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The effect of music playlist tempo on self-paced running, mood, and attentional focus tendencies.

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THE EFFECT OF MUSIC PLAYLIST TEMPO ON SELF-PACED RUNNING, MOOD, AND ATTENTIONAL FOCUS TENDENCIES

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CERTIFICATE OF APPROVAL

MASTER OF SCIENCE THESIS

This is to certify that the thesis of

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ABSTRACT

Objective: The purpose of this study was to examine the effects of music playlist tempo on exercise performance, mood, and attentional focus tendencies. **Background:** Music has been found to provide ergogenic effects during exercise. It is not clear that people using contemporary music players and shuffled playlists understand the potential effect of music tempo on exercise. These ergogenic effects, however may be magnified or suppressed by attentional focus tendencies. **Methods:** This study utilized a repeated measures design with three tempo conditions administered in a partially randomized, balanced fashion. Thirty-six participants participated in three 4800 m running conditions (Varying, Constant, No music) on three separate days, with at least 48 hours between them. On testing days the participants were asked to fill out the Subjective Exercise Experience Scale (SEES) and were given the selected tempo playlist for that day. They were instructed to "enjoy their run" and allowed to run at a self-selected pace for 4800 m. During the run, split times, HR, and RPE were gathered for each 400 m increment. Total run time, average HR, and average RPE were also calculated. The participants filled out the SEES and the Attentional Focus Questionnaire (AFQ) at the end of the run. **Data Analysis:** Descriptive statistics were run along with six one-way repeated measures ANOVAs to assess differences in run time, RPE, HR, wellbeing and fatigue sub-scales of the SEES, and attentional focus tendencies between conditions. Paired t-tests were run to assess differences in 400 m split times, RPE, and HR between fast and slow tempo musical selections heard during the varying condition. Alpha level was set at 0.05. **Results:** Ending RPE for the constant tempo and no music conditions approached significance ($p = .06$). A significant difference in HR ($p < .01$) was also found between the fast and slow selections of the varying tempo condition. No other variables were found to be significantly different between the varying tempo, constant tempo, and no music conditions. **Conclusions:** The current study demonstrated that music tempo does not have a significant effect on exercise performance, mood, nor attentional focus tendencies. Runners may listen to music during exercise without worrying about specific tempos on their playlists. Therefore, it appears a playlist tempo does not need to be the main factor in selecting music for exercise, but instead individuals may listen to music of diverse tempos with no apparent negative consequences on exercise performance.

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CHAPTER 1

INTRODUCTION

People often listen to music at venues that are used for physical activity. Whether at a sporting event, fitness center, or exercise class, the sound of music is commonly heard. Many people on stationary exercise equipment use headphones to block out surrounding noises heard in fitness centers. People using headphones with digital music players (e.g., mp3) often create playlists consisting of their favorite workout songs. Recently, it was found that people believed their playlists were composed of fast tempo music selections, when in fact their playlists were composed of varying tempo music between 84 and 184 beats per minute (bpm) (Bly, 2012). Music tempo greater than 180 bpm is reported to be optimal for improving running performance (Schneider, Askew, Abel, & Struder, 2010).

When music improves the quality of an exercise session it is said to have an ergogenic effect. Two common ergogenic effects of music on cardiovascular exercise are increases in exercise intensity and duration, both of which are attributed to lower ratings of perceived exertion (RPE) and increased motivation when exercising with music (Karageorghis & Terry, 1997). The attentional focus of the exerciser may play a critical role in whether music produces an ergogenic effect for the individual (Brewer, Van Raalte, & Linder, 1996). If the exerciser has the tendency to listen to bodily signals during exercise (associative focus) music is unlikely to affect their exercise performance because they will be focusing on internal bodily cues (i.e., breathing, leg pain). Conversely, those who focus on their surroundings (dissociative focus) should benefit from listening to music due to their tendency to focus on external cues (i.e., music) instead of internal cues.

The role that music tempo plays in lowering RPE or changing mood is not well understood. During cyclical and rhythmic based activities such as running, it is known that constant fast tempos increase running efficiency, while constant slow tempos decrease running efficiency. However since most playlists do not consist of musical selections with a constant tempo (Bly, 2012), it is of interest to know how contemporary music playlists with varying tempo affect exercise performance, mood, and attentional focus tendencies. A better understanding of the role of music on exercise should be of great interest to exercise professionals, the medical community, and exercisers in general.

Statement of Purpose

The purpose of the study was to examine the effects of music playlist tempo on exercise, mood, and attentional focus tendencies. Specifically, the purpose was to examine the effects of varying tempo, constant tempo, and no music on exercise performance, mood, and attentional focus tendencies during a 4800 m self-paced run.

Hypothesis

The hypotheses of the study were:

1. A varying tempo playlist would produce faster overall time to completion for the 4800 m self-paced run when compared to constant tempo playlist and no music.

2. A varying tempo playlist would produce lower ratings of perceived exertion (RPE), higher ratings for the positive wellbeing sub-scale of the SEES, and lower

ratings for the fatigue sub-scale of the SEES when compared to constant tempo playlist and no music.

3. Musical selections with a fast tempo in the varying tempo playlist condition would produce lower RPE's, and faster 400 m lap times compared to the slow tempo selections during the same condition.

4. The varying tempo playlist and constant tempo playlist would produce greater dissociative tendencies in runners when compared to no music.

Assumptions of the Study

Assumptions of the study were:

1. Tempo changes could be interpreted quickly and can impact RPE and HR in the time it takes to run 400 m.

2. Changes in time to complete the self-paced run, RPE, and mood could be attributed to the effects of music tempo and not lyrics or any other aspect of musicality.

Definition of Terms

The following terms were operationally defined for purposes of this study:

1. Fast tempo songs were defined as any musical selection with a tempo within 2 bpm greater or less than 230 bpm.

2. Medium tempo songs were defined as any musical selection with a tempo within 2 bpm greater or less than 180 bpm.

3. Slow tempo songs were defined as any musical selection with a tempo within 2 bpm greater or less than 130 bpm.

4. Playlist was defined as a selection of music playing on a continuous loop, and being played in a quasi-random order with each song being changed per 400 m increment for the duration of the 4800 m self-paced run.

5. Lap was considered one complete circuit on a 200 m indoor track.

6. Healthy was defined as being free of disease and injury.

7. Recreational runners were defined as those who run at least three days a week for 30 min or more and were not currently in an athletic season.

Delimitations

The delimitations were:

1. Only healthy recreational runners between the ages of 18 and 60 y of age participated in the study.

2. The varying tempo playlist condition was composed of six fast and six slow tempo selections with each selection played on a continuous loop for the time it took to complete 400 m and thus may not run to completion or may loop depending on time to complete 400 m.

3. The constant tempo playlist condition was composed of 12 medium tempo selections with each selection played on a continuous loop for the time it took to complete 400 m and thus may not run to completion or may loop depending on time to complete 400 m.

4. Running 4800 m, with 400 m lap split times, was the only exercise examined.

5. RPE was measured only in the last 20 m of each 400 m segment of the run and was not monitored continuously throughout the 400 m.

6. Mood was only measured using the Subjective Exercise Experiences Scale (SEES) before and after each condition and not monitored continuously throughout the run.

7. Attentional Focus tendencies were determined using the Attentional Focus Questionnaire (AFQ) after each condition.

Limitations

The limitations of the study were:

1. Playlists selected by the researcher may not yield results generalizable to other tempos or to music selections preferred by participants.

2. Results may not apply to non-recreational runners under 18 or over 60 y of age.

3. Results obtained for 400 m lap times and 4800 m run may not be generalizable to shorter or longer distances or other types of exercise.

4. Changes in mood and RPE after the run may not mirror mood or RPE during the exercise.

5. Attentional focus tendencies measured after the run may not mirror the attentional focus tendencies during the exercise.

CHAPTER 2

REVIEW OF LITERATURE

Introduction

Music can be used as a tool to enhance work done during exercise and physical activity. Music elicits a psychological enhancement which translates to an increase in physical work as well as the ability to maintain focus and motivation during prolonged bouts of cardiovascular exercise. It is believed that music can disrupt feelings of psychological and physical fatigue while acting as an external stimulus for those who may not have the internal drive to continue otherwise (Brownley, McMurray, & Hackney, 1995). This chapter examines the literature, and reveals the gaps within the literature, in regards to: 1) Exercise and Attentional Focus; 2) Music, Exercise and Mood; and 3) Ergogenic Effects of Music.

Exercise and Attentional Focus

There are two types of attentional foci, associative and dissociative. Associative focus is when people pay attention to internal physical signs (e.g., heart rate, breathing) while exercising. Dissociative focus is when people pay attention to their surroundings (e.g., music, television, and environment) while exercising. Each type of attentional focus can potentially affect exercise performance. Those who utilize an associative focus may use physical signals (e.g., breathing, pain) to alter their exercise patterns. Those with dissociative focus may avoid thinking about pain or fatigue by focusing on external stimuli such as music or television (Barwood, Weston, Thelwell, & Page, 2009).

Attentional focus is not constant and often is based on the environment. For example, an individual may demonstrate associative focus tendencies when exercising in an area without appealing external stimuli while the same individual may demonstrate dissociative focus tendencies when exercising with appealing external stimuli. Attentional focus tendencies may also be influenced by the experience level of the exerciser (Wrisber & Pein, 1990). Wrisberg and Pein examined the attentional focus of recreational joggers, consisting of both men and women who just finished a jogging session outdoors. They found that experienced runners dissociated more than inexperienced runners, being more apt to focus away from unpleasing physical cues associated with exercise.

In another study, subjects were instructed to complete as many quadriceps extension repetitions as possible in two sets (Gill & Strom, 1985). During one set, the subjects internally (associate) focused; during the other set they externally (dissociate) focused. Gill and Strom (1985) found that the participants preferred the dissociative focus style and performed a greater number of repetitions during the dissociative focus condition.

In contrast, a study by Scott and colleagues (1999) found that associative focus strategies produced improved rowing ergometer performances in trained rowers who paced their rowing with how their body felt. They utilized an association recording that had the coach taking the rowers through a 40 min workout while referencing bodily cues (e.g., leg pain, breathing) to help the rowers to notice the bodily cues more frequently. The study also utilized two dissociative recordings consisting of music from the top 40 pop charts, as well as a videotape showing rowing races in order to offer two different types of external stimuli, but neither was as effective as the associative strategy.

Another study by Brewer and colleagues (1996) found that associative focus may be related to improved performance in endurance activities. They used nine members of a cross-country team and 35 students from an introductory psychology class. The subjects completed a version of the Attentional Focus Questionnaire (AFQ), which was adapted for the stair climbing activity to find the extent to which they would engage in various attentional behaviors during a hypothetical maximal effort endurance run. After completing the AFQ, participants were instructed to climb as many flights of stairs as they could in 12 min using a Lifestep stair climbing machine. Participants who were cross-country runners reported associative focus for the pre- and post-trial questionnaire more than the psychology students (Brewer, Van Raalte, & Linder, 1996). The researchers concluded that associative focus was positively related to performance and a high level of experience. However, training level was not controlled, and thus the results may be due to fitness as opposed to experience. Therefore, the increase in performance could have been caused by training differences, indicating that the positive relationship between attentional focus and performance may not be as meaningful as originally believed.

In summary, some studies suggest exercise or sport experience may impact attentional preference with little work on attentional focus in the recreational exerciser being done. Furthermore, how listening to music during sub-maximal exercise effects attentional focus has not been well studied.

Music, Mood, and Exercise

Mood affects the exercise experience and adherence to exercise programs both long and short term. If a person is in an improper mood while exercising they may be less likely to continue exercising or may not put forth an adequate effort. We also know that music can impact feelings depending on the person and choice of music. Thus, music may play a vital role in affecting mood when combined with exercise (Macone, Baldari, Zelli, & Guidetti, 2006; Plante, Gustafson, Brecht, Imberi, & Sanchez, 2011; Steptoe & Cox, 1988).

Mood can be altered by listening to music. Moreover, studies have found positive changes in mood during moderate to low intensity exercise with music (Plante et al., 2011; Seath & Thow, 1995). However, few studies have found positive changes in mood following vigorous exercise regardless of the use of music (Macone et al., 2006; Steptoe & Cox, 1988).

A study done by Plante and colleagues (2011) examined the effects of music and social contact on exercise benefits and mood. They found that exercise creates positive mood changes with music and social interaction enhancing the effect of exercise on mood. Another study, by Seath and Thow (1995), examined the effect of music on the perception of effort and mood during cardiovascular exercise. Subjects participated in a 15 min aerobic dance class either with or without music. The subjects filled out a mood questionnaire following both conditions, and reported significant positive effects in their mood, while also reporting significant positive effects or decreases in perception of effort, during the music condition (Seath & Thow, 1995).

In contrast, Macone and colleagues (2006) found that music did not have an effect on mood beyond the effects caused by exercise. They examined the effects of music on exercise of a moderate intensity. Participants ran on a treadmill on two separate occasions, either with or without music, until voluntary exhaustion. The music had no lyrics and was in the range of 140 to 160 bpm. Macone and colleagues (2006) found that although the participants ran longer while listening to music they reported similar measures of negative mood (i.e., tension, depression, confusion, and state anxiety) in both the music and no music conditions.

A similar study done by Steptoe and Cox (1988) found that the participants performing vigorous exercise experienced increases in tension while showing no improvement in mood regardless of condition (music vs. metronome). However, they reported a mild improvement in mood, measured as a decrease in tension level, over time during low intensity exercise. A mild improvement in mood seen during low intensity exercise could be attributed to a decrease in physiologic responses (HR, ventilation rate) when compared to the vigorous exercise condition.

More research into the effects of listening to music during exercise and its effects on mood is needed. For example, it is simply unknown if lyrics of a song have any profound effects on mood during bouts of cardiovascular exercise. Also, the intensity of exercise may play a role in whether there is a significant change in mood, though the evidence is contradictory.

Ergogenic Effects of Music

An ergogenic aid is a method of augmenting exercise performance and many people use music as an ergogenic aid. However, the proper selection of music may be critical if it is truly to have a positive ergogenic effect. The proper selection of music may create a sense of arousal in an athlete and can be used to "hype up" prior to competition (Koc & Curtseit, 2009).

Music is particularly useful in sports that rely on rhythm due to the ability to synchronize certain movements (rowing, leg turnover, and breathing) with tempo (Abernethy & Batman, 1994; Karageorghis et al., 2010; Koc & Curtseit, 2009; Schneider et al., 2010; Simpson & Karageorghis, 2006; Styns, van Noorden, Moelants, & Leman, 2007; Terry et al., 2011). Accordingly, athletes that participate in sports that rely on a sense of rhythm and require a high tempo to be competitive, like running and rowing, may benefit by listening to upbeat high tempo music during competition or training (Koc & Curtseit, 2009; Schneider et al., 2010; Simpson & Karageorghis, 2006; Styns et al., 2007; Terry et al., 2011). The specific mechanism of music in improving performance beyond helping athletes sustain a tempo is not well understood but music has been shown to have an effect on motivation, RPE, exercise duration, productivity, and intensity.

Music and Motivation

Listening to motivational music arouses profound feelings and encourages the continuation of exercise during moments of physical and psychological fatigue (Brownley et al., 1995; Young et al., 2009). Motivational music allows a greater cardiovascular workload to be completed when compared to music that does not have a motivational component (Barwood et al., 2009; Brownley et al., 1995; Elliott, Carr, &

Orme, 2005; Terry, Karageorghis, Saha, & Auria, 2011; Young, Sands, & Jung, 2009). The motivational component of music comes from the lyrical meaning to the listener, the tempo of the music, or a combination of the two. These findings are most easily optimized in music that is self-selected (Terry et al., 2011). Motivational music has been shown to have the greatest effect in those who lack the internal drive to continue and need an external stimulus to motivate in order to continue (Brownley et al., 1995).

Motivational music that consists of high tempo selections can impact distances traveled, and time completed, during exercise sessions of high and moderate intensity (Barwood et al., 2009; Brownley et al., 1995; Elliott et al., 2005; Terry et al., 20011; Young et al., 2009). Elliott and colleagues (2005) found that music does not necessarily need to be classified as motivational to elicit beneficial effects during exercise. However, their music was high tempo, which can elicit motivational effects for listeners (Barwood et al., 2009; Brownely et al., 1995; Terry et al., 2011; Young et al., 2009). While motivational music during exercise has been shown to be beneficial, the lack of self-selected music in research acts as a limitation because motivational effects can be different based on musical preference.

Music and Locomotive Frequency

The tempo of the music has been shown to elicit a rhythmic motion to improve running efficiency (Brownley et al., 1995; Karageorghis et al., 2010; Koc & Curtseit, 2009; Matesic & Cromartie, 2002; Schneider et al., 2010; Simpson & Karageorghis, 2006; Styns et al., 2007; Terry et al., 2011). To optimize the effect of music on rhythmical movements, the music should be synchronous with the movement pattern (Karageorghis et al., 2010). Simpson and Karageorghis (2006) examined the effects of synchronous music on the rhythmic nature of a 400 m sprint. Although a 400 m sprint is commonly considered a maximal effort, the cadence of the sprint utilizes a steady rhythm of strides throughout the race. They found that listening to synchronous motivational music, which consisted of a fast tempo musical selection, produced faster times, than the non-music condition (Simpson & Karageorghis, 2006). The faster times were due to increases in leg turnover speed presumably caused by the increase in tempo.

Schneider and colleagues (2010), knowing that tempo affects running cadence, determined optimal tempos, which are above 120 bpm (2Hz) and closer to 180 bpm (3 Hz) for maximizing running performance. The optimal bpm for running is faster than that of walking due to the higher frequency of leg turnover observed in running, which is typically close to 180 steps/min (Schneider et al., 2010).

The tempo of selected music also has a direct effect on walking cadence. Styns and colleagues (2007) found that most people synchronize their walking movements with the tempo of music, with 120 bpm being the optimal tempo for walking. Similar effects were seen with step-ups during circuit training for which it was found that exercisers completed more repetitions when listening to synchronous high tempo music when compared to the other strength-oriented exercises (sit-ups, squats, jumping jacks, heel raises, and press behind the neck) in the same condition (Karageorghis et al., 2010). Karageorghis and colleagues (2010) found that the increase in repetitions was only seen during step-ups, which may be attributed to the rhythmic nature of the exercise and its popularity in exercise classes where high tempo music is commonly played.

Music and Exercise Perfomance

Depending on the tempo of selected music, there is an increase in lower body movement (leg turnover speed) with music producing increases in overall exercise pace which then often improves overall exercise distance and time (Edworthy & Waring, 2006; Elliot et al., 2005; Koc & Curtseit, 2009; Matesic & Cromartie, 2002; Schneider et al., 2010; Simpson & Karageorghis, 2006; Ward & Dunaway, 1995). Accordingly, studies have found listening to music can increase the total distance run with fast tempos increasing running speed when compared to slow tempos (Edworthy & Waring, 2006). Interestingly techno music, which is composed of high tempo beats, produced a decrease in lap pace of both trained and untrained individuals compared to a no music condition (Matesic & Cromartie, 2002). This was attributed to the asynchronous nature of techno music with the exerciser being unable to get in a rhythm that would increase running efficiency. The following sections discuss music and its effects on exercise intensity, RPE, and duration.

Music and Exercise Intensity and RPE

Music produces a decrease in RPE during moderate intensity exercise, but the research has not been conclusive in regards to the effect of music on RPE for bouts of high intensity exercise (Baldari, Macone, Bonavolonta, & Guidetti, 2010; Barwood et al., 2009; Brownley et al., 1995; Edworthy & Waring, 2006; Elliott et al., 2005; Matesic & Cromartie, 2002; Miller, Swank, Manire, Robertson , & Wheeler, 2010; Nakamura, Periera, Papini, & Nakamura, 2010; Razon, Basevitch, Land, Thompson, & Tenebaum, 2009; Schneider et al., 2010; Szmedra & Bacharach, 1998; Young et al., 2009). Specifically, high tempo, preferred, and motivation music all had greater effects on lowering RPE than slow tempo, non-preferred, and non-motivational music (Brownely et al., 1995; Barwood et al., 2009; Edworthy & Waring, 2006; Elliott et al., 2005; Miller et al., 2010; Nakamura et al., 2010; Young et al., 2009).

Young and colleagues (2009) examined the effects of music during high intensity bouts of treadmill exercise on RPE, and found that music did not have an effect on RPE. In contrast, Barwood and colleagues (2009), and Nakamura and colleagues (2010), examined the effects of music during high intensity bouts of exercise and found that music decreased RPE. Barwood and colleagues, however, combined high tempo motivational music with video and found that recreational gym users were 13 percent more likely to extend, or endure bouts of high intensity exercise than when no music or video alone was used. Nakamura and colleagues found that preferred musical selections produced an increase in cycling distance, and a decrease in RPE, during bouts of high intensity without any physiological changes.

The differences seen in music's effect on RPE during bouts of low to moderate intensity exercise compared to high intensity may be explained by attentional focus tendencies during various exercise intensities. During bouts of moderate intensity exercise, the exerciser may dissociate from the exercise and feelings of exhaustion. However, with high intensities dissociation may not be possible due to the physical sensation of exhaustion that is caused by exercising close to maximal capacity. Therefore, though needing further study, the differences in findings between studies may be explained by attentional focus tendencies at different exercise intensities.

Music has been used during submaximal exercise testing or moderate intensity exercise to resist fatigue and produce positive physiological responses during exercise (Baldari et al., 2010; Elliott et al., 2005; Szmedra & Bacharach, 1998). Baldari and colleagues (2010) found that both trained and active participants decreased their level of anxiety after exercise independent of the presence of music. They also reported decreases in RPE levels when they evaluated the effects of music during submaximal exercise with participants running at 75% heart rate reserve (HRR) (Baldari et al., 2010). A similar study found that music, regardless of type, increased the overall distance traveled, intensity, and decrease RPE during submaximal cycling (Elliott et al., 2005). Szmedra and Bacharach (1998) examined the effects of music on RPE during submaximal steady state treadmill running. They found that there was a significant decrease in RPE by those listening to music when compared to no music. They concluded music during exercise alters the participants RPE levels by dissociating away from feelings of discomfort that occur during prolonged exercise (Szmedra & Bacharach, 1998). An interesting component of the study was the use of headphones, which blocked out any surrounding noise besides that of the music.

In summary, research has found that exercise intensity may vary based on the tempo of the music. Additionally, listening to music may have different effects on RPE based on the intensity of exercise.

Music and Exercise Duration

Exercise duration can be increased with the proper selection of music (Baldari et al., 2010; Copeland & Franks, 1991; Terry et al., 2011). Specifically, upbeat tempos compared with no music have been shown to increase exercise duration during treadmill running in both trained and untrained individuals (Baldari et al., 2010). Similar results were found in triathletes who ran one additional minute while listening to constant tempo self-selected motivation music during a run on a treadmill to volitional exhaustion compared to the neutral music and no music conditions (Terry et al., 2011). Interestingly, the Baldari et al. (2010) study tested at a submaximal intensity while the Terry et al. study tested at maximal intensity, suggesting that music may be able to increase exercise duration at both moderate and high intensity exercise. Another study, done by Copeland and Frank (1991), examined the effects of different types of music on HR, RPE, and time to exhaustion. While Baldari et al. (2010) found an increase in duration with upbeat music, Copeland and Frank (1991) found that slow and soft musical selections also increased time to exhaustion compared to no music and pop music. This is the only study to find that slow tempo music can produce positive effects on exercise performance. Young and colleagues (2009) also examined the effects of pop music on exercise duration in female college soccer players during a maximal treadmill test. They found that pop music had no effect on time to exhaustion. It is unclear if the lack of pop music effect is due to the high intensity exercise or the type of music. However, given the effects of slow music on exercise duration it may be due to specific character of pop music.

Summary

The ergogenic effects of music during exercise have been shown to produce beneficial effects in the reduction of fatigue and RPE, and increases in the overall duration, speed, and distance covered during cardiovascular exercise. Music can also produce positive changes in mood. A tempo of 180 bpm has been found to be the optimal tempo for running and has produced the greatest effects when looking at locomotive frequency and efficiency. However, researchers have always used musical selections of a constant tempo and have not addressed the use of varying tempos commonly seen with the use of playlists on contemporary music players during a cardiovascular exercise session. There could be potential benefits of variable tempo music playlist such as producing positive mood changes, decreases in RPE, and increases in distance, speed, and duration of an exercise session.

CHAPTER 3

METHODOLOGY

This study examined the effects of music playlist tempo (varying tempo, constant tempo, and no music) on exercise performance, mood, and attentional focus tendencies during running. The methodology for this study is presented in the following subsections: Participants, Design, Measurements, Procedures, and Statistical Analysis.

Participants

The study collected data from 36 healthy recreational exercisers above the age of 18 from a mid-sized town in central New York. The Ithaca College Human Subjects Review Board approved the study and participants signed an informed consent form (Appendix A) prior to their participation.

Design

The study utilized a repeated measures experimental design with three conditions administered in a partially randomized, balanced fashion. The three conditions were a varying tempo playlist (VT), constant tempo playlist (CT), and no music (NM). These conditions were administered in six orders: 1) VT, CT, NM; 2) VT, NM, CT; 3) CT, NM, VT; 4) CT, VT, NM; 5) NM, VT, CT; and 6) NM, CT, VT, such that six participants were assigned to each of the six orders. A slight deception was used to ensure that participants were not consciously thinking about song tempo and how their running might be affected by tempo. They were told that the purpose of the study was to examine generally the effects of music on exercise performance. The participants were not told that the real purpose study was to examine the effects of varying tempos on exercise performance until they completed their participation in the study.

Running took place on a 200 m indoor track so that the environmental conditions could be controlled to the greatest extent possible. An Apple I-Pod Touch contained musical selections chosen in an apparently random fashion (i.e., the participants were not aware of the order of songs in each playlist or the condition they were receiving). Each of the three conditions was administered on separate days, at nearly the same time of day, with at least 48 h between each condition.

Measurements

The primary outcome variable was time to complete 4800 m. Additionally, time, HR and RPE were measured at 400 m intervals during each condition throughout the 4800 m. Data on mood were collected before and after each condition. Finally, attentional focus tendencies were examined after each condition.

Time

Overall time to complete 4800 m and each 400 m split were measured using a Smartspeed timing system (Fusion Sport, Cooper Plains, QLD, Australia) which has error correction processing (ECP). ECP combines the use of a single beam gate with microprocessor technology. The microprocessor eliminates the false signals from small body parts (i.e., hands, feet) tripping the timing gate and instead focuses on the larger body parts (i.e., the torso) crossing the finish line. The smartspeed timing system was set up at 200 m on the first lane straight away of the indoor track so that others who may be using the track at the time of data collection would not set off the timing gates. The distance of 400 m was determined by using two complete laps around the indoor track with each lap measuring 200 m. The timing for each 400 m split was determined using the Smartspeed timing system PDA which displays each split time and the total time for the laps completed. The 400 m times were calculated by adding each the two 200 m lap times for each 400 m segment together.

Heart Rate

Heart rate was measured using a Polar RS800CX heart rate sensor (Polar Electro, Lake Success, NY) every 30 s for the entire 4800 m. An average HR was calculated for every 400 m as well as for the entire 4800 m for each of the three conditions.

Rating of Perceived Exertion

RPE was measured using the 6 to 20 Borg Scale (Appendix B) which has been repeatedly validated (Borg, 1982; Chen, Fan & Moe, 2002). RPE was measured at 380 m of each 400 m segment throughout each of the three conditions. RPE was measured by the participant calling out an RPE score as the researcher held a poster while standing at the 180 m mark on the track.

Mood

Measurement of mood was made using the Subjective Exercise Experience Scale (SEES), which has been validated by McAuley & Courneya (1994). The SEES is a 12-item, 7 point scale, which measures how a person is feeling (Positive, Fatigued) at a certain point in time. Participants were asked to complete the questionnaire 10 min before and 5 min after each condition. The questionnaire has three sub-scales: Positive Wellbeing, Distress, and Fatigue. The Positive sub-scale is composed of the sum of questions 1, 4, 7, 10; the Distress sub-scale is composed of the sum of questions 2, 5, 8, 11; the Fatigue sub-scale is composed of the sum of questions 3, 6, 9, 12. The sub-scale with the greatest sum is considered the significant state of mood at that point in time.

Attentional Focus

Attentional focus tendencies were measured using the Attentional Focus Questionnaire (AFQ) which was validated by Brewer and colleagues (1996). The AFQ is a 31-item questionnaire which measures, on a 7-point scale ranging from 1 "I did not do this at all" to 7 "I did this all the time", the extent of engagement of attentional focus during exercise. Participants were asked to complete the questionnaire after each testing condition. The questionnaire has three sub-scales: Associative, Dissociative, and Distress. The average score of each sub-scale is used to represent whether the participant demonstrated associative, distress, or dissociative tendencies with the highest average being the significant state of attentional focus.

Music Selection

Playlists loaded on an Apple I-Pod Touch contained music selections chosen by the researcher to correspond to the correct tempo for each condition. Song order was made using the shuffle feature on I-Tunes for both the VT and CT conditions and kept constant for all participants. The playlist (Appendix C) for the VT condition consisted of 12 musical selections; six consisting of slow tempo (130±2 bpm), and six consisting of fast tempo (230±2 bpm). The playlist for the CT condition consisted of 12 medium tempo (180±2 bpm) musical selections. A website (www.jog.fm) provided the song tempos of the selected music for both the VT and CT conditions. The selections consisted of various genres of music chosen by the researcher. I-Tunes software (Apple Inc.) was used to download the music for the playlists and transfer the playlists to an Apple I-Pod Touch, with each song being edited using Garage Band (Apple Inc.) so that the song could be played in a continuous loop until the participant completed 400 m. The song order was originally chosen using the shuffle feature of I-Tunes with the researcher noting the order of the songs through the use of the reverse remote software application (Apple Inc.), which was also used to change song track once the participant completed 400 m. The song order was kept constant for all participants throughout the data collection process. The third condition, no music, had participants still using the Apple I-Pod Touch without any music being played through the headphones.

Testing Procedures

Each participant completed the three conditions on three separate days with at least 48 hours between conditions and always less than seven days between trials. A 200 m indoor track was used for each condition with both the temperature and humidity kept as constant as possible throughout the data collection process. Conditions for a participant occurred at the same time of day in an effort to control for diurnal variation. Prior to the first condition, participants filled out an informed consent form (Appendix A), and a health history and demographic form (Appendix D). The participants also filled out an exercise history form (Appendix E) prior to each condition. Upon arrival for each condition, participants were asked to complete the SEES (Appendix F) to measure their mood prior to testing for that day. Then participants were fitted with a Polar HR monitor while the RPE scale was verbally explained and demonstrated to participants to encourage consistency. Participants were then taken through a dynamic warm up (Appendix G). An I-Pod Touch with the selected playlist was given to participants with volume level recorded for each listener to be used for the remaining two conditions. After being given the I-Pod Touch, participants were told to "enjoy their run" prior to starting the music and running for 4800 m at a self-selected pace. At the completion of each 400 m segment, the song selection was changed. After completing the self-paced 4800 m run, participants were asked to complete the SEES again. After completing the SEES participants were also asked to complete the AFQ (Appendix H).

Statistical Analysis

Descriptive statistics were calculated to summarize demographic information (e.g., age, weight, and gender) and the five dependent variables. Three one-way repeated measures ANOVA were run in order to examine the effects of each condition (varying, constant, no music) on the dependent variables (4800 m time, HR, RPE). Two one-way repeated measures ANOVA were run in order to examine the effects of each condition on the Positive Wellbeing and Fatigue sub-categories of the SEES where the difference between the pre and post questionnaires for each condition was analyzed between conditions. A one-way repeated measures ANOVA was run in order to examine the effects of each condition on the dissociative sub-category of the AFQ. An average was calculated for time (400 m), HR, and RPE for all six of the fast tempo music selections and all six of the slow tempo music selections used in the varying tempo playlist condition. Dependent t-tests were used to determine if differences existed between the fast and slow tempo music selections. Alpha was set to 0.05 for all tests.

CHAPTER 4

RESULTS

The purpose of this study was to examine the effects of music playlist tempo on exercise performance, mood, and attentional focus tendencies. Specifically the effects of varying tempo, constant tempo, and no music were examined during a 4800 m self-paced run. The following chapter describes subject characteristics, run time, HR, RPE, mood, and attentional focus tendencies for the 4800 m run.

Subject Characteristics

Fourteen of the 36 subjects were male. The average age of all subjects was 32.3 y ± 11.4 with an average weight of 153.9 ± 31.0 lbs. The subjects worked out on average 4.9 ±1.4 days a week, with their running sessions lasting 44.0 ± 22.2 min. Subject characteristics are presented in Table 1.

Run Time

Mauchly's test indicated that the assumption of sphericity for the one-way repeated measures ANOVA had been violated $\chi^2(2) = 64.28$, $p < .01$, therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon = .54$). The results showed that there were no significant differences in time to complete 4800 m between varying tempo ($M = 26.05$ min, $SD = 4.58$), constant tempo ($M = 25.12$ min, $SD = 5.55$) and no music ($M = 26.38$ min, $SD = 4.56$) conditions, $F(1.08, 37.86) = 2.31$, $p = .14$. Run times (4800 m) for the varying tempo, constant tempo and no music conditions are presented in Figure 1. There also was no significant difference in 400 m split times between the fast ($M = 130.11$ s, $SD = 23.5$) and slow ($M = 130.40$ s, $SD = 22.6$) tempo musical selections played during varying tempo playlist trial as determined with a paired

Table 1
Subject Characteristics

	M	SD	Min	Max
AGE (y)	32.5	11.4	18	62
WEIGHT (lbs)	153.9	31.0	104	270
WORKOUTS (days)	4.9	1.4	3	7
AVG RUN DURATION (min)	43.2	20.4	30	120

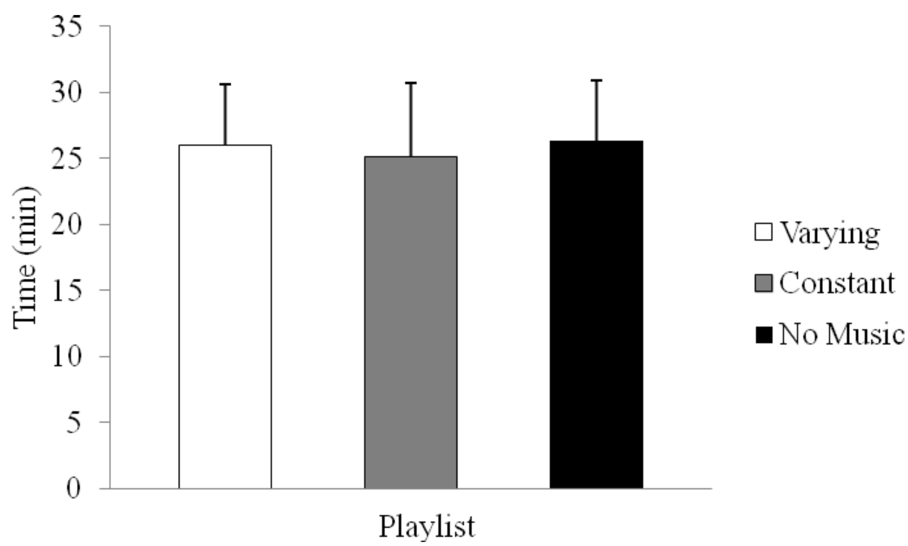

Figure 1. Mean and SD (error bars) for run times for 4800 m under three playlist (tempo) conditions.

t-test, *t*(35) = -.387, *p* = .70. Average split times (400 m) for the fast and slow tempo musical selections of the varying tempo playlist are presented in Figure 2.

Heart Rate

There were no significant differences in HR for the 4800 m run between varying tempo (*M* = 166.3 bpm, *SD* = 10.4), constant tempo (*M* = 167.2 bpm, *SD* = 10.0), and no music (*M* = 165.1 bpm, *SD* = 10.6) conditions, *F*(2,64) = 2.03, *p* = .14. There was a significant difference for HR between fast (*M* = 167.8 bpm, *SD* = 10.3) and slow (*M* = 165.0 bpm, *SD* = 10.5) tempo musical selections during the varying tempo playlist trial as determined with a paired t-test, *t*(35) = 9.64, *p* = .00. HR for the fast and slow tempo musical selections for the varying tempo playlist trial is presented in Figure 3.

RPE

Two one-way repeated measure ANOVAs were run to examine the effects of each condition (varying playlist tempo, constant playlist tempo, no music) on RPE over the 4800 m run. There were no significant differences in RPE for the entire 4800 m run between varying tempo (*M* = 12.6, *SD* = 1.6), constant tempo (*M* = 12.4, *SD* = 1.7), and no music (*M* = 12.8, *SD* = 1.5) conditions, *F*(2,70) = 2.00, *p* = .14. There was a significant difference in ending RPE for the 4800 m run between varying tempo (*M* = 14.8, *SD* = 2.4), constant tempo (*M* = 14.8, *SD* = 2.1), and no music (*M* = 15.5, *SD* = 1.9) conditions, *F*(2,70) = 3.40, *p* = .04. Post-hoc tests using a Bonferroni correction revealed the ending RPE of the constant tempo condition was not quite less then RPE in the no music condition (*p* = .06). There were no significant differences for other comparisons (Figure 4). There was no significant difference for RPE between fast (*M* = 12.6, *SD* = 1.7) and slow (*M* = 12.6, *SD* = 1.6) tempo musical selections played during the

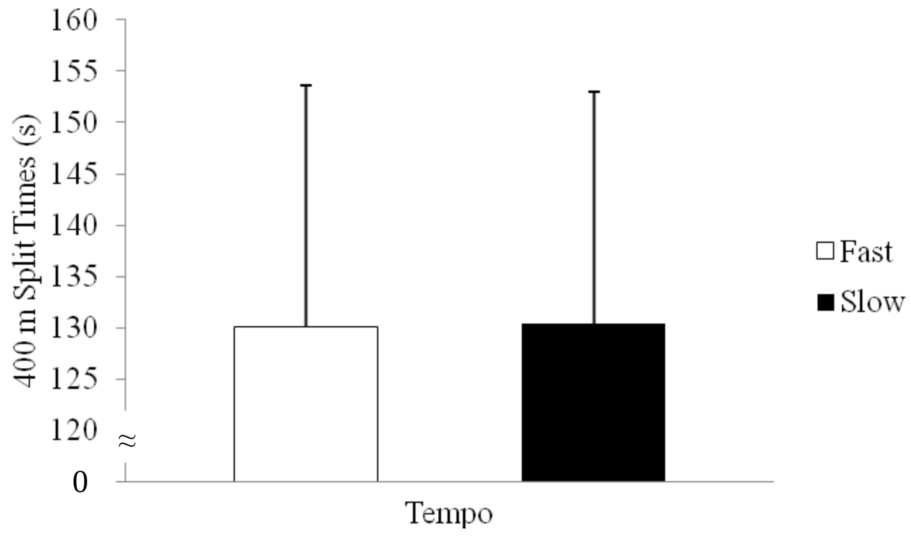

Figure 2. Mean and SD (error bars) for 400 m split times(s) v. tempo with average 400 m time for fast tempo and slower tempo selections.

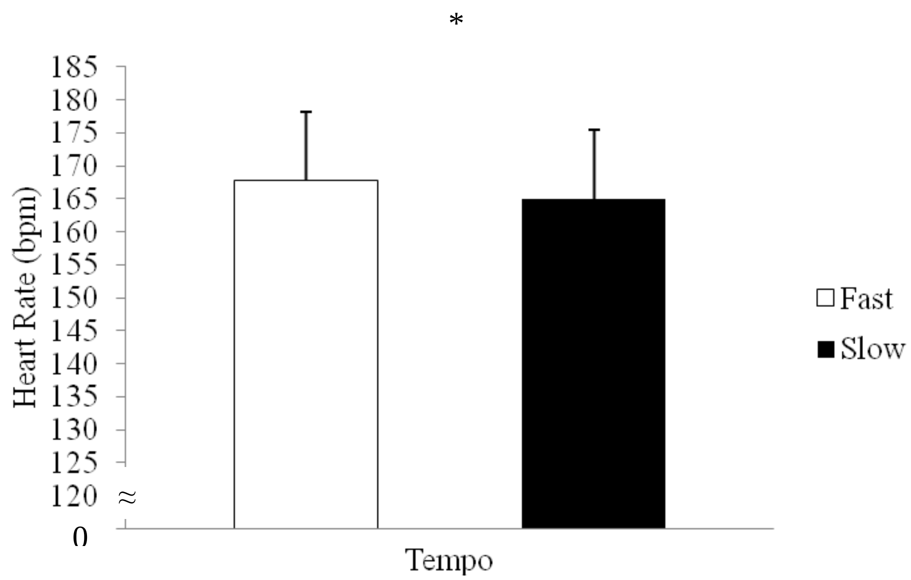

Figure 3. Mean and SD (error bars) for heart rate vs. tempo. HR for fast and slow tempo musical selections during the varying tempo playlist trial. * $p = .00$ between conditions.

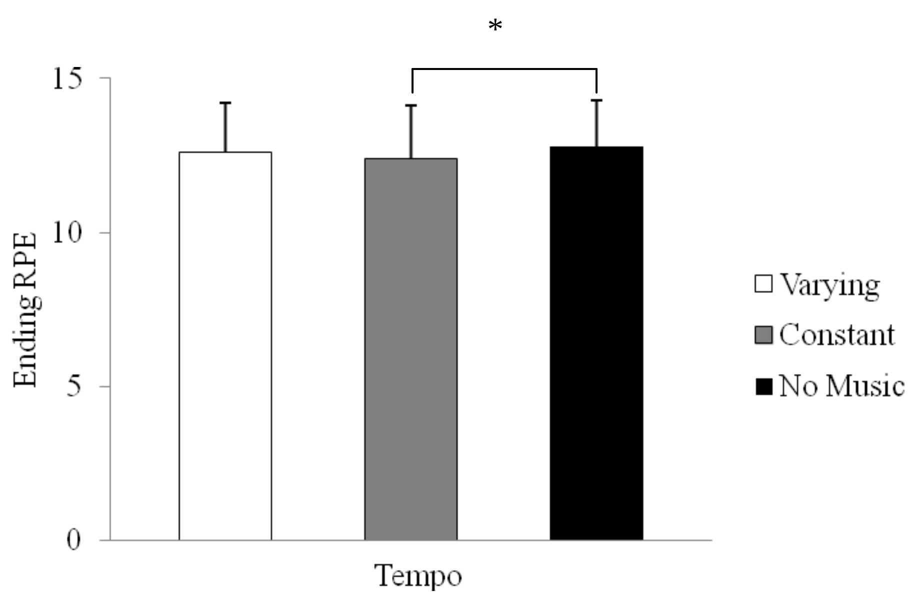

Figure 4. Mean and SD (error bars) for RPEs at the end of the 4800 m run for each condition. * p = .06 between conditions.

varying tempo playlist trials as determined with a paired t-test, $t(35) = 2.59$, $p = .80$.

Mood

For the well-being sub-scale score on the SEES after exercise, there were no significant differences between varying playlist tempo ($M = 1.5$, $SD = 3.9$), constant playlist tempo ($M = 1.5$, $SD = 4.0$), and no music ($M = .08$, $SD = 3.0$) conditions, $F(2,70) = 2.94$, $p = .06$. There was, however, a tendancy for mood to be greater after the music trial, and there was no significant difference seen in the fatigue sub-scale of the SEES between varying tempo ($M = 1.4$, $SD = 4.4$), constant tempo ($M = 1.5$, $SD = 5.0$), and no music ($M = 2.3$, $SD = 4.4$) conditions, $F(2,70) = .48$, $p = .60$.

Attentional Focus Tendencies

Examining the dissociative sub-scale of the AFQ, there were no significant differences between varying tempo playlist ($M = 32.7$, $SD = 9.2$), constant tempo playlist ($M = 33.3$, $SD = 10.3$), and no music ($M = 34.5$, $SD = 10.6$) conditions, $F(2,70) = .73$, $p = .49$. This indicates that the participants did not use dissociation to a greater extent in the various conditions.

CHAPTER 5

DISCUSSION

The purpose of this study was to examine the effects of music playlist tempo on exercise performance, mood, and attentional focus tendencies in a healthy population of recreational exercisers. Specifically, the effects of varying tempo, constant tempo, and no music were examined during a 4800 m self-paced run. Previous research found that listening to music can have diverse effects on exercise performance, mood, and attentional focus tendencies. However, no previous study has yet addressed if these variables are affected by differing tempos commonly heard when listening to music playlists on contemporary playing devices. This chapter will first discuss music playlist tempo effects on exercise performance and then discuss playlist tempo effects on post-exercise mood and attentional focus tendencies.

Music and Exercise

Previous research demonstrates that music has been found to provide ergogenic effects during exercise especially in regards to exercise intensity, and duration, both of which are attributed to lower ratings of RPE (Karageorghis & Terry, 1997). Based on this literature it was hypothesized that a varying tempo playlist would produce faster overall 4800 m times when compared to a constant tempo playlist or no music. It was also thought that musical selections with a fast tempo in the varying tempo playlist condition would produce faster 400 m split times compared to the slow tempo selections during the same run. Despite these hypotheses, there were no significant differences in 4800 m run times between conditions, nor significant differences in 400 m lap times between the fast and slow tempo selections during the varying tempo playlist condition.

Karageorghis and colleagues (2010) found that in order to optimize the effect of music on rhythmical movements such as running, the music must be synchronous with the movement pattern. Schneider and colleagues (2010) found that the optimal tempo for running was around 180 bpm in order to maximize running performance. Running tempo was faster than the appropriate bpm for walking (120 bpm) due to the higher frequency of leg turnover observed in running. Therefore, in the current study a tempo of 180 bpm was selected for the constant tempo playlist. In the present study, the use of a constant tempo musical selection may have provided a rhythmic cadence for the participant to run, which matched their typical running pace. The varying tempo playlist musical selections may have hindered ability to get into a consistent rhythm that would produce an increase in running efficiency and decrease in overall fatigue. Thus varying tempo did not decrease time or RPE.

In the varying tempo playlist condition, selections were either 130 bpm or 230 bpm in the hopes that the drastic change in tempo between musical selections would cause an interval-like exercise effect. In fact, Edworthy and Waring (2006) found that faster tempo musical selections increased the speed in which an individual runs when compared to musical selections of a slower tempo. It was suspected that 130 bpm would have participants running at a pace below normal, while during songs at 230 bpm participants would be running at a pace above normal. The interval effect did not occur in the current study because there were no significant differences in 400 m split times between the fast and slow tempo selections of the varying tempo playlist condition.

Unlike Edworthy and Waring (2006), Matesic and Cromartie (2002) found that high tempo techno music worsened lap times in both trained and untrained individuals when compared to the no music condition. They believed the asynchronous nature of techno music led to an inability to keep in rhythm with the music. In the current study, with a song tempo change every 400 m in the varying tempo playlist condition, the exerciser may not have gotten into a rhythm that aids running efficiency. Most other studies examined the effects of music tempo on treadmill running at a constant pace to volitional exhaustion and have not looked at time to travel a known distance (Baldari et al., 2010; Edworthy & Waring, 2006; Terry et al., 2011; Young et al., 2009). Studies have generally found that individuals listening to a faster tempo tended to run longer and faster than those listening to slower tempo music or no music. The current study using a self-controlled pace, found neither significant differences in the time to run 4800 m nor significant differences in 400 m split times. The current study does not support findings of previous studies in reporting an ergogenic effect of music in terms of exercise duration and intensity. The participants were not given a specific pace to run, but instead were instructed to "enjoy their run". The present study found that individuals run at a constant pace regardless of the music being heard. The current findings support the idea that music and music tempo may not play a critical role in determining self-paced running intensity. This supports the use of contemporary music players, which allow the creation of multiple playlists, consisting of various songs of various tempos and genres, played in a randomized order with the use of the shuffle feature. It can be inferred that individuals may listen to music of any tempo instead of focusing on music of a certain tempo to achieve a specific running pace.

Music and RPE

The results of the current study did not support the hypotheses that a varying tempo produces lower ratings of RPE compared to constant tempo and no music conditions. Moreover, musical selections with a fast tempo in the varying tempo condition did not produce a lower RPE when compared to the slow tempo selections during the same run. This compliments findings of Young and colleagues (2009) who showed music did not have an effect on RPE during high intensity bouts of exercise on a treadmill. There was, however, a near significant ($p = .06$) effect with participants tending toward lower RPE at the end of the 4800 m run after listening to music of a constant tempo compared to no music. If the effect is real, the constant tempo music may act as a buffer to the feelings of fatigue seen toward the end of the long run (4800 m).

In contrast, Barwood and colleagues (2009), and Nakamura and colleagues (2010), both found that music decreased RPE during exercise. Barwood and colleagues used high tempo motivational music along with video, while the current study used playlists consisting of music of specific tempos with no regard to whether they were motivational in nature. The study by Nakamura and colleagues used preferred musical selections and found music to produce a decrease in RPE during bouts of high intensity exercise. In contrast, the current study used music selected based on tempo without regard to whether it was the preferred musical selections of the participants. It is feasible that preferred music with motivational qualities played during high intensity effort will improve RPE, but the present study did not use this set of music attributes.

Music and HR

A significant effect of tempo on HR was found between the fast and slow tempo musical selections of the varying tempo condition. A 3 bpm greater HR was associated with fast as compared to with slow tempo selections. Music may elicit a psychological enhancement, and depending on the music choice, may “hype up” an individual which may increase HR due to the motivational characteristics of the music. This would explain how HR was greater during fast tempo music even though running speed (i.e., intensity) or RPE were not altered. Elliot and colleagues (2005) found that music does not need to be classified as motivational to elicit beneficial effects during exercise. The musical selections of the current study were not chosen based on motivational characteristics, but instead specific tempos. The use of high tempo musical selections, although not classified as motivational, still may elicit motivational effects in listeners (Barwood et al., 2009; Brownely et al., 1995; Terry et al., 2011; Young et al., 2009).

Music and Mood

The belief that the varying tempo condition would produce higher ratings for the positive wellbeing sub-scale, and lower ratings for the fatigue sub-scale of the SEES, was based on the initial RPE lowering hypothesis. It was also believed that the continuous change in auditory stimuli, between slow and fast tempos within the varying tempo playlist, might provide distraction diminishing fatigue and improving ratings for positive wellbeing compared to the constant tempo and no music conditions. These potential positive impacts of a shuffle-like playlist with varying tempos within the varying tempo condition were not verified presently.

Moreover, the findings of the current study did not support the hypothesis that a varying tempo would produce higher ratings for positive wellbeing and lower ratings for the fatigue sub-scales of the SEES compared to constant tempo and no music. The current hypothesis was made due to the belief that the varying playlist would allow for greater stimulus throughout the run. These findings are similar to the findings by Macone and colleagues (2006) who found that music did not have an effect on mood beyond the effects caused by exercise. A similar study by Steptoe and Cox (1988) also found music did not produce significant differences in mood compared to no music regardless of the exercise intensity. However, these findings are not similar to those found by Seath and Thow (1995), who reported significant positive effects in mood during an aerobic dance class with music compared to the same class without music. Nor are they similar to those found by Plante and colleagues (2011), who found that music along with social interaction created significant positive mood changes during exercise than when compared to the same exercise without music and social interaction. In the current study, aerobic dance and social interaction were not used making comparison to these studies difficult. The findings of the current study do not support the use of contemporary music players allowing individuals to select music of any tempo in hopes of bettering their mood.

Music and Attentional Focus

The findings of the current study did not support the hypothesis that varying and constant tempo would produce greater dissociative tendencies in runners compared to no music. The current hypothesis was offered due to the belief that the use of music, whether varying or constant in tempo, would provide greater external stimuli therefore producing greater dissociative tendencies when compared to the no music condition. The findings of the current study do not coincide with the belief that when external stimuli, such as music, are provided during exercise individuals will be more apt to dissociate (Barwood et al., 2009). However, the findings of the current study do support research suggesting attentional focus tendencies may be influenced by the experience level of the exerciser (Wrisberg & Pein, 1990). Wrisberg and Pein found that inexperienced recreational joggers associated to a greater degree during an exercise session then experienced recreational joggers. Brewer and colleagues (1996) found experienced runners reported greater associative attentional focus tendencies then those who were deemed inexperienced. Results from Wrisber and Pein, and Brewer and colleagues, provide evidence for why there was not a significant difference in the dissociative attentional focus tendencies of the experienced participants in the current study.

Summary

Although the current study only found significant differences when examining the ending RPE between the constant and no music conditions and HR between the fast and slow tempo musical selections of the varying playlist, there are practical implications of these findings in regards to the use of contemporary music players. These findings indicate that the effect of music tempo and song order on exercise maybe trivial. Therefore, when creating a music playlist for exercise, these findings show that individuals should not worry about tempo and enjoy their music when running.

CHAPTER 6

SUMMARY, CONCLUSIONS, RECOMMENDATIONS

Summary

This study examined whether music playlist tempo had a significant effect on exercise, mood, and attentional focus tendencies in trained recreational runners. These runners (N = 36) participated in a repeated measures design study consisting of three music conditions (Varying, Constant, No Music) administered in a partially randomized, balanced fashion. Each participant participated in all conditions on three separate days with at least 48 hours between conditions. On testing days the participants were asked to fill out the SEES, were given the selected playlist for that day, and instructed to "enjoy their run". The participants ran at a self-selected pace for 4800 m with split times, HR, and RPE measured for each 400 m increment. At the conclusion of 4800 m, run time, HR, and ending RPE were measured and participants were asked to complete the SEES and AFQ.

Run time, RPE, ending RPE, HR, positive wellbeing and fatigue sub-scales of the SEES, and the dissociative sub-scale of the AFQ were statistically analyzed with one-way repeated measures ANOVA. Split times (400 m), RPE, and HR for the fast and slow tempo musical selections of the varying tempo playlist condition were statistically analyzed with paired t-tests. No significant differences between conditions were found in run time, RPE, HR, positive wellbeing and fatigue sub-scales, and the dissociative sub-scale. Ending RPE was found to approach significance with only the constant tempo playlist almost having a lower RPE than the no music condition. Split times and RPE of fast and slow tempo musical selections during the varying tempo playlist condition were not found to be different. However, HR between the fast and slow tempo musical selections was found to be slightly greater ($p < .05$) during the faster tempo selections than the slower tempo selections. These findings suggest that music playlist tempo does not have substantial effect on exercise performance, mood, or attentional focus tendencies, but may have a small effect on HR. Playlist tempo does not need to be the main factor in selecting music for exercise, but instead individuals may listen to music of any tempo with no apparent negative consequences on exercise performance.

Conclusions

Results of this study support the following conclusions:

1. Overall time to complete a 4800 m self-paced run does not differ between conditions with or without music regardless of tempo.

2. RPE, positive wellbeing, and fatigue sub-scales of the SEES do not differ with or without music.

3. Dissociative attentional focus tendencies do not differ between conditions with or without music.

4. RPE and 400 m split times do not differ between the fast and slow tempo musical selections of the varying tempo playlist condition, however, HR may be slightly greater (≈ 3 bpm) when listening to fast tempo music.

5. Runners can listen to a musical playlist of any tempo without affecting their 4800 m running performance.

Recommendations

The following recommendations for future study are to:

1. Examine the effects of music playlist tempo on runners of various experience levels.

2. Examine the effect of playlist tempos on shorter and longer distances or other types of exercise.

3. Examine the effects of music genre, as well as preferred music on exercise, mood, and attentional focus tendencies when used in a playlist.

4. Examine the effects of varying tempos when used in a playlist during bouts of high intensity exercise.

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APPENDIX A

INFORMED CONSENT FORM

THE EFFECT OF VARYING MUSIC AND MUSIC TEMPO, VIA RANDOM SHUFFLE ON SELF-PACED RUNNING AND MOOD

1. Purpose of the Study: The purpose is to examine the effects of music on exercise performance, mood, and dissociative attenional focus tendencies during a 4800 m, self-paced run.

2. Benefits: You may benefit from participating in this study because you will learn whether you focus on internal bodily cues, or your surroundings during exercise, as well as whether it is better for you to listen to or not listen to music during exercise. You will also get an in depth view in how scientific research is conducted, and how data collection occurs. Your participation will also benefit the graduate student, who is learning how to conduct scientific research. Last, it is hoped that the data generated will benefit the scientific community.

3. Your Participation Requires: You to be healthy and 18 years old or older and able to run for 4800 m on 3 separate tests on 3 separate days. Each test will be separated by approximately 2 days. On each test day you will be asked to listen to music and run at a self-selected pace for 4800 m.

Prior to the first test, you will be asked to fill out a healthy history form in order to check for any health issues prior to your participation in the study.

Prior to each test, you will be asked to fill out a 24 hour health history questionnaire, as well as a questionnaire examining your mood prior to the test. You will then be fitted with a chest strap so I can measure your heart rate. You will then be taken through a dynamic warm up for approximately 10 min. Upon completion of the warm up, you will be given a I Pod touch and will be instructed to begin running for 4800 m at a self-selected pace. At the completion of each test you will be asked to walk around the track for 5 min in order to allow for adequate cool down. Following the cool down, you will be asked to complete another questionnaire examining your mood following your participation in that day's testing as well as a questionnaire examining your attentional focus tendencies for that day's testing.

Total participation time for all 3 testing days will be about 3 hr. After the study is completed, I will provide you with your results and an explanation in regards to the test and its findings.

4. Risks of Participation: The risks associated with the self-paced running for 4800 m include skeletal muscle injury and possibly a cardiac event, which could be fatal. With the wide range of age groups the risk of a cardiac event may be higher for some more

Initials: _________ Date: ________

than others. You may also experience sore muscles 24 to 48 hours following the test. In order to minimize the risks, you will warm-up and cool-down before and after each test. During this time your heart rate will constantly be monitored. In the case of abnormal heart rate response to exercise you will not be allowed to continue. If you feel poorly at any point during the test, you may terminate it at any time. In the event that there is an injury or cardiac event, standard first aid procedures will be promptly administered. I am CPR and First Aid certified. A cellular phone will be present during all tests and a call will be made to 911 to seek additional assistance if warranted.

5. Compensation for Injury: If you suffer an injury that requires any treatment or hospitalization as a direct result of this study, the cost of such care is your responsibility. If you have insurance, you may bill your insurance company. Ithaca College and the investigator will not pay for any care, lost wages, or provide other compensation.

6. If you would like more information about this study at any time prior to, during, or following the data collection, you may contact Kristopher Bly at kbly1@ithaca.edu or (607)377-4341.

7. Withdrawal from the study: Participation in this study is voluntary and you may withdraw at any time if you so choose.

8. Confidentiality: Confidentiality is guaranteed for all participants. All data will be kept and stored in the Exercise and Sport's Science Department at Ithaca College. If you wish to be included in any popular publications stemming from this work you will have the opportunity to allow your data to be printed in connection with your name.

I have read the above and I understand its contents. I agree to participate in the study.

I acknowledge that I am of 18 years or older.

_______________________________ _______________________________

Your Name (please print) Your Signature

APPENDIX B

BORG SCALE

6

7 Very, very Light

8

9 Very Light

10

11 Fairly Light

12

13 Somewhat Hard

14

15 Hard

16

17 Very Hard

18

19 Very, very Hard

20

APPENDIX C

VARYING AND CONSTANT PLAYLISTS

VARYING PLAYLIST

Six Fast Tempo Songs (≈ 230 bpm)

Bonobo and Adreya Triana – Wonder When
Stabil Elite – Rave Maria
Herbie Hancock – Auto Drive
The Reverend Horton Heat – Big Little Baby
The Lemonheads – Rockin Stroll
Hello Goodbye – When We First Met

Six Slow Tempo Songs (≈ 130 bpm)

Limp Bizkit – My Way
Kelly Clarkson - Since You've Been Gone
Foster the People – Pumped Up Kicks
Billy Joel – Uptown Girl
Jimmy Buffet – Margaritaville
Taylor Swift – You Belong with Me

CONSTANT PLAYLIST

Twelve Constant Tempo Songs (≈ 180 bpm)

Papa Roach – Last Resort
The Allman Brothers – Ramblin Man
Sublime – Santeria
Jay-Z and Beyonce – 03' Bonnie and Clyde
IYAZ – Replay
John Mayer – Who Says
White Snake – Here I Go Again
Dropkick Murphy's – The Warrior's Code
50 Cent – In da Club
Led Zeppelin – Rock and Roll
Jimi Hendrix – Foxy Lady
Mumford and Sons – Roll Away Your Stones

APPENDIX D

MEDICAL HISTORY AND HEALTH HABIT FORM

ID #: ____

Age: _____________ Weight: _____________ Sex: __________________

Do you run for 30 minutes or more at least three days a week? [ ] yes [ ] no

Medical/Health History (please check all that apply)
[ ] Heart/Disease [ ] Lung Disease
[ ] Stroke [ ] Diabetes
[ ] Heart Murmur [ ] Epilepsy
[ ] Skipped, rapid or irregular heart rhythms[ ] Injuries to back, hips, knees, ankles, or feet
[ ] High Blood Pressure
[ ] High Cholesterol
[ ] Rheumatic Fever
[ ] Other conditions/comments: (please explain)

Present Symptoms (please check all that have applied within the last **six months**)
[ ] Chest pain [ ] Ankle/Leg Swelling
[ ] Shortness of Breath [ ] Joint/muscle injury requiring medical attention
[ ] Lightheadedness [ ] Allergies (if yes, please list)
[ ] Heart Palpitations
[ ] Loss of consciousness
[ ] Illness, surgery, or hospitalization
[ ] Other conditions/comments: (please explain)

Current medications (please list all medications presently being taken)

Exercise Habits
Do you presently engage in physical activity? [ ] Yes [ ] No
If so, what type of exercise? [ ] Aerobic [ ] Strength Training [ ] Both
How hard do you exercise? [ ] Easy [ ] Moderate [ ] Hard
How many times a week do you work out on average? ____________
How long is your running session? ___________________________
Have you ever had any discomfort, shortness of breath, or pain while exercising?
[ ] Yes [ ] No

Music Listening

Do you presently listen to music?	[ ] Yes	[ ] No
Do you listen to music during exercise?	[ ] Yes	[ ] No

If so, what genre of music? [ ] Metal [ ] Rock [ ] Hip Hop

[ ] Techno [ ] Gospel [ ] Country [ ] R&B [ ] Other

APPENDIX E

24 – HOUR HEALTH HISTORY FORM

Name: ________________________________ Date: ___________

Current Health Status (please check all that apply)

[ ] Nausea	[ ] Sore Throat	[ ] Headache
[ ] Body Ache	[ ] Chills	[ ] Lethargy
[ ] Nasal Drip	[ ] Cramping	[ ] Dizziness
[ ] Muscle Aches	[ ] Chest Pain	
[ ] Shortness of Breath		

If female, date of last period ____

Diet

Have you consumed alcohol in the last 12 hours? [ ] Yes [ ] No

Have you used caffeine or nicotine in the last three hours? [ ] Yes [ ] No

Did you eat any food in the last three hours? [ ] Yes [ ] No

If so, please list:

Has your diet changed drastically since the last exercise test? [ ] Yes [ ] No

If so, please describe:

Exercise

Have you exercised in the last 24 hours? [ ] Yes [ ] No

If so, please describe:

Has your exercise routine changed at all since the last test? [ ] Yes [ ] No

If so, please explain:

Over-the-Counter and/or Prescription Drug Use

Have you taken any over the counter drugs (e.g., cold meds) in the last 24 hours?
[ ] Yes [ ] No

Has there been any change in your use of prescription drugs?
[ ] Yes [ ] No

If so, please explain:

Injury

Have you experienced any physical pain in the last 24 hours?
[ ] Yes [ ] No

If so, please explain:

Is there any physical injury we should know about before you perform the test?

[ ] Yes [ ] No

If so, please explain:

Sleep Pattern:

Has your sleep pattern changed since the last exercise test? [ ] Yes [ ] No

Do you feel drowsy, tired, or run down at this time? [ ] Yes [ ] No

If so, please describe:

Has there been any change since the last exercise test that you feel could compromise your performance on today's exercise test?
[ ] Yes [ ] No

If so, explain:

Other questions/comments/concerns please state below.

APPENDIX F

SUBJECTIVE EXERCISE EXPERIENCE SCALE

How Do You Feel?

This inventory contains a number of items designed to reflect how you feel at this particular moment in time (i.e., Right Now). Please circle the number on each item that indicates **HOW YOU FEEL RIGHT NOW. With 1 being not at all, 4 being moderately, and 7 being very much so.**

I FEEL:

1. Great

1 2 3 4 5 6 7

With 1 being not at all, 4 being moderately, and 7 being very much so

2. Awful

1 2 3 4 5 6 7

With 1 being not at all, 4 being moderately, and 7 being very much so

3. Drained

1 2 3 4 5 6 7

With 1 being not at all, 4 being moderately, and 7 being very much so

4. Positive

1 2 3 4 5 6 7

With 1 being not at all, 4 being moderately, and 7 being very much so

5. Crummy

1 2 3 4 5 6 7

With 1 being not at all, 4 being moderately, and 7 being very much so

6. Exhausted

1 2 3 4 5 6 7

With 1 being not at all, 4 being moderately, and 7 being very much so

7. Strong

1 2 3 4 5 6 7

With 1 being not at all, 4 being moderately, and 7 being very much so

8. Discouraged

1 2 3 4 5 6 7

With 1 being not at all, 4 being moderately, and 7 being very much so

9. Fatigued

1 2 3 4 5 6 7

With 1 being not at all, 4 being moderately, and 7 being very much so

10. Terrific

1 2 3 4 5 6 7

With 1 being not at all, 4 being moderately, and 7 being very much so

11. Miserable

1 2 3 4 5 6 7

With 1 being not at all, 4 being moderately, and 7 being very much so

12. Tired

1 2 3 4 5 6 7

With 1 being not at all, 4 being moderately, and 7 being very much so

APPENDIX G

DYNAMIC WARM - UP

Butt Kicks – 40 m

High Knees – 40 m

Skips with Arm Circles – 40 m

High Skips – 40 m

Side Lunges – 40 m

APPENDIX H

ATTENTIONAL FOCUS QUESTIONNAIRE

Please rate how much you engage in the following activities during exercise

1----------2----------3----------4----------5---------6----------7
I did not do this at all — I did this all the time

______1. Letting your mind wander

______2. Monitoring specific body sensations (e.g., leg tension, breathing rate)

______3. Trying to solve problems in your life.

______4. Paying attention to your general level of fatigue

______5. Focusing on how much you are suffering

______6. Singing a song in your head

______7. Focusing on staying loose and relaxed

______8. Wishing the run/walk would end

______9. Thinking about school, work, social relationships, etc.

______10. Focusing on your performance goal

______11. Wondering why you are even running/walking in the first place

______12. Making plans for the future (e.g., grocery list)

______13. Getting frustrated with yourself over your performance

______14. Writing a letter or paper in your head

______15. Paying attention to your form or technique

______16. Reflecting on past experience

______17. Paying attention to your rhythm

______18. Thinking about how much you want to quit

______19. Focusing on the environment (e.g., scenery)

______20. Thinking about competitive strategy or tactics

______21. Counting (e.g., objects in the environment)

______22. Monitoring your pace

______23. Thinking about how much the rest of the run/walk will hurt

______24. Meditating (focusing on a mantra)

______25. Encouraging yourself to run/walk fast

______26. Trying to ignore all physical sensations

______27. Concentrating on the run/walk

______28. Wondering whether you will be able to finish the run/walk

______29. Thinking about pleasant images

______30. Monitoring the time of the run/walk

______31. Other: ____

(Brewer, Van Raalte, & Linder, 1996)