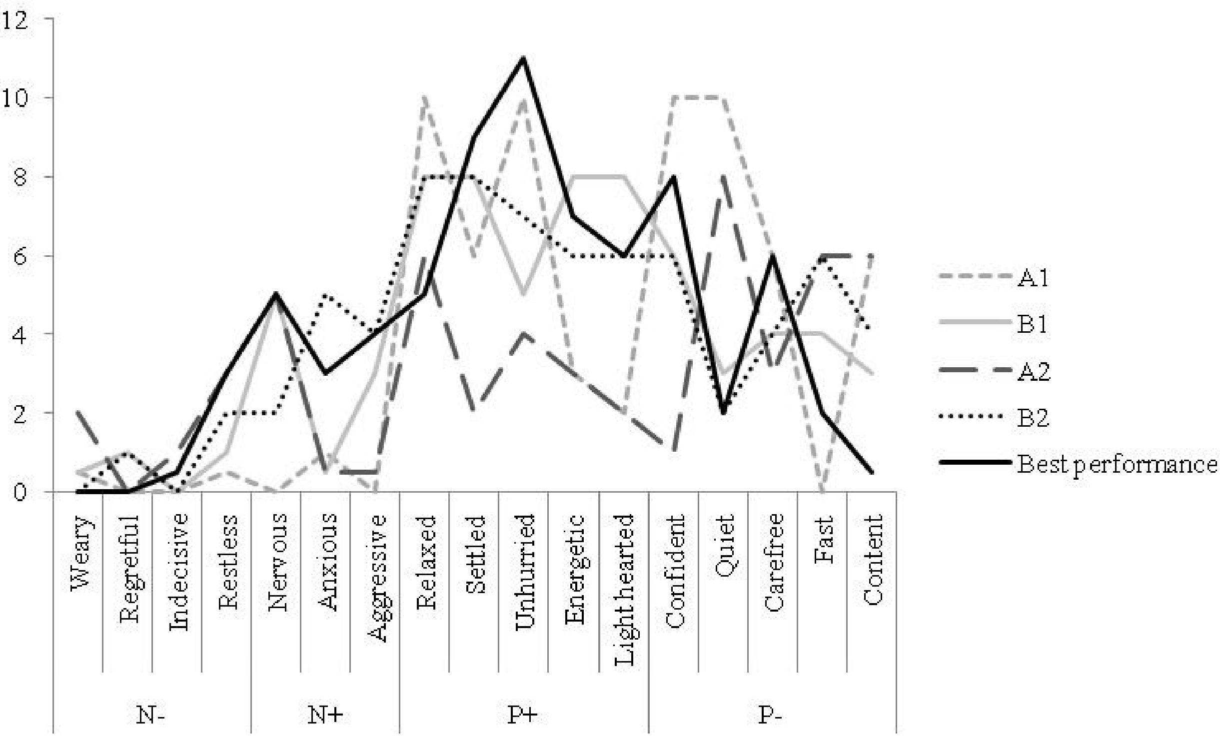

Figure 12. IZOF scores participant 1.P+ = helpful positive emotions N+ = helpful negative emotions; N- = harmful negative emotions; P- = harmful positive emotions.

IZOF

Participants IZOF data are presented in Figures 12-20. Participant 5 (Figure 16) scores on the music conditions were closer to scores attributed to participant's best performance than the no-music conditions. Helpful negative scores for participant 7 on the music condition were closer to the values for participant best performance than the no music values. Overall the scores highlight a lack of consistency in the intensity of emotions experienced during the trials.

Intervention evaluation questionnaire

In the first question the athletes were asked to evaluate the intervention on a scale of 1-5, where 1 was unhelpful and 5 helpful. The mean response was 4 (SD=.66). Table 2 presents the categories of the athletes' comments regarding the effects of the music intervention on their performances. The category with the highest occurrence of answers was activation. In total the participants mentioned eight categories regarding the effects of the intervention. The categories; motivation, decreased accuracy, improved performance, and concentration were each mentioned by two athletes. Regarding the effects of the pre-task music on how participants felt before the trials, most participants pointed out that the pre-task music motivated and increased concentration, as shown in Table 3. Three participants mentioned that the pre-task music increased activation. As shown in Table 4, when asked to provide comments about the pre-task music intervention five participants considered the study to be "good", and four participants mentioned that it increased their self-awareness about preparation to compete.

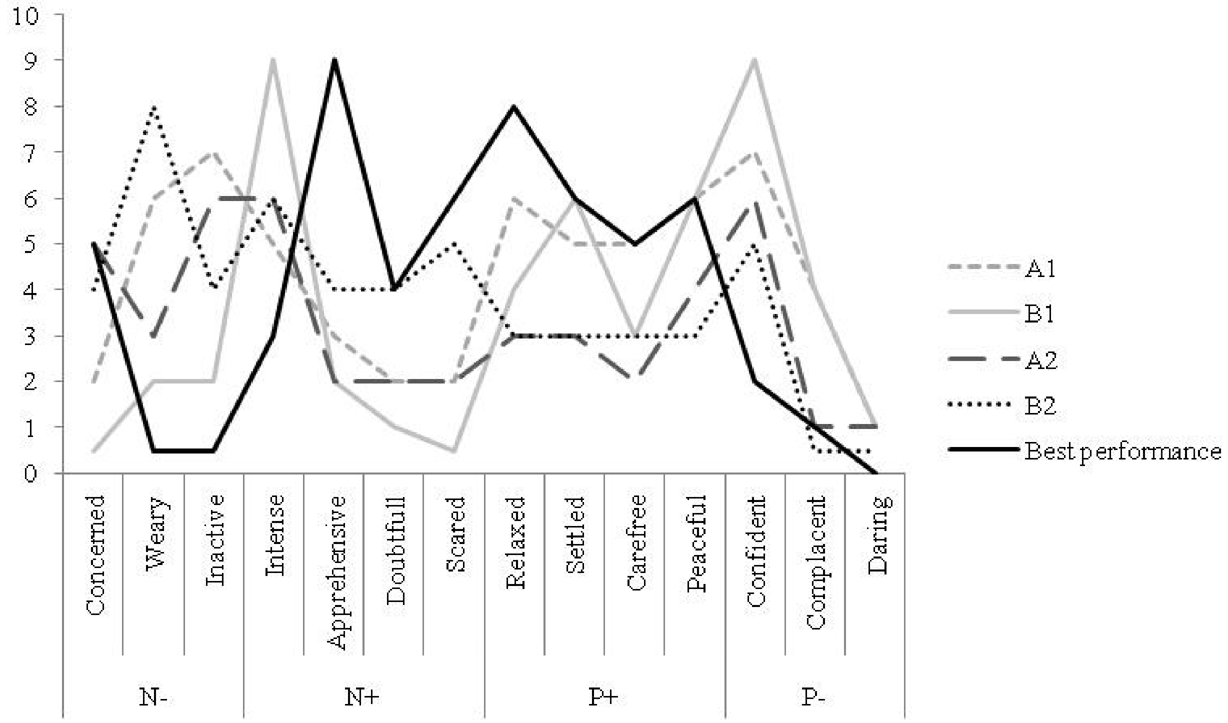

Figure 13. IZOF scores participant 2.P+ = helpful positive emotions N+ = helpful negative emotions; N- = harmful negative emotions; P- = harmful positive emotions.

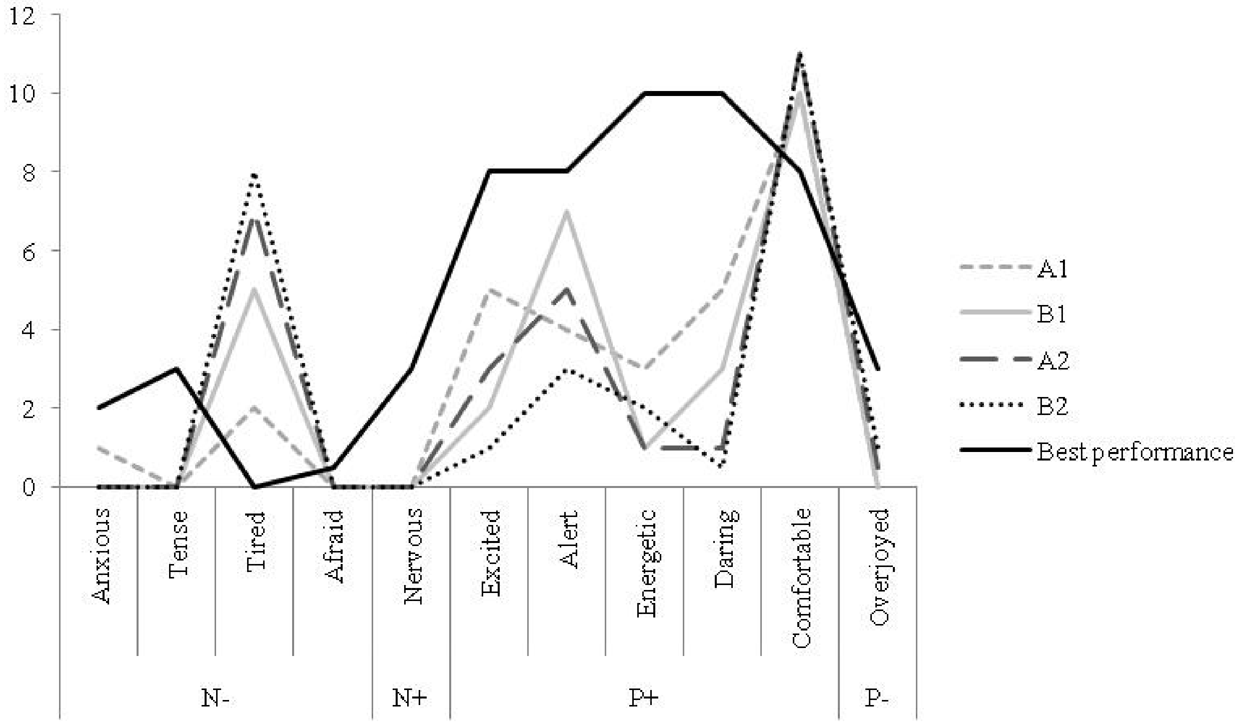

Figure 14. IZOF scores participant 3.P+ = helpful positive emotions N+ = helpful negative emotions; N- = harmful negative emotions; P- = harmful positive emotions.

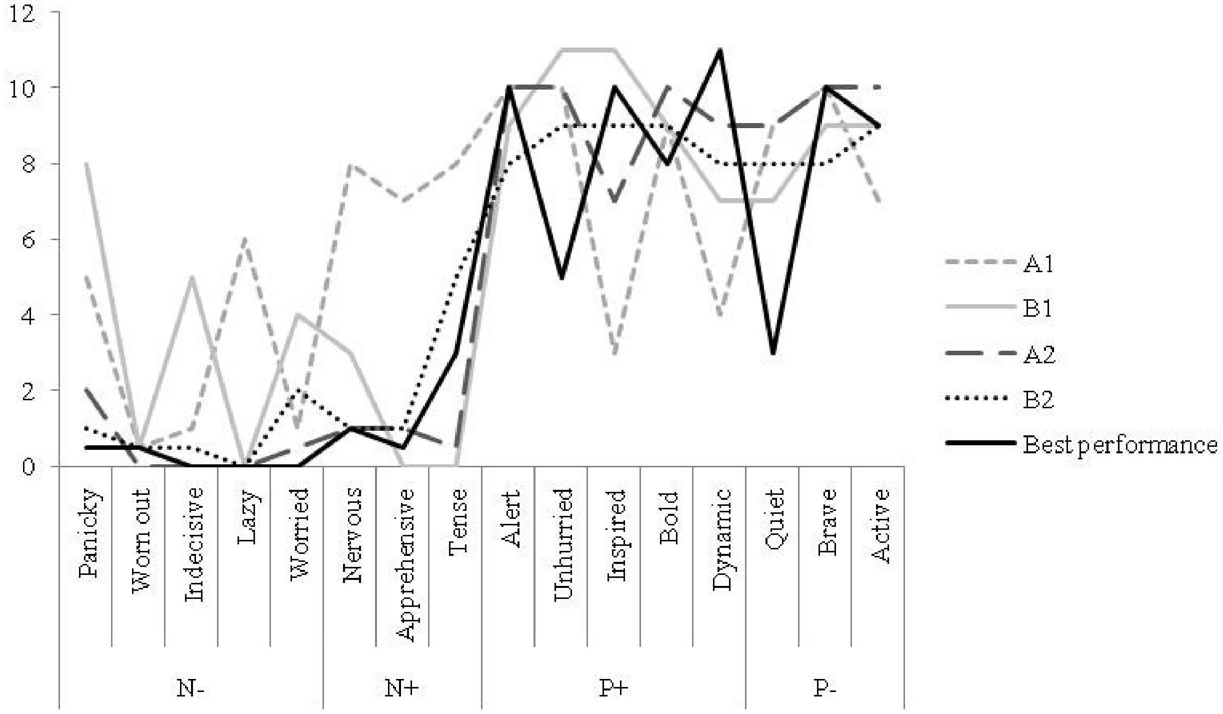

Figure 15. IZOF scores participant 4.P+ = helpful positive emotions N+ = helpful negative emotions; N- = harmful negative emotions; P- = harmful positive emotions.

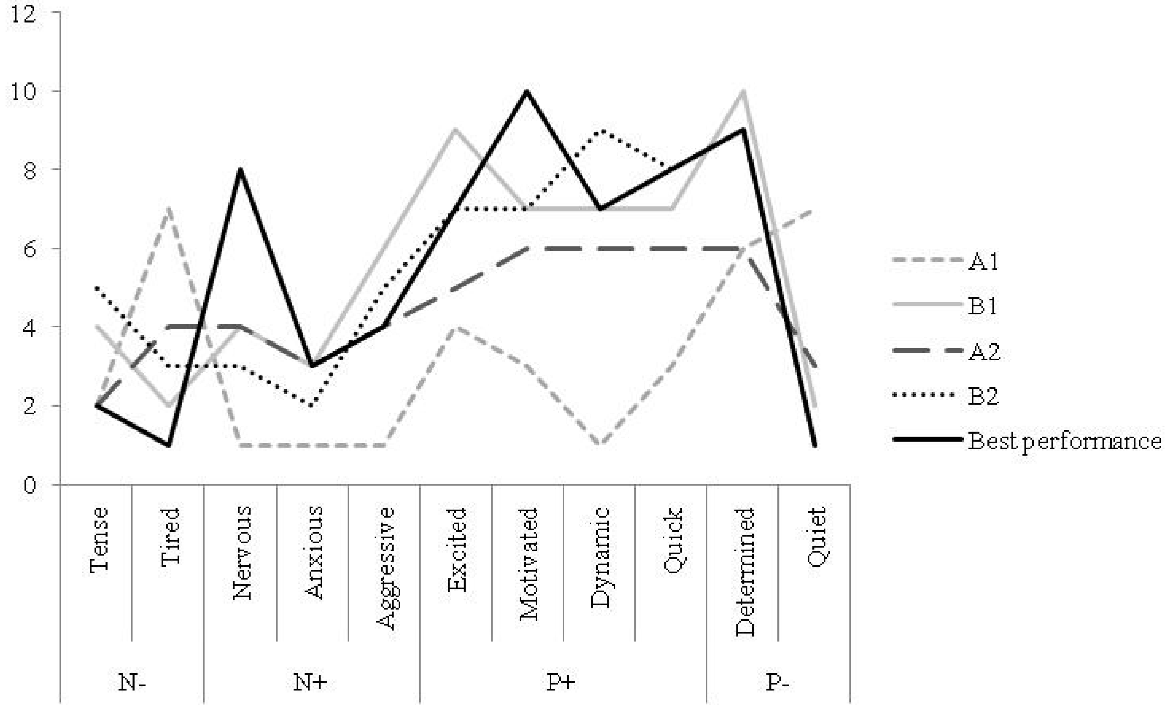

Figure 16. IZOF scores participant 5. P+ = helpful positive emotions N+ = helpful negative emotions; N- = harmful negative emotions; P- = harmful positive emotions.

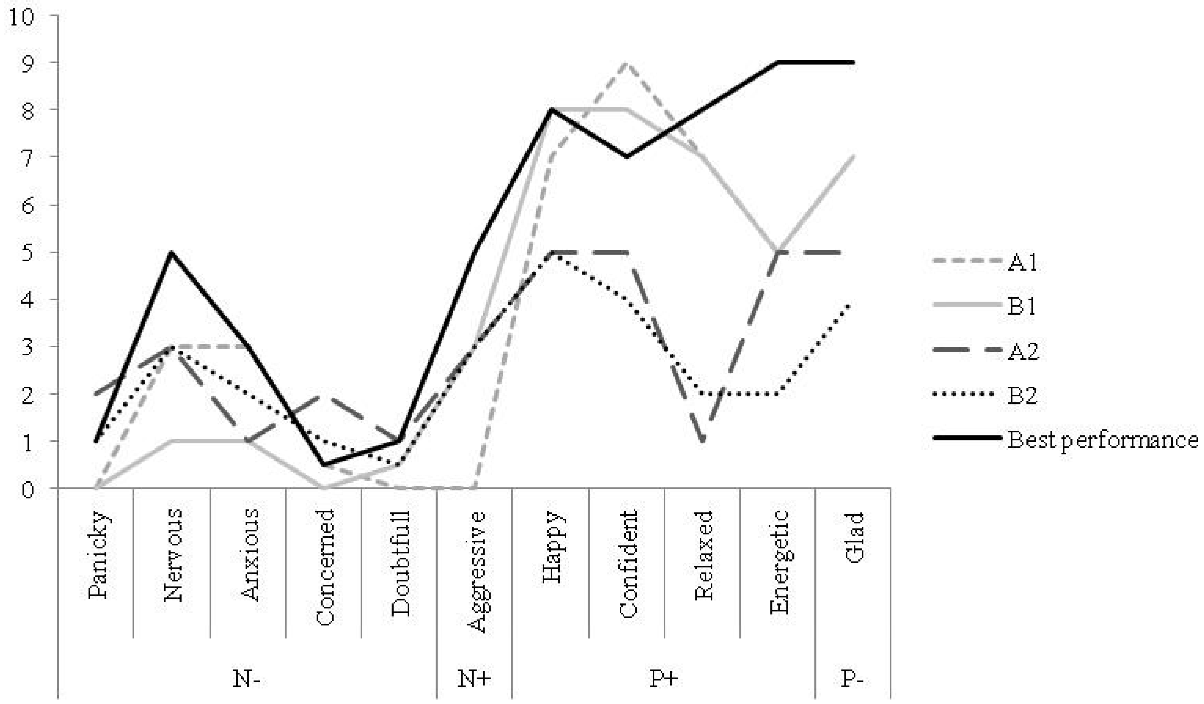

Figure 17. IZOF scores participant 6.P+ = helpful positive emotions N+ = helpful negative emotions; N- = harmful negative emotions; P- = harmful positive emotions.

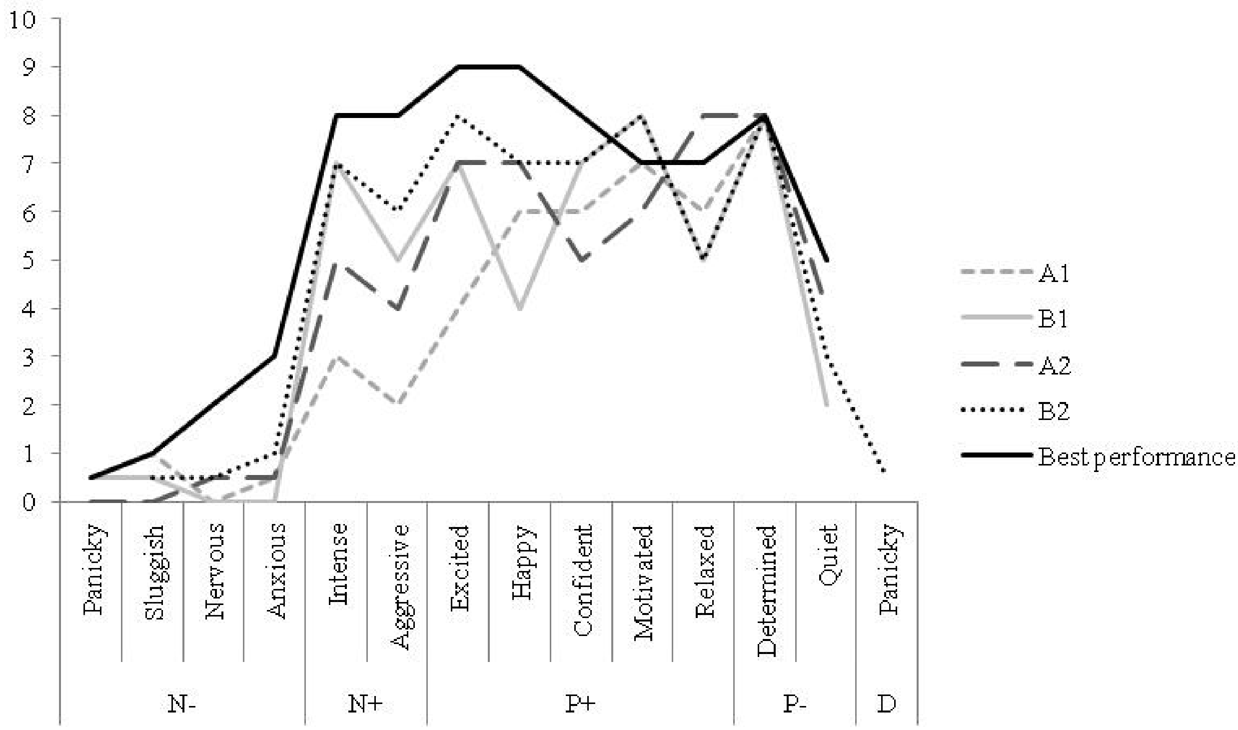

Figure 18. IZOF scores participant *7*. P+ = helpful positive emotions N+ = helpful negative emotions; N- = harmful negative emotions; P- = harmful positive emotions.

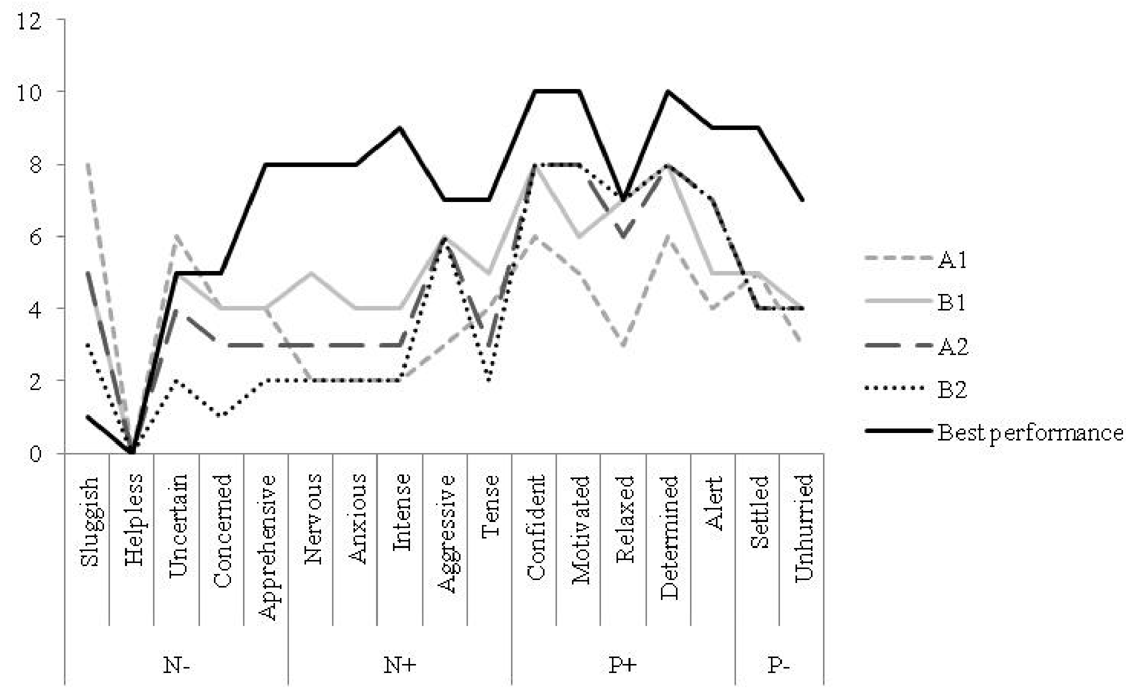

Figure 19. IZOF scores participant 8.P+ = helpful positive emotions N+ = helpful negative emotions; N- = harmful negative emotions; P- = harmful positive emotions.

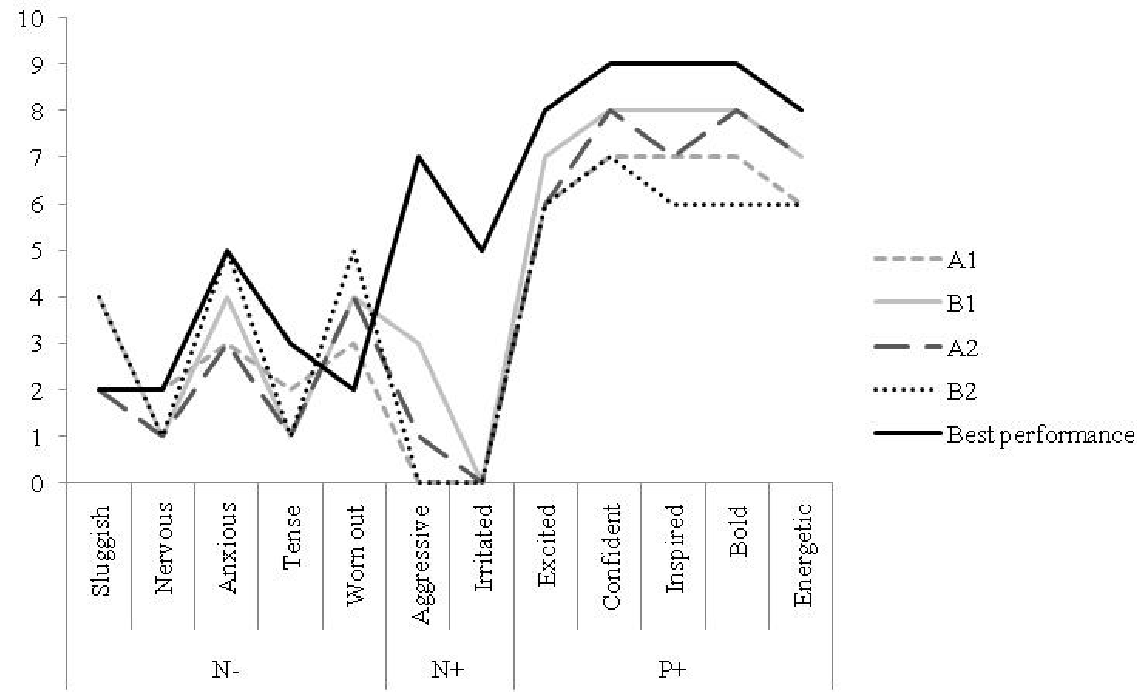

Figure 20. IZOF scores participant 9. P+ = helpful positive emotions N+ = helpful negative emotions; N- = harmful negative emotions; P- = harmful positive emotions.

Table 2

Responses For The Question: "What effects, if any, did the pre-task music have on your performance?"

Categories	Sample Quote	# of Participants
Activation	"It felt like I had more energy"	4
Motivation	"Motivated me to do better when I was completing the tasks"	2
Decrease in accuracy	"I was trying to go too fast that accuracy slipped"	2
Improved performance	"It made me do the circuit faster and better than previous attempts"	2
Concentration	"It aided my concentration during performance"	2
Decrease in arousal/ relaxed	"The music calmed me down from a state of nervousness"	1
Aggressiveness	"I felt more aggressive"	1
No effect on performance	"The song I was listening to didn't really affect my performance"	1

Table 3

Responses For The Question: "What effects, if any, did the pre-task music have on how you felt before the trial?"

Categories	Sample Quote	# of Participants
Motivation	"I felt more determined to do better"	4
Concentration	"It let me disconnect from the outside world and let me focus on the task ahead"	4
Activation	"Boosted my arousal levels and made me feel more excited"	3
Confidence	"I felt more confident"	1
Better preparation	"Felt like it prepared me for exercise"	1

Table 4

Responses For The Question: "Any other comments you would like to make about the study?

Categories	Sample Quote	# of Participants
Good study	"I felt as if it was a very good study"	5
Self-awareness	"Made me think about pre-match preparation in a different way"	4
Motivation	"The music motivated me to perform better"	1
Decrease in accuracy	"I may have tried too hard and made mistakes"	1
IZOF	"I think participants need a bit more time to complete the IZOF sheet"	1

Discussion

The aim of the present study was to investigate the effects of self-selected asynchronous pre-task music on performance and emotions. Earlier studies have focused on the influence of asynchronous music on performance when music was played in the background. This approach is not ecologically valid, as the majority of sports don't allow music to be played during competition (Mesagno, Marchant, & Morris, 2009; Pates, Karageorghis, Fryer, & Maynard, 2003). Additionally, prior investigations of the effects of asynchronous music on performance used researcher selected music tracks, which doesn't take into consideration the idiosyncrasies of music selection (Bishop, Karageorghis, & Loizou, 2007). Previous studies have found some support for the benefits of pre-task music on performance, emotional states and arousal (Bishop, 2010; Bishop, Karageorghis, & Kinrade, 2009; Pates et al., 2003). Athletes in Bishop et al. study mentioned the use of pre-task music as a strategy of emotional regulation. According to these athletes listening to music improved mood, increased arousal and visual and auditory imagery. The present study used self-selected music, and to increase external validity a pressure manipulation was developed. Additionally, to investigate the influence of music on emotional states the IZOF model was used. According to Hanin (2000) when an athlete is in an optimal performance zone he or she is completely involved in the task, with the best recruitment and use of available resources. Thus, a secondary aim of this study was to further the understanding of the relationship between emotions and performance. It was hypothesized that listening to pre-task music would help participants to achieve their IZOF and improve performance in a soccer skill test.

According to the study results the hypothesis suggesting that pre-task music would improve performance hasn't been supported. The observed changes in the dependent variables due to the intervention are reliable with an IOR over 80% (Hrycaiko & Martin, 1996). According to the visual inspection of the data consistent improvement in time and kick accuracy subsequent to listening to pre-task music was only noted for participant 2. Additionally participant 3 presented an improvement in time in B_1 and B_2 phases. Nevertheless, this participant's results for accuracy remained stable from A_1 to B_1 and presented a decrease from A_2 to B_2. The results for time performance in the soccer skill task for participants 1 and 8 shows an improvement in performance on this variable throughout the experimental phases. This improvement may be an indication of improvement due to habituation to the task. This suggests that participants 1 and 8 may have needed a longer habituation period before the beginning of the experimental trials. The overall results for time and kick accuracy didn't present a consistent improvement among the participants. Bishop, Karageorghis and Loizou (2007) guidelines for selection of pre-task music could offer an explanation for these results. According to Bishop et al. grounded theory when selecting a pre-task music, it is important to consider the athlete's current emotional state and desired emotional state. Additionally, it is important to consider if athlete's emotional state needs to become more or less positive, and if arousal levels should be increased or decreased (Bishop, 2010). Participants' music selection was performed during the assessment session. Hence after the first experimental trial (A_1) participants emotional state and arousal levels could be different from the previous session. Thus it is possible that participants may have had their arousal in inadequate levels after listening to the music track. Some participants could be overly aroused, and for these the increase in time displayed on the graphs was actually a result of loss in accuracy. It could be noticed that some participants when running through the dribble part of the skill test lost the ball and had to recover it before continuing the circuit, which increased considerably their trial time. Regarding arousal levels and task demands Cox, Karageorghis, and Pates (In preparation) suggested that loud, fast-tempo and highly arousing music may be beneficial to performance on power-related or motoric tasks. However, music with these same qualities played before a task that requires concentration and coordination may be detrimental to performance.

Moreover, when selecting pre-task music it is also essential to consider the extrinsic sources of emotion in music (e.g. extra-musical associations) that are strong determinants of music content more than intrinsic sources (Bishop, 2010; Sloboda & Juslin, 2001; Terry &Karageorghis, 2011). What can be observed on participants' selection of music tracks is the presence of tracks that can be associated with sporting glory, soccer and strength. The music track selected by participant 8 was the theme for the reality show "The Contender", that may induce extra musical associations related to strength and victory. Participant 9 selected a song that was the sound track from the soccer video game Pro Evolution Soccer. For that participant this song is probably associated with achievement in soccer, motivation, and with his soccer athletes' idols.

Additionally, when selecting pre-task music the acoustical qualities such as tempo should be taken into consideration (Karageorghis & Terry, 1997). Participant's selected music tracks had diverse acoustical qualities. For example participant 1 selected a piece of song with a slow tempo, and romantic lyrics, "*Let's get married*" by Jagged Edge. Similarly, participant 4 also selected a song with romantic lyrics and with a melancholic harmony, "*Black coffee*" by Bucie. However participant 2 selected the music "*Live forever*" by Oasis that has a faster tempo and happier harmony than the two previously mentioned selected pieces. Considering participant 2 improvement in performance on the soccer skill test it can be argued that this selection was appropriate.

According to Bishop (2010) athletes' music selection is also influenced by peer and family influences. The participants on the present study were from different cultural backgrounds and nationalities which may have influenced their music selection. Hence, the participants' music selection was highly idiosyncratic even though they went to the same university and played for the same soccer team. For example participants 5, 6 and 7 selected *R&B* style music tracks by well known artists, while participant 2 selected a pop rock. Therefore, due to the individual differences on music selection, future studies using self-selected music should also take into consideration potentially mediating effects of participants' personality type (Bishop et al., 2009).

According to the graphically displayed data the improvement in performance wasn't consistent on B_1 and B_2 phases. A limitation of the present study that may have influenced these results is that auditory imagery wasn't taken into consideration on the study methodology. Bishop's et al. (2007) study with young tennis players and their use of music with the intention of manipulating emotional state showed that participants reported auditory imagery (e.g. singing to oneself) as a consequence of listening to music. Auditory imagery and visual imagery obey the same neural principles (Bishop et al.). Therefore, even when the music track was not played (i.e. the physical stimulus is absent) participants on the present study could still have the song on the brain, especially for familiar music tracks. According to Bishop et al, a performance-facilitating emotional state can be achieved by singing to oneself the lyrics of a well known music track.

The influence of music track lyrics over performance was also investigated by Mesagno et al. (2009). As a result of attending to the music lyrics participants diverted attention from self-focusing under pressure. Moreover, according to participants, the song lyric was not only a distraction but also a positive method of cognitive restructuring (Mesagno et al.). Therefore, singing to oneself the song lyrics on the present study may have influenced performance on the soccer skill test. The pressure manipulation may not have been effective if participants were distracted by the music lyrics. Therefore on the A_2 phase participants could be singing their music track to themselves which may have influenced the intervention results. Thus future studies to avoid the influence of the variable auditory imagery on performance could consider using a single subject multiple baselines across individuals design instead of the single subject A-B-A-B. On the single subject multiple baselines across individuals the intervention is only started once the participants achieve a stable baseline. After this stable baseline is obtained the intervention can start and it won't be withdrawn as in the A-B-A-B design (Martin, 2007).

Participants' IZOF results on B_1 and B_2 didn't provide support to the hypothesis that pre-task music would help athletes to achieve optimal emotion states before performance. The graphically displayed data showed a great variation of emotion intensity throughout all the experimental trials. These results may indicate that this study didn't succeed in establishing athletes' IZOF. Repeated assessment (on training sessions, and competition) may have been needed to define participants' optimal emotions and intensity (Hanin, 2000). Moreover participants may have encountered some difficulties in understanding the meaning of the words on the emotion pool list (Appendix D). This may have resulted in an inadequate selection of emotions in the assessment session. Another limitation of using the IZOF model is that even though the aim was to assess participants' emotion intensity before the trials, participants completed the IZOF only after finishing a trial. This retrospective method may have resulted in inaccurate answers from the participants. Participants' answers may have been influenced by the outcome of the recently finished trial. As mentioned earlier the results on the IZOF could have been influenced by emotion intensity on the day of the experimental trials. Thus the music selected on the assessment meeting may not have been the appropriate choices for the experimental trials (Bishop et al., 2007).

Moreover, participants during the experimental phase only listened to their songs one time before the trials B_1 and B_2. Nevertheless, as suggested by Bishop et al. (2007) a longer period of habituation with the music could have increased its strength. Participants may have needed additional training in the use of music to control their pre-task emotions and emotion intensity to achieve their IZOF. Additionally according to the literature on pre-performance routine to achieve the optimal emotional state before performance is necessary to have consistency in the use of the routine (Lidor, 2007).

Regarding the social validity assessment of this intervention, the overall result indicates a positive outcome from the players' perspective. When questioned about the intervention effects on their performance the majority of athletes pointed out that they felt an increase of activation levels. Moreover, some participants indicated that they felt an increase in motivation to do better on the soccer skill test, yet other participants mentioned that they felt as though they had done better on the skill test and that they were faster. As discussed earlier, two participants mentioned that they felt a decrease in accuracy as a result of an increase in arousal. One participant mentioned that the motivation to perform well resulted in tension during the B_1 and B_2 phases which in turn led to mistakes during completion of the soccer skill test. Another participant felt he made more mistakes because he "*was trying too hard*" (participant 9). Conversely, two athletes mentioned an increase in concentration while performing and a decrease in arousal as a result of the pre-task music. Furthermore, one participant reported that he felt more aggressive as a consequence of listening to his music track, and another participant mentioned that he didn't feel any effect on his performance at all.

When questioned about the effects that the pre-task music had on how they felt before the trial, four participants mentioned that they felt motivated and also four participants reported that they were more focused on the task. These findings are in agreement with the literature on pre-performance routines, according to Cohn (1990) and Lidor (2007) routines can aid in the improvement of concentration by helping to avoid task irrelevant thoughts and getting the athlete ready to perform. Additionally, Mesagno et al. (2009) study with choking susceptible athletes' showed that participants had a decrease of general distractibility as an effect of listening to music.

An unexpected effect of the music intervention was that participants reported an increase of self-awareness. According to the participant's comments the assessment meeting where they described their most and least successful performances helped them to look differently at their preparation to compete. Moreover, participants mentioned that the intervention taught them which type of music they should listen to before competing. These positive results on the athletes' intervention evaluation are significant; according to the Single Case design literature a positive result in the social validity assessment is even more important than positive statistical results (Bryan, 1987).

One of the present study strengths was the use of the soccer skill test from Abouzekri and Karageorghis (2010) that aimed to emulate the skills used in a soccer match, thus enhancing ecological validity. Participants, after the completion of the skill test, commented that they indeed used the same skills of a real match, and they considered the test to be an enjoyable experience.

Conclusion

The purpose of this study was to investigate the effects of self-selected asynchronous pre-task music on soccer player's emotions and performance in a soccer skills test. The findings however do not support the hypotheses that pre-task music would improve participants' performance time and kick accuracy. Additionally it was not possible to establish a relationship between self-selected music and achievement of participant's IZOF.

Nevertheless, when asked about the effects of listening to their pre-task music, participants' comments were positive. The participants reported improvement in concentration, confidence, motivation and arousal. This finding is in agreement with previous studies (Bishop et al., 2007; Pates et al., 2003). Participants in Pates et al. (2003) reported increases in movement automaticity, concentration and confidence, whereas athletes in the Bishop et al study reported listening to music as a strategy to manipulate emotional states.

In summary according to participant's experiences, music has a positive effect on emotions as a component of their pre-performance routine. However, due to this study's previously discussed limitations, it was not possible to establish a direct relationship between a pre-task music choice and improvement in performance or achievement of participant's zones of optimal functioning. Nevertheless, participants mentioned benefits as consequence of listening to pre-task music, thus there is a need for further studies to explore the possible benefits of pre-task music. According to the findings of the present study and previous investigations (Bishop et al., 2007), athlete's music choices are highly idiosyncratic and influenced by cultural background, thus future studies should maintain an individualistic approach.

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Appendix

Appendix A

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Volunteer Information Sheet

Effects of Music on performance of a Football Task

The Brunel University School of Sport and Education Research Ethics Committee have approved this study. We are interested in studying the effects of music on the performance of a football task.

Who can take part?

This study will be carried out with healthy adults. Participants with hearing deficiencies will not be eligible.

What will I have to do?

You will be asked to choose music tracks that you consider would beneficial for you before performing, and respond to a small number of questionnaires. You will perform a trial composed of three short circuits (including a dribble area and shooting task). There will be four trials in one day; some of your trials will be listening to your pre-task music and the others not. All of the data collected will be kept anonymous and confidential.

What if I change my mind during the study?

If at any point and for any reason you do not want to carry on, then you may stop. There are no consequences of withdrawal from the study. That is, participation decisions or experimental performance are completely unrelated to academic processes and will not affect students' progress in courses.

What happens to the information?

All the information we get from this study about you, including your name, will be kept in confidence and will only be used for research purposes. The data will be collected and stored in accordance with the 1998 Data Protection Act. The data we collect from all volunteers will be combined, and it will not be possible to identify any individual within the published results. The data will be kept for 5 years following publication and then destroyed.

What happens at the end of the study?

When the study is complete and all the results are analysed, we will provide you with a summary of your results and, if you wish, you can request a copy of the article that will emanate from our findings.

A full debrief will be offered to you at the end of the study.

Appendix B

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Informed consent form: *The effects of self selected asynchronous pre-task music on performance on a football task*

Please complete the whole of this sheet:	*Please tick the appropriate box* YES	NO
Have you read the Research Participant Information Sheet?	☐	☐
Have you had an opportunity to ask questions and discuss this study with a research assistant?	☐	☐
Have you received satisfactory answers to all your questions?	☐	☐
Who have you spoken to?		
Do you understand that you will not be referred to by name in any report concerning the study?	☐	☐
Do you understand that you are free to withdraw from the study:		
- at any time	☐	☐
- without having to give a reason for withdrawing?	☐	☐
- without affecting your future treatment?	☐	☐
Do you agree to take part in this study?	☐	☐

Signature of Research Participant:	
Date:	
Name in capitals:	
Witness statement	
I am satisfied that the above-named has given informed consent.	
Witnessed by:	
Date:	**Name in capitals:**

Appendix C

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Demographic questionnaire
Details About You

Family name: ___________________ First name: _____________________

Age: ___________ years Sex: Male / Female (please circle)

Means of contact if you would like a report on the findings:
____

____
Contact telephone number (if we need to confirm that you are still attending):
____

Nationality: ________________________ (e.g. British, French, Indian, Nigerian)

First language: _______________________ (e.g. English, French, Urdu, Mandarin)

Ethnic Background: (Please tick one of the following options)

White	**Mixed**	**Asian or Asian British**	**Black or Black British**	**Chinese or Other Ethnic Group**
British ☐	White and black Caribbean ☐	Indian ☐	Caribbean ☐	Chinese ☐
Irish ☐	White and black African ☐	Pakistani ☐	African ☐	
	White and Asian ☐	Bangladeshi ☐		
Any other White background (Please state)	Any other Mixed background (Please state)	Any other Asian background (Please state)	Any other Black background (Please state)	Any other ethnic group (Please state)

How would you describe your sexual orientation: _______________________________
(e.g. Gay, Lesbian, Bisexual, Heterosexual etc.)

In which country did you attend secondary school?: ____________________________

Do you have a hearing deficiency of any sort: Yes / No (please circle)

Appendix D

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Individual Zones of Optimal Functioning

The following questions are designed to help you to establish your Individual Zone of Optimal Functioning (IZOF).

Think of a time in recent seasons that you performed really well, and then think of another time you performed poorly: do not compare yourself with other athletes.

Indicate the date, place, and results of your most successful performance:

____

____

Provide any important details about this competition and your performance during it.

____

____

____

____

____

Indicate the date, place, and results of your least successful performance:

____

____

Provide any important details about this competition and your performance during it.

____

____

____

____

____

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Go over the list of HELPFUL- positive (pleasant) emotions below and circle from the list **up to five (5)** words that describe the emotions you felt **before** your most successful performance in the past. Each line in the list consists of several synonyms; you may select only **one** word on the same line. If you don't find a word describing an emotion that is important to you, you may add your own word at the end of the list. Follow the same procedure for HELPFUL – negative (unpleasant) emotions.

Helpful positive emotions **(P+)**	Helpful negative emotions **(N+)**
Active, dynamic, energetic, vigorous	Angry, aggressive, furious, violent
Quick, rapid, fast, alert	Intense, fierce
Confident, certain, sure	Tense, strained, tight, rigid
Determined, set, settled, resolute	Annoyed, irritated, distressed
Brave, bold, daring, dashing	Anxious, apprehensive, worried
Inspired, motivated, stimulated	Concerned, alarmed, disturbed, dissatisfied
Excited, thrilled	Nervous, jittery, uneasy, restless
Delighted, overjoyed, exhilarated	Discouraged, dispirited, depressed
Relaxed, comfortable, easygoing	Afraid, fearful, scared, panicky
Calm, peaceful, unhurried, quiet	Doubtful, uncertain, indecisive, irresolute
Cheerful, merry, happy	Helpless, unsafe, insecure
Glad, pleased, satisfied, contented	Inactive, sluggish, lazy
Light-hearted, carefree	Sorry, unhappy, regretful, sad, cheerless
Nice, pleasant, agreeable	Tired, weary, exhausted, worn out
Your own emotion:………………………….	Your own emotion:…………………………..

Follow the same procedure as above, selecting **up to five (5)** words to describe the HARMFUL-negative and HARMFUL-positive emotions you felt **before** your less successful performance. Circle the words that you selected. Again, you can add words of your own to the ends of the lists.

Harmful negative emotions **(N-)**	Harmful positive emotions **(P-)**
Angry, aggressive, furious, violent	Active, dynamic, energetic, vigorous
Intense, fierce	Quick, rapid, fast, alert
Tense, strained, tight, rigid	Confident, certain, sure
Annoyed, irritated, distressed	Determined, set, settled, resolute
Anxious, apprehensive, worried	Brave, bold, daring, dashing
Concerned, alarmed, disturbed, dissatisfied	Inspired, motivated, stimulated
Nervous, jittery, uneasy, restless	Excited, thrilled
Discouraged, dispirited, depressed	Delighted, overjoyed, exhilarated
Afraid, fearful, scared, panicky	Relaxed, comfortable, easygoing
Doubtful, uncertain, indecisive, irresolute	Calm, peaceful, unhurried, quiet
Helpless, unsafe, insecure	Cheerful, merry, happy
Inactive, sluggish, lazy	Glad, pleased, satisfied, contented
Sorry, unhappy, regretful, sad, cheerless	Light-hearted, carefree
Tired, weary, exhausted, worn out	Nice, pleasant, agreeable
Your own emotion:………………………….	Your own emotion:…………………………..

From *Emotions in Sport* by Yuri L. Hanin, 2000, Champaign, IL: Human Kinetics.

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On the form below, write the words you chose as helpful emotions **before** your most successful performance (P+,N+) and those you chose as harmful emotions experienced **before** your less successful competition (N-,P-). Make sure that emotions in each category are entered correctly under the appropriate subheadings: helpful-positive (P+), helpful-negative(N+), harmful-negative (N-), and harmful-positive(P-). This is your individualised scale with the content of emotions important for your performance.

		Intensity of emotions												
(P+)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(P+)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(P+)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(P+)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(P+)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(N+)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(N+)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(N+)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(N+)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(N+)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(N-)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(N-)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(N-)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(N-)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(N-)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(P-)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(P-)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(P-)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(P-)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•
(P-)	______	0	0.5	1	2	3	4	5	6	7	8	9	10	•

From *Emotions in Sport* by Yuri L. Hanin, 2000, Champaign, IL: Human Kinetics.

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Now go over the list of emotions you just created (previous page) and think about the intensity of these **before** your most successful performance. Circle one value (0- •) on the intensity scale for each emotion you wrote on the list (P+, N+,N-,P-) indicating the MAGNITUDE of the emotion you felt just **before** this performance. The intensity of the scale is defined immediately below.

Modified Borg CR10 Scale (CR-10 Scale)

•	Maximal possible
10	Very, very much
9	
8	
7	Very much
6	
5	Much
4	
3	Moderate
2	Little
1	Very little
0.5	Very, very little
0	Nothing at all

From *Emotions in Sport* by Yuri L. Hanin, 2000, Champaign, IL: Human Kinetics.

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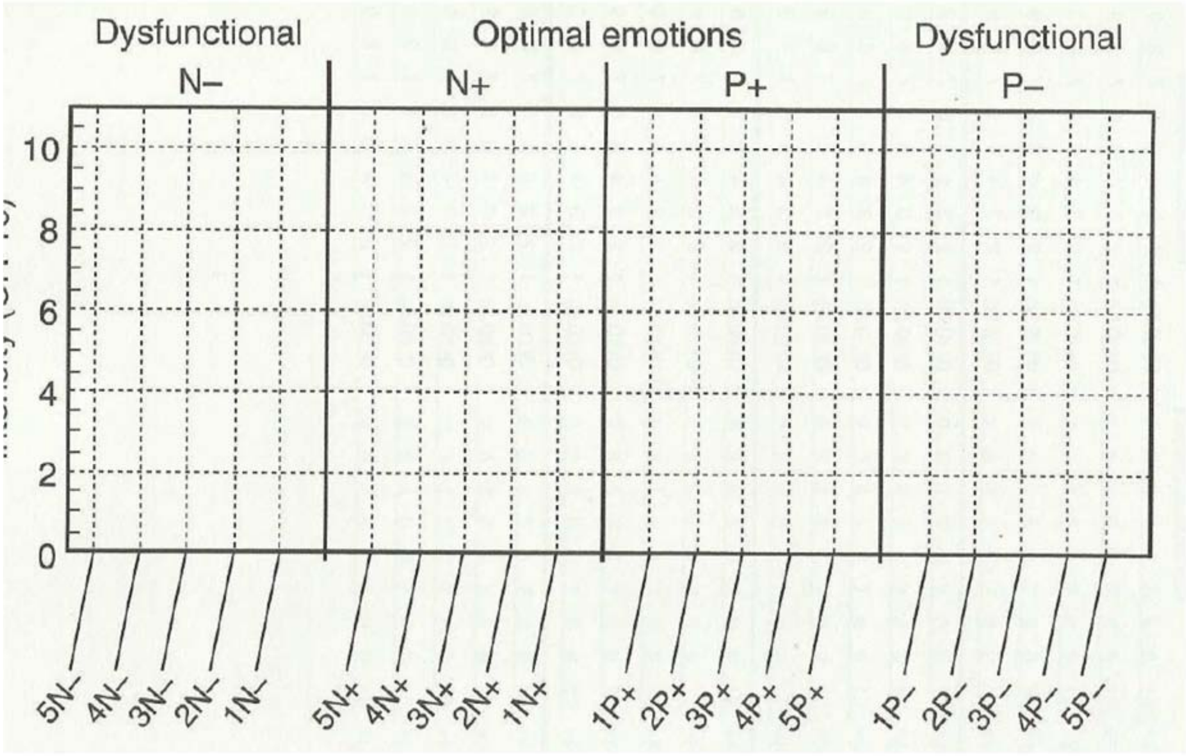
To finish your IZOF profile, first select the emotion of highest intensity from the P+ category list. Enter it under the 1P+ subheading, in the middle of the following graph. Plot the intensity of this emotion. Then, take the second highest intensity emotion descriptor from the same P+ category, enter it on the graph under subheading 2P+, and plot its intensity. Do the same for the other emotions in this category, enter it on the graph under subheading 2P+, and plot its intensity. Do the same for the other emotions in this category (3P+,4P+,5P+). Thus emotions in this category are ranked from the highest (1) to the lowest (5) in intensity. Following this procedure, do the same for the emotion descriptors in other categories (N+, N-, and P-) by again raking them on the intensity from the highest (1) to the lowest (5) within each category and plotting intensity scores for your most successful performance. Connect the emotion intensity scores of all emotion descriptors across the four categories to derive the IZOF optimal emotion profile for you.



Appendix E

Brunel Music Rating Inventory-3 (BMRI-3)

This questionnaire is designed to assess the extent to which the piece of music you selected would motivate you before you play football. For our purposes, the word "motivate" means that you would want to pursue your football goals with greater intensity. As you think of the piece of music, indicate the extent of your agreement with the six statements listed by circling one of the numbers to the right of each statement. Provide an honest response to each statement. Give the response that best represents your opinion, and avoid dwelling too long on any single statement.

		Strongly disagree		**In between**				**Strongly agree**
1	The rhythm of this music would motivate me during my mental preparation before playing.	1	2	3	4	5	6	7
2	The style of this music (i.e. rock, dance, jazz, hip-hop, etc.) would motivate me during my mental preparation before playing.	1	2	3	4	5	6	7
3	The melody (tune) of this music would motivate me during my mental preparation before playing.	1	2	3	4	5	6	7
4	The tempo (speed) of this music would motivate during my mental preparation before playing.	1	2	3	4	5	6	7
5	The sound of the instruments used (i.e. guitar, synthesizer, saxophone, etc.) would motivate me during my mental preparation before playing.	1	2	3	4	5	6	7
6	The beat of this music would motivate me during my mental preparation before playing.	1	2	3	4	5	6	7

Music track ____

BRMI-3 rating __________

Appendix F

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Concentration Grid - Directions: Beginning with the assigned number, you will have one minute to put a slash through each number in the proper sequence.

84	27	51	78	59	52	13	85	61	55
28	60	92	04	97	90	31	57	29	33
32	96	65	39	80	77	49	86	18	70
76	87	71	95	98	81	01	46	88	00
48	82	89	47	35	17	10	42	62	34
44	67	93	11	07	43	72	94	69	56
53	79	05	22	54	74	58	14	91	02
06	68	99	75	26	15	41	66	20	40
50	09	64	08	38	30	36	45	83	24
03	73	21	23	16	37	25	19	12	63

Appendix G

Evaluation

The effects of music on the performance of a football task

How would you evaluate the music intervention overall:

Unhelpful 1 2 3 4 5 Helpful

What effects, if any, did the pre-task music have on your performance?

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What effects, if any, did the pre-task music have on how you felt before competing?

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Any other comments you would like to make about the study?

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Thank you very much for your participation.