

The Immediate effect of musical Tempo on Stress, Mood and Self-Efficacy

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Submitted in partial fulfillment of the requirements of the Bachelor of Arts degree (Psychology
Specialization) at DBS School of Arts, Dublin

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March 2012

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Acknowledgements

The author would like to acknowledge the contribution of Dr Patricia Frazer for her supervision over the current study. The author would also like to acknowledge the principal and teachers from the school involved in the study for their co-operation and availing of the school's facilities to conduct the current experiment, as well as the participants who took part in the study. The author would also like to recognise Eli Kelly of E-Li Music Productions Ireland for the composition and mastering of the musical piece used in the current experiment.

Abstract

This study aimed to explore the effects of musical tempo on three psychological variables; stress, mood and self-efficacy. The Perceived Stress Scale (PSS), the UWIST Mood Adjective Checklist (UMACL) and the Generalised Self-efficacy Scale (GSES) were used as measurement. Digital recording technology was used to create two versions of a piece of music that varied in tempo but held pitch and other musical elements constant. 22 female adolescents participated in the experiment. A repeated measures design was used. Results revealed no significant effect of tempo on stress, mood or self-efficacy. The results indicate that fast tempo does not increase levels of stress, mood or self-efficacy and slow tempo does not significantly decrease levels of stress, mood or self-efficacy.

Introduction

Students listen to music for 14 hours per week on average, (Jones & Alarcon, 2009). Because some students are being exposed to music every week for this length of time as well as being exposed to music unintentionally in restaurants, shops, night clubs, television and radio, it is important to further understand the immediate effects of music on psychological variables. The specific variables investigated in this experiment are stress, mood and self-efficacy and the affect which musical tempo may have on these psychological elements.

Amezcuca, Angel Guevara and Ramos-Loyo (2005) view music as having many varying components including tempo, mode, tone, rhythm, timbre, harmony, melody and loudness. Many research sources have implied that in order to fully understand the psychological effects of music, it is vital to dissect and isolate the individual components of music, (Kellaris & Kent 1991, Oakes 2003). Amezcuca et al (2005) are also in agreement with the theory that because of the complexity in music it is essential to study the effects of music using each component individually. For this reason, the current study will be focusing on the effects of varying musical tempo in particular. Tempo is a variable which provides a more scientific, accurate and easier experimental application, compared with tone or texture etc. Tempo is quantifiably measured using a metronome and is measured in beats per minute (BPM) (Oakes 2003). Milliman (1982) suggested slow musical tempo to be defined as less than 72BPM and fast tempo to be greater than 94BPM, for this reason the current study will use 60BPM for the slow music condition and 120BPM for the fast music condition.

Stress, mood and self-efficacy have been defined in many ways. Stress has been described as the body's "reaction to a change that requires a physical, mental or emotional adjustment or response" (Morrow 2011, *para.1*). Mood has been described as "a group of

persisting feelings associated with evaluative and cognitive states which influence all the future evaluations and actions” (Amado-Boccaro, Donnet & Olie 1993 p.117). Albert Bandura first defined self-efficacy as “the belief in one’s capabilities to organise and execute the courses of action required to manage prospective situations” (Bandura 1995 p.2).

Music in general has been found to have profound effects in psychology literature. It has been found to improve adherence and function of people with neurological diseases, improve exercise endurance and enhance the motivation of patients to take part in pulmonary and cardiac exercise rehabilitation programs, as well as leading to an improvement in balance, (Ziv & Lidor 2011). Music has also been found to aid in the relief of pain (Knox, Beveridge, Mitchell & MacDonald, 2011). Research on the effects of specifically musical tempo, has been predominantly associated with cognitive abilities such as memory (Oakes & North 2006), perception of waiting times in public places which may cause stress (Oakes 2003) This research has also been centred around subjective responses to the actual music heard as being sad/happy or slow/fast (Kellaris & Rice 1993), as well as spatial abilities (Husain, Thompson & Schellenberg 2002), and the amount of time spent in commercial places such as restaurants (Caldwell & Hilbbert 2002). Fewer research studies have been focused on the effects of music on stress, mood and self-efficacy, especially with specific relation to musical tempo as appose to music in general or the presence or absence of music.

Music and Stress

Music as an effective intervention to reduce stress has been predominantly investigated using physiological measures such as cortisol levels (West 2004), heart rate (Scheufele 2000), pulse rate and blood pressure (Masuda, Miyamoto & Shimizu 2005), respiration rate (Han, Li,

Sit, Chung & Jiao), and EEG (Field et al 1998). Masuda, Miyamoto and Shimizu (2005) examined the effects of music listening on postoperative pain and/or stress. The experimental group listened to music for 20 minutes. Researchers measured stress, blood pressure, heart rate, and skin temperature and blood flow at the finger tip. Results showed a significant decrease in levels of postoperative pain and/or stress in the music intervention group. West (2004) found a decrease in cortisol levels (a hormone associated with stress), among participants after listening to music. Measurements were taken before and after a stress inducing task. Scheufele (2000) studied the effects of music on attention, relaxation and stress responses. Measurements were taken before and after a stress manipulation phase which was followed by progressive relaxation or music after which measurements were taken again. Results from the Profile of Mood States (POMS) Tension Subscale revealed a decrease in stress scores after the music intervention compared with baseline scores. Heart rate levels also decreased in the music intervention group compared with baseline measurements. Music has also been found to reduce levels of stress among staff and patients in a hospital environment (Harrison, 2004). Live musical performances, including ballet, jazz, light opera and world music have been found to reduce levels of aggression and stress among patients and levels of stress in staff, in an Accident and Emergency (A&E) department. (Harrison, 2004). Chang, Chen and Huang (2008) used the Perceived Stress Scale while studying the effects of music on stress. They investigated the effects of music therapy among 236 pregnant women, examining stress, anxiety and depression. The experimental group were exposed to two weeks of a music intervention which consisted of known pieces of music for 30 minutes per day. Anxiety was assessed using the State-Trait Anxiety Inventory. Listening to music was found to significantly decrease stress and anxiety levels as well as depression compared with the control group and it was suggested that listening

to music for 30 minutes per day, can substantially reduce psychological stress, anxiety and depression during pregnancy (Chang, Chen and Huang, 2008). However this study did not examine the effect of varying the tempo, as the tempo's ranged only from 60-80BPM, the current study aims to investigate both fast and slow tempi. In the study by Chang, Chen and Huang (2008) participants in the control group were not asked to keep daily diaries, and were not asked to avoid listening to music. Therefore the control group may have listened to music for the same duration a day as the experimental group and as there were no diaries kept, the researchers were unable to investigate this element in the control group. Although the study by Chang, Chen and Huang (2008) provides a more 'natural' environment to examine the effects of music in the current study aims use a design which is more preserved from extraneous variables which cannot be accounted for.

Others have researched sleep quality as being affected by music. Harmat, Takacs and Bodizs (2008) investigated the effects of music on sleep quality among students. Listening to music before going to sleep significantly improved sleep quality compared with listening to audiobooks or a no music condition. This study used sedative classical music only. Tseng, Chen and Lee (2010) used the Perceived Stress Scale (PSS) and the State Anxiety Inventory to measure stress and anxiety among participants. However this study found no significant differences in stress or anxiety levels in the experimental group who listened to music for 30 minutes compared with the control group who had no music condition.

Tempo and Stress

Musical tempo in particular has been found to have profound effects on stress. Oakes (2003) isolated musical tempo using digital music technology which will also be used in the

current research. Oakes's study found that slow tempo music caused participants' perception of waiting time to be significantly less than when fast tempo music was played. Waiting perceptions were longer again in the no music control group. However these findings were only concluded from short waits (4-15 minutes). No significant difference was found in perceptions of waiting time between slow or fast musical tempo for long waiting times (18-25 minutes). It was also found that slow musical tempo caused 'satisfaction' with wait duration to be significantly higher than fast musical tempo, with short and long waits. Interestingly, the control group with no music caused the lowest levels of 'satisfaction' during short waits however the no music condition caused the most overall 'satisfaction' for participants with long waits. This study also included a five-item scale which examined participant's relaxing/stressful response to the waiting process. The scale ranged from 'very relaxing' to 'very stressful'. They found that slow musical tempo resulted in significantly higher levels of relaxation as opposed to stress, for both short and long waits. This study found no significant effect of musical tempo upon musical liking.

Han, Li, Sit, Chung, Jiao and Ma (2010) conducted a study among patients receiving mechanical ventilation, examining the effects of music on physiological stress responses as well as anxiety levels. A Chinese version of the Spielberger State-Trait Anxiety Scale and other physiological measures were used. It was found that patients who listened to music demonstrated a significant reduction of anxiety levels. The music listening group also showed significant reduction of anxiety levels according to measures of physiological stress response, for example respiratory and heart rate. The participants listened to music for 30 minutes. The music was their own preference from a choice of 40 pieces. The 40 pieces of music consisted of four categories

which were all of a relaxing nature and ranged in slow tempos from 60-80BPM however there was no comparison group with a faster tempo.

Music and Mood

Music has been found to significantly affect mood state. Smith and Noon (1998), investigated whether various contemporary music categories could affect the mood states of students. The researchers used the Profile of Mood States (POMS) as a measurement. Mood states were measured before and after participants listened to music. Overall, the various pieces of music caused a significant change in mood. The categories of music in this study included 'tense', 'depressed', 'angry', and 'all moods'. However, only 12 students participated in this study. West (2004) also found that listening to music improved mood disturbance. Measurements were taken before and after a stress inducing task. Scheufele (2000) also studied the effects of music on mood. The music listening condition resulted in less negative effect on participants' mood after a stress inducing task compared with a no music condition.

Field, Martinez, Nawrocki, Pickens, Fox and Schanberg (1998) studied the effects of music on mood state as well as right frontal EEG activation associated with chronic depression. Fourteen chronically but not clinically depressed female adolescents were asked to listen to rock music for 23 minutes. A control group which also consisted of chronically depressed adolescents were simply asked to sit down and relax their minds and muscles. Salivary cortisol levels revealed a decrease in the stress hormone in the music intervention group and music also had a positive effect on the EEG measurement. However results of the self-report measurement showed no significant change in mood state. Reasons for this discrepancy in results could be due to the fact that participants listened to five popular songs and these musical pieces consisted of

varying tempos as well as other musical elements. The songs ranged from 'Greatest Love of All' by Whitney Houston which has a slow tempo to 'Straight up' by Paula Abdul which is considered an upbeat dance song. In this study by Field et al (1998) music is generalised. Such a variety of music and lack of considering the many variables of music could have contributed to the results of this study being inconsistent with previous research. Field et al (1998) have also suggested the possibility of contradictory results from the objective EEG and cortisol measurements compared with the more subjective measurement of self-report being caused by the participants having no control over their EEG and cortisol levels unlike self-reports. They have also suggested that biochemical and physiological changes may occur more quickly than self-observed changes.

Hanser and Thompson (1994) conducted a study that involved a music intervention among homebound elders between the ages of 61-86. The participants were experiencing symptoms of major or minor depression. The experiment was based over eight weeks. Participants were randomly assigned to one of three conditioned groups. The first group were visited at home by a music therapist once a week, and taught music listening, stress reduction techniques. The second group received only a telephone call by a music therapist once a week while being assigned a self-administered program, where the same techniques as the first group applied. The third group were assigned as a wait list control. Results showed significant improvements of depression, distress, self-esteem and mood, in both the first two groups assigned to the music interventions. These improvements maintained over a nine month follow-up. As the results showed significant improvements for both the first and second conditions of music intervention, it can be assumed that it was mainly the music intervention that caused these psychological improvements of depression, distress, self-esteem and mood, as opposed to

whether participants were visited by a therapist or only received a phone call. However it is also possible that this may have been a placebo effect.

Research has found that personal preference of the participant of the music used in the experiment, associations with the chosen music, the context in which the music is listened to and the emotion which is expressed by the musical composition are all significant elements which increase levels of engagement with the music, (Knox, Beveridge, Mitchell & MacDonald, 2011).

Tempo and Mood

Webster and Weir (2005) presented musical tempo at 72, 108 and 144BPM. As the tempo increased so did happiness ratings of the music. A difference in gender was also found in responses to the musical pieces. Female's happy/sad responses were altered more by tempo and mode than males. For this reason the current study has focused on females only. Schellenberg, Peretz and Viellard (2007) indicated fast tempo and major mode to be considered as happy-sounding excerpts and slow tempo with minor mode to be considered sad-sounding musical compositions. Webster and Weir (2005) also found that the interaction between mode and tempo indicated that the extent to which faster tempo increased happiness ratings was more significant in major music than in minor music where no significance was found. For this reason the current study will use a musical composition that is in major mode. Caldwell and Hilbert (2002) found that restaurant patrons dined for longer when the background music was slow tempo than fast tempo. In fact, patrons spent an average of 15 minutes longer in the restaurant when the background music was of slow musical tempo. This study also found that musical preference was positively associated with the amount of time patrons spent dining, however no significant interactive effect between musical tempo and preference was found on actual time patrons spent

in the restaurant. However this study found no significant effect of tempo on 'perceptions' of time spent in the restaurant. They also found that patrons spent more money in the slow tempo condition compared with fast tempo, however because slow tempo resulted in more time spent dining, the increase in money spent could simply be a result of having more time to spend money. This study fails to investigate what exactly it was about fast or slow tempo that altered time spent in the restaurant. It can be questioned whether the musical tempi had an effect on the patron's mood, or stress for example, which in turn effected the length of time they spent dining.

Steinberg & Raith (1985) examined the effects of tempo on depressed mood among 53 psychiatric adult inpatients. They found that slower tempo caused a negative decrease in depressive mood. However the findings were only found to be conclusive for endogenous-depressive patients and not for neurotic or schizophrenic patients. Hunter, Schellenberg and Schimmack (2008) used instrumental musical pieces from a broad range of genres. They examined the affective responses to music that varied in tempo as well as mode (major or minor). It was found that fast tempi of musical excerpts enhanced happy and pleasant feelings. Hunter et al (2007) also examined whether mode would affect responses to the music. It was found that the major mode increased happy and pleasant feelings, whereas minor modes elevated sad and unpleasant feelings. However, the study does not define what specific tempi were considered to be fast and what tempi were used as the fast condition, (Hunter, Schellenberg & Schimmack, 2007).

Opposing research by Husain, Thompson and Schellenberg (2002) used a Mozart Sonata, and varied the tempo and mode of this piece of music. The POMS was used as a measurement of mood. Fast tempo was played at 165BPM while the slow musical piece was 60BPM. The results

revealed that changes in tempo affected arousal but not mood, however varying mode affected mood but not arousal.

Music and Self-efficacy

The concept of self-efficacy was first established as part of Bandura's social cognitive theory (SCT). SCT explains self-efficacy as the belief that a person has in one-self as being competent and capable to achieve a desired outcome by behaving a certain way (Bandura, 1997). Bandura's (1977) approach to self-efficacy employs measuring situation-specific beliefs. However the current study will focus on generalised self-efficacy beliefs using the Generalised Self-Efficacy Scale (Schwarzer & Jerusalem, 1995). Although self-efficacy can be lasting, it can be manipulated or altered, and is not static (Rowland 2005). Rowland (2005) suggested that external events such as emotional arousal, verbal persuasion and vicarious learning can influence self-efficacy

Barwood, Weston, Thelwell and Page (2009), investigated the effects of motivational music and video on exercise performance which is of high intensity. The researchers attempted to boost self-efficacy through fast tempi, inspirational lyrics and videos of influential sporting moments. Music with tempo ranging from 120BPM to 140BPM was chosen for the study. Barwood et al (2009) found that participants in the music intervention ran significantly further than those in the non-motivational condition. Kanther-Sista (2008) conducted a study in which three conditions were used; participant-selected music, a Mozart piece and a recording of a Greek language instruction. The study examined the effects of the three conditions on positive and negative affect as well as general self-efficacy. Participants listened to one of the three musical conditions for 18 minutes. Results showed that while participant-selected music caused a

significant increase in positive affect and a decrease in negative affect, general self-efficacy was not found to be affected by participant-selected music, the Mozart piece or the recording of the Greek language instruction.

Self-efficacy is an important psychological element that deserves extensive research which may contribute to finding ways of increasing levels of self-efficacy in individuals. Higher self-efficacy has been found to positively affect mobility, quality of life and activities of daily living among patients who have suffered from a stroke, (Korpershoek, Van der Bijl & Hafsteinsdottir, 2011). Self-efficacy has also been found to be negatively associated with depression among stroke patients, (Korpershoek, Van der Bijl & Hafsteinsdottir, 2011). Low levels of self-efficacy have also been found to be a predictor of relapse among smokers (Elfeddali et al, Feb 2012). These findings indicate the importance of self-efficacy and value of research which aims to find interventions that may improve levels of self-efficacy.

Tempo and Self-efficacy

In an interesting study, Heckel, Wiggins and Salzberg (1963) played two pieces of music at 60BPM and 172BPM, in order to investigate if tempo of background music would affect the rate of speech in group psychotherapy. Each group was exposed to five trials with 6 minutes of slow tempo and 2 minutes 47 seconds of fast tempo with 30 second intervals of silence between each of the trials. Results revealed a significantly higher number of words spoken per minute compared with the slow tempo trials. Although the study was the first of its kind in examining the effects of tempo on rate of speech, the reasoning behind these results seem to be somewhat lacking. It could be possible that varying the tempo caused a change in mood, stress or self-efficacy. If a certain tempo improved stress levels and mood, participants may have felt more

able to speak. If the tempo affected their self-efficacy participants may have felt more capable of overcoming the obstacle of speaking. For this reason the current study will also investigate whether musical tempo can affect self-efficacy.

Many studies focus on the effects of music on exercise performance (Edworthy & Waring, 2006; Copeland & Franks, 1991) and assess results in terms of duration, for example, the length of time on a treadmill (Copeland & Franks, 1991). However, many of these studies lack consideration for more in-depth reasoning behind their results. For example, Copeland and Franks (1991) use music which is either type A (loud, fast exciting and popular) or type B (soft, slow, easy-listening and popular) as the independent variable and heart rate, perceived exertion, and time to exhaustion in exercise as the dependent variables. However Copeland and Franks (1991) failed to examine other variables which may have influenced the results, such as self-efficacy. Participants may have had varying levels of self-efficacy posttest, as well as the possibility that the music may have altered their self-efficacy. As Bandura (1977) explained, self-efficacy can influence the amount of effort and duration of effort that “people will expend... in the face of obstacles and aversive experiences” (Bandura, 1977, p. 4). Edworthy and Waring (2006) also found that fast and loud music played during an exercise session on a treadmill enhanced exercise performance. In a study to examine the use of music to manipulate emotional state, Bishop, Karageorghis and Loizou (2007) found that participants listened to music before a competitive tennis match in order to elicit positive emotional state, increase motivation and confidence and to detach from external stressors. In this study by Bishop et al (2007), music which was categorized as eliciting a feeling of being ‘psyched up’ had a mean tempo of 120.9BPM. To elicit a feeling of confidence the mean tempo of the music chosen by participants

was 113BPM, and for positive emotional state the mean tempo was 114BPM. It was also suggested that the right music can boost self-efficacy (Bishop, Karageorghis and Loizou, 2007).

Elliot, Carr & Savage (2004) conducted a pilot study in the attempt to find a heart rate range which was equivalent to that of participants who would be exercising for 12 minutes at a given rate on an exercise bicycle. This process was undertaken in consideration that individual's rather musical tempi that correspond with the pace of their heart beat. The mean heart rate in this pilot study was found to be 132BPM, for this reason the proceeding experiment used music with approximately 130BPM for the music condition. 18 undergraduate students took part in the experiment and results revealed that motivational music which included fast tempi caused participants to travel further on the exercise bicycles. The motivational music also resulted in higher levels of affect during the exercise compared with the no music condition.

Contributions of the current study

Stress can interfere with essential physiological and psychological aspects of an individual's life, such as behaviour, sleep, growth, appetite and wound healing, (Kemper & Danhauer 2005). For this reason it is essential to further contribute to the literature on how stress levels can be improved. Music effectively improves mood and reduces stress levels for both children and adults who are surgical or medical patients, patients undergoing procedures or in intensive units, (Kemper & Danhauer, 2005). Music is an efficient intervention in reducing stress and improving mood states among people who may be experiencing these psychological variables, such as patients in hospitals or patients receiving palliative care, (Kemper & Danhauer 2005). This is because music is a low-cost intervention which also has the benefit of not interfering with technical elements of care, (Kemper & Danhauer 2005). If the results of this

study are significant exposing individuals who are under stress to fast musical tempo could be a low-cost effective intervention in the reduction of stress. The current study will contribute to the literature on effects of musical tempo in that it will investigate a previously lacking analysis of the effects of musical tempo on self-efficacy using the Generalised Self-Efficacy Scale (Schwarzer & Jerusalem, 1995). It will also concentrate on the immediate effects of musical tempo. Few of the studies mentioned have used participants who are in the age range of early adolescence. No evidence has been found for the UWIST Mood Adjective Checklist (UMACL) in measuring mood which has been affected by musical tempo as the current study intends.

The internal validity of some studies (Hunter, Schellenberg & Schimmack, 2008) may be in doubt as none of these studies used digital music technology to isolate and change the tempo, while keeping other musical components as constants. Because many studies (Chang, Chen & Huang, 2008; Field et al 1998) have used a variety of music genres as stimuli, it is likely that the results regarding the independent variable of tempo were confounded by variation in any of the structural components distinguishing one musical composition as unique from another (e.g., pitch, lyrics, mode, timbre). This study is important in that it uses digital music technology to vary tempo.

An important element of the design chosen for the current experiment which some of the research on the topic has lacked is repeated measures (Oakes, 2003; Kibler & Rider, 1983). In using a repeated measures design for this study the problem of individual variation will be overcome. As well as repeated measures the experiment will also be counterbalanced for order effects. This study will help to better understand the effects of musical tempo on psychological variables specifically Stress, Mood and Self-efficacy. If any significant results are found this may be a great contribution to the literature.

Hypotheses

Three hypothesis have been concluded from this research; 1) Music tempo will increase perceived stress with high BPM and decrease perceived stress with low BPM among adolescents. 2) Musical tempo will have an effect on mood, having a positive effect after listening to music with fast BPM and a negative effect on mood after listening to slow BPM. 3) Varying musical tempo will have an effect on self-efficacy, with 120BPM causing higher results in self-efficacy than 60BPM.

Methodology

Materials

The materials used in the current experiment were three self-administered, paper-and-pencil questionnaires; the Perceived Stress Scale (PSS), (Cohen, Kamarck & Mermelstein 1983), the UWIST Mood Adjective Checklist (UMACL) (Matthews, Jones & Chamberlain 1990), and the Generalised Self-Efficacy Scale (Schwarzer & Jerusalem, 1995). Basic demographic information was also attained.

The PSS is a 14-item self-administered questionnaire. (Cohen et al 1983) The test-retest reliability was 0.85 over two days and 0.55 over six weeks (Hewitt, Flett & Mosher 1992). This questionnaire was used to measure perceived stress among participants. The PSS is easily understood and alternative responses are easily grasped. Participants rated their responses on a five-point Likert scale ranging from 'never' (0) to 'very often' (4). The PSS questions the participants' feelings and thoughts. All the scores are summed and higher scores indicate greater levels of stress (Cohen et al 1983). The PSS has shown adequate test-retest reliability (Tseng, Chen & Lee, 2010).

The UMACL was applied to assess the mood of the participants during the experiment. It measures dimensions of energetic arousal, tense arousal and hedonic tone (Matthews, Jones & Chamberlain 1990). The UMACL contains 35 adjectives concerning mood. In completing this questionnaire participants' mood was assessed on a four-point Likert scale ranging from 'definitely not' (1) to 'definitely' (4). Matthews et al (1990) found low correlations between the UMACL scales signifying discriminant validity. It was also reported that there were significant

correlations between the arousal scales of the UMACL and several measures of arousal from psychophysiology which supports the concept of concurrent validity.

The Generalised Self-Efficacy Scale (GSES) is a ten-item scale. The scores for each of the ten items are summed to give a total score. It has been translated by Mary Wegner from the original German version which was by Schwarzer and Jerusalem, (Schwarzer & Jerusalem, 1995). In completing the questionnaire participants are asked to indicate to what extent each statement relates to them. The GSES examines the participants' strength of belief in their ability to respond to difficult situations as well as their belief in their ability to overcome any difficulties that may arise (Schwarzer & Jerusalem, 1995). In samples taken from 23 countries Cronbach's alphas ranged from .76 to .90, with the majority in the high .80s, (Schwarzer & Jerusalem, 1995).

The stimuli consisted of a 'classical-dance' style musical composition. The piece of music used was a novel piece, composed especially for the current study, by Eli Kelly of E-Li Music Productions Ireland. The piece was called 'Man Meets Music'. Original music was used to avoid problems which prior exposure may have caused, such as a positive or negative emotional attachment. The music contained no lyrics so as to avoid an interference of subjective responses to the lyrics. Two versions of 'Man Meets Music' were created; a fast tempo version of 120 beats per minute (BPM) and a slow tempo version of 60BPM. Both versions of the piece of music were produced using digital sound technology. This procedure was used to prevent confounding tempo with pitch. By using digital technology, the music can be stored on a computer as digital information. This information can then be easily edited or changed so that one variable at a time can be manipulated, while holding all other variables constant. For the current experiment the tempo alone was altered. Because the slow version (60BPM) was twice as long as the fast version (120BPM), the fast version was repeated a second time with a subtle

changeover into the repeated piece. This process was also possible using digital technology. Each piece was then ten minutes long. The music composition used in the experiment is in the key of E major.

Apparatus

The current research exploited advances in digital music technology, providing reproduction of digital musical data at various tempi. A completely novel piece of music was composed and mastered for the current research. The musical composition was recorded through ProToolsHD version 8. The sample rate was 48kHz. The piece was mixed through Avantone Mix Cubes. This equipment allows the reproduction of authentic sounding instruments using digital technology. The instruments in 'Man Meets Music' include drums (oldschool backbeat, thunder drums, small taiko drums, big snare, big hard pad), harp (harp and soft strings), shaker, piano, male and female voices (heavens choir), bright bells, tremolo strings, natural sitar and full finger bass, all using Xpand2 software. The music was transferred onto a compact disc (CD).

Participants

Participants were gained through non-probability sampling. A convenience group was made available for the experiment. The group included a 1st year English class from the Meath area. A total of 22 students were asked for their consent to participate in the current study. All participants were female and ranged from 12 to 13 years of age. 12 students were assigned to group A (slow music first), and 10 students were assigned to group B (fast music first). The majority of the participants were of Irish Nationality while only one participant was Polish and one was Indian.

Design

The methodological design of the current research recognised the importance of examining the effects of altering an individual musical variable while maintaining other musical variables as constants (Kellaris & Rice 1993). Therefore musical Tempo is the independent variable while Stress, Mood and Self-efficacy are the dependent variables. A repeated measures and counterbalancing design was used for the current experiment. Counterbalancing was used to alleviate order effects. Participants were placed into group A or group B by assigning odd numbers from the roll-call to group A (n=12) and even numbers to group B (n=10). In order to counterbalance the experiment, on Day 1, group A listened to the piece of music at 60BPM while completing the questionnaires, proceeded by group B listening to the music at 120BPM while filling out the questionnaires. On Day 2, group B were first to listen to the music, this time at 60BPM, followed by group A, who listened to the piece at 120BPM. The main effect of tempo and the interaction between tempo and order of presentation were within-subjects variables, while order of presentation alone was a within-subjects variable.

Procedure

The principal of the school that was involved in the experiment signed a consent form on behalf of the participants as the participants' ages ranged from 11 to 13. However the students were also given their own consent forms which stated that they had the right to withdraw at any time. The consent forms also stated that the data gathered would be confidential but not anonymous as it was a repeated measures experiment and identifiers (in the form of initials and date of birth) were used for inputting data for analysis. On the first day participants were given a brief description of what the experiment entailed. They were informed that they would be

completing three questionnaires and providing basic demographic information, while listening to background music. They were also informed that the same process would be carried out two days later. Participants were then assigned to 'group A' or 'group B'. This process was carried out by selecting every second name on the roll-call. All odd numbers on the roll-call were placed into group A (n=12) and all of the even numbers were assigned to group B (n=10). Group B were then asked to leave the room and were supervised by a teacher in a separate room, while the experiment was conducted with group A. Group A were given the questionnaires and told that they could put their hand up if they wanted to ask any questions. The slow version of 'Man Meets Music' (60BPM) was then played through a stereo and participants were asked to begin filling out the questionnaires. The music was played at a comfortable loudness level and remained uniform for all both groups on both days. When group A had completed their questionnaires, which took approximately 15 minutes, they were then moved into a separate room and supervised. Group B were then asked to come into the experiment room and the same process occurred, except group B listened to the fast version of 'Man Meets Music' (120BPM).

On Day 2 which was two days after this initial experiment, a similar course of events occurred. Students were reminded of what group they were assigned to on the first day, through the roll-call. The second day however, group B were asked to stay first while group A stayed in a separate room. Group B listened to the slow version of 'Man Meets Music' on the second day, whereas group A listened to the fast version on the second day. When the experiment was complete, students were further informed on what the experiment was examining and why the process occurred in the manner that it did, for example why the class was divided into two groups.

Results

A total of 22 students participated in the study, with 12 in the slow-first group and 10 in the fast-first group. The sample was all females. A two-way repeated measures Anova was carried out for each of the three variables; stress, mood and self-efficacy. This analysis was conducted to examine the effects of tempo, order of presentation (slow-first/fast-first), and the interaction between tempo and order of presentation on all three variables.

Table I

Descriptive statistics for all three outcome variables

Music condition	Slow (60bpm) Mean (SD)	Fast (120bpm) Mean (SD)
Stress:	26.55 (7.06)	26.68(7.13)
Mood:	95.59 (9.45)	98.36(10.78)
Self-efficacy	27.64 (4.18)	28.59 (3.51)

Stress

The Levene's test for equality of variances showed that the assumption of homogeneity of variance was met. No significant effect was found in order of presentation on stress, ($F(1, 20) = .001, p = .982$). The two way repeated measures Anova also showed that there was no significant effect of the interaction between tempo and order on stress ($F(1, 20) = .072, p = .792$). However analysis using Anova revealed no overall significant effect of tempo on stress ($F(1, 20) = .018, p = .895$). Table I illustrates means and standard deviations for stress.

Mood

The Levene's test showed that the assumption of homogeneity of variance was met. The Anova showed no significant effect of order of presentation (slow music first/fast music first), on

mood, ($F(1, 20) = 2.732, p = .114$). No significant effect was found on the interaction between tempo and order of presentation on mood ($F(1, 20) = 2.846, p = .107$). However, analyses of variance (Anova) showed that there was no overall significant effect of tempo on mood ($F(1, 20) = 1.849, p = .189$). See table I for means and standard deviations for mood.

Self-efficacy

The test for equality of error variance for self-efficacy showed that the assumption of homogeneity of variance was met. No significant effect was found in order of presentation on self-efficacy ($F(1, 20) = 2.191, p = .154$). The interaction effect between tempo and order of presentation on self-efficacy was also found to be insignificant ($F(1, 20) = .735, p = .401$). However Anova showed no overall significant effect of tempo on self-efficacy ($F(1, 20) = 2.348, p = .141$). See table I for means and standard deviations for self-efficacy.

Discussion

The purpose of this study was to explore whether various musical tempo would significantly affect stress, mood or self-efficacy. It was hypothesised that fast tempo (120BPM) would increase scores on all three dependent variables and slow tempo (60BPM) would cause lower scores for these three variables.

This research presents surprising results. The study found no significant effect of tempo on stress. These findings contradict the majority of previous studies in this area (Oakes, 2003; Han, Li, Sit, Chung, Jiao and Ma, 2010). The study revealed no significant effect of tempo on mood. These results are a distinct contrast to previous research which has found slow music to decrease mood and fast music to increase mood (Hunter, Schellenberg and Schimmack, 2008). The study also contradicted research which has found music to cause an increase in self-efficacy (Bishop, Karageorghis and Loizou, 2007; Barwood, Weston, Thelwell and Page, 2009), as this study found no significant effect of tempo on self-efficacy.

Though overall the results of this study do not support the hypotheses that fast tempo should increase levels of stress, mood and self-efficacy, while slow music should decrease levels of stress, mood and self-efficacy, the non-significant trend in the predicted direction of mean scores of the three dependent variables, provides some encouragement for continuing to research this particular area. It is suggested that the results of this experiment are deemed non-interpretable for several reasons; participants were not exposed to the musical stimulus for a sufficient amount of time for tempo to have an effect on their stress, mood and self-efficacy ratings and participants appeared anxious at the start of the experiment (made evident by questions asked), and therefore the debrief which occurred just before the experiment began

should have been carried out the day before or several days before, for this reason the experiment was somewhat rushed as there was an allocated time of only 35 minutes.

Music and Stress

Oakes (2003) examined the effects of musical tempo on waiting perceptions and within this study participants were assessed on their feelings about a registration process scenario. Participants' feelings were assessed on a five-item scale which ranged from very relaxing (1) to very stressful (5). Results revealed that slow-tempo music resulted in higher scores of relaxation as appose to stress than fast tempo music in both the short-wait ($z = -2.51, p < .05$) condition and the long-wait condition ($z = -2.26, p < .05$). Slow music tempo also resulted in significantly less stress than the no music condition for short waits. The current experiment contradicts this study by Oakes (2003) as there was no significant decrease of the stress levels of the participants while listening to slow music and no significant increase was found in stress levels while listening to fast tempo music. These results conflict with the findings of Scheufele (2000) which revealed a significant decrease in stress levels when participants listened to music compared with baseline measurements however the music intervention occurred after a stress manipulation phase. Much of the research which has examined the effects of tempo or music in its entirety, on stress, has either included measurements at baseline, after a stress intervention task and then after a music intervention, (West, 2004) or used participants who were already in a stressful environment (Chang, Chen & Huang, 2008; Han et al, 2010; Masuda, Miyamoto & Shimizu, 2005). It is possible that a minor stress inducing task before the music intervention with measurements taken at baseline and then following the stress intervention and finally taken after the music intervention, may yield significant results which collaborate with previous research (Han et al, 2010; West, 2004; Oakes 2003). However this speculation is post hoc and further research would

need to be performed. The results of this study also conflicted with those of West (2004), which found a significant decrease in cortisol levels after listening to music. The findings of this study challenges previous research (Chang, Chen & Huang, 2008) which claims that slow music (60-80BPM) can reduce levels of stress. However it must be taken into consideration that in the study by Chang, Chen and Huang (2008), a music intervention was used for 30 minutes per day over a two week period and the sample was that of pregnant women who were suggested to already be under stress. The current study focused on more immediate effects of musical tempo and not over a long duration, on a sample of students who were not under any major stressors according to analysis of PSS scores.

Music and Mood

The results of this study are also in conflict with the findings of Webster and Weir (2005), which indicates that faster tempi should increase mood states, specifically feelings of happiness. Webster and Weir (2005) found that tempi of 72, 108 and 144BPM resulted in mean ratings on the mood scales of 0.30, 0.52, and 0.61, respectively. Field et al (1998) investigated the effects of music on mood state and activation of the right frontal EEG (associated with chronic depression). Participants were chronically but not clinically depressed. The Depression Adjective Checklist (DACL), which is a self-administered adjective checklist that assesses states of mood was used, (Field et al 1998). EEG recordings were also examined as well as salivary cortisol samples and the Music Rating Scale (MRS), which examines how music listened to makes participants feel and how much the music pieces are liked. The results revealed no significant effects on the DACL scores, however a significant decrease was found for cortisol levels and 10 out of 14 participants showed a shift toward left frontal EEG activation (indicating a reduction of depression mood), (Field et al, 1998). The incongruity between self-reported mood

state with EEG scores and cortisol levels illuminates the subjectivity of self-administered questionnaires such as those used in the current study, which give participants more conscious control over responses. Whereas the significant results of both the EEG and cortisol levels which the participants have no conscious control over illustrate the objectivity of these measures. Field et al (1998) also indicate that 'felt' mood state changes may take longer to occur than biochemical or psychophysiological changes. The results of the current research correspond in part with this study by Field et al (1998), in that neither fast nor slow music had a significant effect on mood states among participants using a self-administered questionnaire (UMACL). However the current experiment failed to examine physiological measures to examine mood states. This study required participants to start completing the questionnaire as soon as the music was turned on, therefore this left very little time for the music to cause a change in mood state as Field et al (1998) have suggested.

The current research is in collaboration with the findings of Husain, Thompson and Schellenberg (2002) in that it found no significant effect of tempo on mood state. Husain et al (2002) found that tempo did not affect mood, but mode did significantly affect mood. Tempo was found to significantly affect arousal as appose to mood.

Music and Self-efficacy

Bishop, Karageorghis and Loizou (2007) found that five factors determined the arousal potential and likeability of participants' choice of emotional music: acoustic properties of the music, connection with the artist or lyrics, the involvement of the music in a film soundtrack or music video, peer/family influences and extra-musical associations. It was also found that the participants' selections of music to manipulate their emotional state were highly idiosyncratic.

The genres and acoustical properties of the music tracks selected varied immensely, even when chosen to elicit an identical emotional state. For example, in order to feel confident, one participant chose a track that was 92BPM and in the 'rap' genre, whereas a different participant chose a track that was 144BPM and in the 'power ballad' genre (Bishop, Karageorghis & Loizou 2007). This research suggests that personal preference of music can be important in examining the psychological effects music produces. The current study used musical stimuli chosen by the investigator as oppose to giving the participant the choice of music and in doing so this may have caused the findings to contradict those of Bishop et al (2007). Nakamura, Pereira, Papini & Nakamura (2010) conducted a study to investigate the difference between the effects of preferred music compared with non-preferred music on exercise distance, heart rate and self-reports of perceived exertion. Ratings of perceived exhaustion were higher in the non-preferred music condition than in the preferred or no music conditions. The preferred music condition also caused higher performance than the non-preferred music. This study by Nakamura et al (2010) also illuminates the significance in the choice of music for experiments. Kanther-Sista (2008) has also emphasised the importance of participant-selected music as does Knox, Beveridge, Mitchell and MacDonald (2011). Although the piece of music for the current study was composed in order to ensure extra-musical variables would not contaminate the results, research (Bishop et al 2007; Nakamura et al 2010) would suggest that using a piece of music which is novel but which the participants have some choice in and preference for produces more significant results. The results of the current study in finding that tempo had no significant effect on self-efficacy are in agreement with the results of Kanther-Sista (2008). Kanther-Sista (2008) found no significant effect of participant-selected music, a Mozart piece or a Greek language instruction recording on self-efficacy among participants.

Criticisms of the current study

The age of the participants in the current study ranged from 11 to 13. Although the UMACL can be used on participants from the age of 12 up (Matthews, Jones & Chamberlain 1990), the students from the current study found many of the adjectives of the UMACL difficult to understand. Completion of the questionnaires was interrupted several times during the course of the experiment by participants inquiring about the meaning of several of the adjectives. Kellaris and Kent (1991) suggest that individual components of music can work interactively, such as tempo and mode, and therefore should not be treated in isolation in research or practical application. The current study examined the effects of tempo in isolation from other musical components. This research should have examined the interactive effects of tempo with another musical element such as mode to assess the possible interaction of these variables.

The duration of exposure to the music stimuli was relatively short (10 minutes). This may have been a weakness in the experiment and it is possible that longer exposure to the music may yield different results in collaboration with previous research (Field et al 1998). A convenience sample of 22 1st year students who were all female, from a small town was used in the present research. This created limitations regarding generalizability of the findings. There was also only one genre of music, 'classical dance', used in this research, which also affects the generalizability of the findings. The current study used a musical composition which was chosen by the investigator. Music which was preferred and chosen by the participants, even if it was simply a preferred genre would have enhanced this research. The Hawthorne effect (Machol, 1975) suggests that by simply observing people can change their behaviour. This effect may have contributed to the insignificant results found.

The experiment had to be completed within the allocated time of an English class which was 35 minutes. Participants were not debriefed prior to this allocated time. Therefore much of the start of the 35 minutes was taken up completing consent forms, and a debrief of what the experiment entailed (i.e. listening to music, completing questionnaires, demographic information, identifiers) as well as assigning participants to either group A or group B. It also took considerable time to explain to participants that the study was not a test and that there was no right or wrong answers. This was essential as the participants were young students in a school environment and several of the participants were confused and asked questions relating to whether the experiment was a type of test. This debrief took more time than initially anticipated and resulted in the experiment being slightly rushed. For these reasons more time should have been allocated for the completion of the experiment.

Implications for future research

In the current study, only one element of music structure was examined. Future research should explore other structural elements of music, such as pitch, mode and texture. There is also a need for future research to analyse the interactive effects of altering musical tempo in conjunction with other variables such as mode and timbre. Some research studies (Scheufele, 2000; Kibler & Rider, 1983) have drawn conclusions about the effects of musical tempo while ignoring the possible interaction, or its subsequent affective implications. Future research should aim to produce a similar experiment in other contexts as well as with older age groups. The quantity of participants should also be taken into consideration. Future research should also attempt to conduct a study in which the duration for the musical condition is of sufficient length. Different musical genres should also be explored. Future research should also examine the effects of tempo on the stress, mood and self-efficacy of males, as this study used female

participants only. The effects of self-selected music compared with investigator-selected music were not compared in the current study. Future research conducted should attempt to alleviate this limitation by allowing participants to choose the music they would like.

Previous research (Field et al, 1998) has shown that self-reports have failed to provide significant results, (in the same experiment using the same music) where EEG scores and cortisol levels have succeeded in revealing positive increases in mood and decreased levels of stress, from listening to music. For this reason along with the unexpected results from the current experiment, future research should attempt to examine the outcome variables of this study using measures which are more objective (e.g. EEG and cortisol levels) than self-reports or self-administered questionnaires.

Conclusion

This study has examined the influence of tempo on listeners' stress, mood and self-efficacy. Slow tempo was not found to influence participants stress, mood or self-efficacy and fast tempo (120BPM) did not significantly affect stress, mood or self-efficacy. However, post hoc speculation would suggest that future studies accounting for the limitations addressed may yield significant results for all three variables. An abundance of previous research (Oakes, 2003; Han et al 2010; Hunter, Schellenberg and Schimmack, 2008, Karageorghis and Loizou, 2007) has found evidence for the positive effects of music and tempo on stress, mood and self-efficacy. The results of this study suggest that more research is needed on the effects of tempo on stress, mood and self-efficacy. Moreover, it is recommended that incorporating the interaction of other musical elements with tempo such as mode, should be explored.

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Appendix

UWIST Mood Adjective Checklist (UMACL)

Instructions: Please read the words below and circle the number that best describes your mood at the present time.

Definitely= 4 Slightly= 3 Slightly not= 2 Definitely not= 1

Contented	4	3	2	1
Satisfied	4	3	2	1
Low-Spirited	4	3	2	1
Dissatisfied	4	3	2	1
Gloomy	4	3	2	1
Depressed	4	3	2	1
Sad	4	3	2	1
Sorry	4	3	2	1
Impatient	4	3	2	1
Annoyed	4	3	2	1
Angry	4	3	2	1
Irritated	4	3	2	1
Fearful	4	3	2	1
Anxious	4	3	2	1
Jittery	4	3	2	1
Tense	4	3	2	1
Calm	4	3	2	1
Restful	4	3	2	1
Unconcerned	4	3	2	1
Composed	4	3	2	1
Self-Controlled	4	3	2	1
Peaceful	4	3	2	1
Comfortable	4	3	2	1
Active	4	3	2	1
Energetic	4	3	2	1
Industrious	4	3	2	1
Alert	4	3	2	1
Fortunate	4	3	2	1
Vigorous	4	3	2	1
Bright	4	3	2	1
Dull	4	3	2	1
Unenterprising	4	3	2	1
Quiet	4	3	2	1
Sluggish	4	3	2	1
Passive	4	3	2	1

Generalised Self-efficacy Scale (GSES)

Please read the sentences below and select an answer for each statement which indicates how much the statement applies to yourself.

1 = Not at all true 2 = Hardly true 3 = Moderately true 4 = Exactly true

1	I can always manage to solve difficult problems if I try hard enough.	
2	If someone opposes me, I can find the means and ways to get what I want.	
3	It is easy for me to stick to my aims and accomplish my goals.	
4	I am confident that I could deal efficiently with unexpected events.	
5	Thanks to my resourcefulness, I know how to handle unforeseen situations.	
6	I can solve most problems if I invest the necessary effort.	
7	I can remain calm when facing difficulties because I can rely on my coping abilities.	
8	When I am confronted with a problem, I can usually find several solutions.	
9	If I am in trouble, I can usually think of a solution.	
10	I can usually handle whatever comes my way.	

Instructions

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. That is, don't try to count up the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate.

For each question choose from the following alternatives

0 = never 1 = almost never 2 = sometimes 3 = fairly often 4 = very often

1. In the last month, how often have you been upset because of something that happened unexpectedly?
2. In the last month, how often have you felt that you were unable to control the important things in your life?
3. In the last month, how often have you felt nervous and stressed?
4. In the last month, how often have you successfully dealt with irritating life hassles?
5. In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life?
6. In the last month, how often have you felt confident about your ability to handle your personal problems?
7. In the last month, how often have you felt that things were going your way?
8. In the last month, how often have you found that you could not cope with all the things you had to do?
9. In the last month, how often have you been able to control irritations in your life?
10. In the last month, how often have you felt that you were on top of things?
11. In the last month, how often have you been angered because of things that happened that were outside of your control?
12. In the last month, how often have you found yourself thinking about things that you have to accomplish?

13. In the last month, how often have you been able to control the way you spend your time?

14. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?